The Bylaws of Undergraduate Programs

Faculty of Engineering, Ain Shams University

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Part A: Introduction

The history of Faculty of Engineering, Ain Shams University goes back to 1839. It was first known as the School of Technical Operations. In 1932, it was further developed to the School of Applied Engineering. In 1946, it was announced as the High Institute of Engineering by a Ministerial Decree. In 1950, Law 93 established Ibrahim Pasha University and the High Institute of Engineering was the base of the Faculty of Engineering. In 1954, Law 493 changed the name of Ibrahim Pasha University to Ain Shams University. It is called Faculty of Engineering, Ain Shams University thereafter.

Vision and Mission of the Faculty of Engineering, Ain Shams University

Vision

The vision of the Faculty of Engineering, Ain Shams University is to be one of the best known for its leadership on the regional and international levels in engineering education and scientific research, through unique academic programs and specializations that meet the needs of society and contribute to sustainable development.

Mission

The mission of the Faculty of Engineering, Ain Shams University is to develop distinguished graduates that are able to keep abreast of the technological development in various disciplines, which fulfill the needs of local and regional markets. These graduates should be able to accomplish scientific and applied research, through the creation of the favorable environment for the faculty members and their assistants and students, the provision of advanced educational programs on the undergraduate and graduate levels, in addition to the continuing education, and the establishment of consulting centers and advanced research labs that participate in the community services and meet their needs.

What is new in this Curriculum?

This curriculum emphasizes the importance of student's self-directed learning. We implement new educational approaches such as Problem-Based Learning (PBL) and make use of the growing advancements in educational technology, e.g. distance education and remote learning. In addition, we move from discipline-oriented curricula to integrated curricula. The following concepts are the bases of the design of this curriculum:

1. Excellence demands extraordinary education, it follows that we need to:
   - Switch from Education to Learning.
   - Recognize the student as the core of the teaching process.
   - Provide students with best environment to succeed in their studies.
   - Focus on practical applications in Engineering.
2. One Campus, one curricula, one standard quality of education throughout the campus.
3. The Faculty is divided into Programs and all Programs follow the Credit-Hour system.
4. Combining bylaws, curricula and regulations of the previous semester-based education system (previously known as mainstream), and the Credit-Hour Engineering Programs (previously known as New Programs).
5. Unifying different processes related to Education and Students'Affairs for all programs and students.
   - Same Pool of Courses.
   - Same Quality Standards.
   - Same Start / End of Semester.
   - Same Study Slots during the day.

- Same Student Information System (SIS).
- Same Examination Papers Control Procedures.

6. Common courses have same Code/ILO/Content/Delivery methods/Assessment Criteria.
7. Student evaluation depends on the course nature, and therefore can be different from course to course.
8. Tendency to reduce the number of simultaneous courses per semester to increase the student's learning process.
9. Before preparing our Programs, similar programs were reviewed in top Universities in USA and Europe.
10. Compliance with the European Credit Transfer System (ECTS) in order to facilitate student mobility with European Universities.
11. Our target is to have every program partnered with an international university.
12. Introduce the concept of Student Scholarship.
13. Redefine the relationship between Programs and Departments.
14. Introduce a new organizational structure for the Education and Student Affairs at the Faculty of Engineering.

Article (1): Offered Programs

The Faculty of Engineering, Ain Shams University offers a variety of Engineering Programs. Each Program is administrated by a Program Steering Committee. The programs are divided into Specialized and Inter-Disciplinary Programs. They are carefully selected to satisfy the needs of the National Industry, as well as the needs of the Regional Industry, which recruits many graduates from Egyptian Universities.

Table 1 List of Undergraduate Programs offered by the Faculty of Engineering, Ain Shams University.

Engineering Programs	Specialized Programs	Mechanical Engineering	1	Design and Production Engineering Program
			2	Mechanical Power Engineering Program
			3	Automotive Engineering Program
			4	Mechatronics Engineering Program
		Architectural Engineering	5	Architectural Engineering Program
		Electrical Engineering	6	Electrical Power and Machines Engineering Program
			7	Electronics and Communication Engineering Program
			8	Computer and Systems Engineering Program
		Civil Engineering	9	Structural Engineering Program
			10	Water Engineering and Hydraulic Structures Program
			11	Utilities and InfrastructureProgram
	Inter-Disciplinary Programs		12	Materials Engineering Program
			13	Manufacturing Engineering Program
			14	Mechatronics Engineering and Automation Program
			15	Landscape Architecture Program
			16	Environmental Architecture and Urbanism Program
			17	Housing and Urban Development Program
			18	Communication Systems Engineering Program
			19	Energy and Renewable Energy Engineering Program
			20	Computer Engineering and Software Systems Program
			21	Building Engineering Program
			22	Civil and Infrastructure Engineering Program

Ain Shams University awards, based on the request of the Council of the Faculty of Engineering, the Bachelor of Science Degree in Engineering as follows:

1. **Bachelor of Science in Mechanical Engineering**
   - Design and Production Engineering Program
   - Mechanical Power Engineering Program
   - Automotive Engineering Program
   - Mechatronics Engineering Program
   - Materials Engineering Program
   - Manufacturing Engineering Program
   - Mechatronics Engineering and Automation Program

2. **Bachelor of Science in Architectural Engineering**
   - Architectural Engineering Program
   - Landscape Architecture Program
   - Environmental Architecture and Urbanism Program
   - Housing and Urban Development Program

3. **Bachelor of Science in Electrical Engineering**
   - Electrical Power and Machines Engineering Program
   - Electronics and Communication Engineering Program
   - Computer and Systems Engineering Program
   - Communication Systems Engineering Program
   - Energy and Renewable Energy Engineering Program
   - Computer Engineering and Software Systems Program

4. **Bachelor of Science in Civil Engineering**
   - Structural Engineering Program
   - Water Engineering and Hydraulic Structures Program
   - Utilities and Infrastructure Program
   - Building Engineering Program
   - Civil and Infrastructure Engineering Program

Article (2): Agreements with other Universities

Some of our programs are partnered with other universities, either by offering double degrees, or through cooperating in several teaching activities. It is possible to extend these agreements to other programs.

Article (3): Faculty Departments

The courses at the Faculty of Engineering, Ain Shams University are offered by 13 different departments.

Table 2 List of Departments at the Faculty of Engineering, Ain Shams University.

Field	#	Department	Acronym
Basic Science	1	Engineering Physics and MathematicsDepartment	PHM
Mechanical Engineering	2	Design and Production Engineering Department	MDP
	3	Mechanical Power Engineering Department	MEP
	4	Automotive Engineering Department	MEA
	5	Mechatronics Engineering Department	MCT
Architectural Engineering	6	Architecture Engineering Department	ARC
	7	Urban Design and Planning Department	UPL
Electrical Engineering	8	Electrical Power and Machines Engineering Department	EPM
	9	Electronics and Communication EngineeringDepartment	ECE
	10	Computer and Systems Engineering Department	CSE
Civil Engineering	11	Structural Engineering Department	CES
	12	Irrigation and HydraulicsEngineering Department	CEI
	13	Public Works Engineering Department	CEP

A Faculty Department is responsible for scientific research, and teaching courses to all programs, which need courses in the specialization of the department and holding the department code. The department is responsible for the scientific content of the course and the nomination of instructors to each course, either from the department, from another department, or from outside the faculty. The assignment of instructors from outside the faculty is subject to the approval of the Education and Students' Affairs Committee. Additionally, the department is responsible for the continuous development of teaching methodologies and scientific content throughout the courses.

The following subjects are assigned to the relevant department to teach and to carry out research work:

1. **Engineering Physics and Mathematics Department**
   Mathematics, Physics, Mechanics, Chemistry.

2. **Design and Production Engineering Department**
   Casting and Welding Technology, Industrial Engineering, Materials Engineering, Mechanical Measurements, Mechanics of Machines and Automatic Control, Design and Engineering Drawing, Metal Cutting, Metal Forming, Mechatronics.

3. **Mechanical Power Engineering Department**
   Thermodynamics and Gas Dynamics, Heat and Mass Transfer, Fluid Mechanics, Combustion, Thermal Power Systems, Internal Combustion Engines, Air Conditioning and Refrigeration, Automatic Control and Measurements.

4. **Automotive Engineering Department**
   Automotive Engines, Automotive Design, Systems and Programs of Maintenance, Vehicle Repair, Control Systems in Vehicles, Electronic Systems in Vehicles, Automotive Technology.

5. **Mechatronics Engineering Department**
   Automation and Control, Embedded Design, Mechatronics Design and Manufacturing, Robotics and Mechatronics Applications

6. **Architectural Engineering Department**
   Architectural Design, Theory of Architecture, History of Architecture, Computer Applications in Architecture, Working Drawings, Building Technology, Legislations and Project Management, Building Conservation and Restoration of Architectural Heritage.

7. **Urban Design and Planning Department**
   Urban Design, Urban Planning, city planning, Landscaping, Environmental Studies, Sociology Urban Geography, Urban Economy, Housing, Geographic Information systems, urban renewal and rehabilitation of historic and heritage sites.

8. **Electrical Power and Machines Engineering Department**
   Fundamentals of Electrical Engineering, Electrical Machines, Electric Power Systems, High Voltage Engineering, Power Electronics, Protection and Switchgear Engineering, Electrical Measurements and Testing, Control of Power Systems.

9. **Electronics and Communication Engineering Department**
   Electrical Materials, Electronic Measurements, Electronic Engineering, Electronic Circuits, Communications, Electromagnetic Waves, Electrical Testing, Integrated Circuits.

10. **Computer and Systems Engineering Department**
    Computer Organization, Software Engineering, Computer Networks, Computer Applications, Industrial Measurements and Testing, Systems Engineering, Automatic Control, Artificial Intelligence and Applications.

11. **Structural Engineering Department**
    Structural Analysis, Design of Concrete Structures, Design of Steel Structures, Properties Testing and Strength of Materials and Quality Control, Geotechnical and Foundation Engineering, Construction Engineering and Project Management.

12. **Irrigation and Hydraulics Engineering Department**
    Irrigation and Drainage Engineering, Fluid Mechanics, Hydraulics, Water Structures Design, Inland Navigation and Harbour Engineering, Engineering Hydrology, Water Resources Engineering and Water Management, Dams and Tunnels Engineering.

13. **Public Works Engineering Department**
    Surveying and Geodesy, Photogrammetry and Remote Sensing, Traffic Engineering, Sanitary Engineering, Environmental Engineering, Transportation Planning, Highway and Airport Engineering, Railway Engineering.

Article (4): Teacher Support and Development Center, Faculty of Engineering Ain Shams University

The mission of the Teacher Support and Development Center (TSDC) is to produce education didactics modules, adopt the most advanced technological tools to satisfy Sustainable Development Goals (SDGs) and commit to continuous growth in a challenging environment.TSDC aims to make the most out of the available resources and uncover potential capabilities. Our academic teachers are keen to abide by the highest levels of cultural values and ethical priorities and boost creativity and innovation of academic teachers while respecting a sense of belonging.

The Teacher Support and Development Center is responsible for:

1. Doing research on the teaching and learning process in different programs at the faculty.

2. Encouraging teachers to adopt new teaching technologies and strategies such as CDIO (Conceive, Develop, Implement and Operate).
3. Providing support to include Sustainable Development Goals (SDGs) in the curricula of different programs.
4. Providing support in the implementation of other Engineering skills such as team working, communication skills, critical thinking, etc.
5. Developing and maintaining several teacher manuals, such as code of conduct, manual for different activities during the teaching process.
6. Organizing training for continuous development.
7. Developing administration staff involved with the students.
8. Teaching the general courses to the faculty students.

Article (5): ProgramSteering Committee

The Program Steering Committee is assigned for oneacademic year by the Faculty Council after the recommendation of the Concerned Department for Specialized Programs or the Concerned Departments for the Inter-Disciplinary Programs.

The Program Steering Committee is responsible for:

1. All administration aspects concerned with the program students.
2. Following up the academic advising for the program students.
3. Following the study plan for each student until completing the program requirements.
4. Administration of the course equivalence for students transferred from other programs or from other faculties. The decision of the course equivalence is done by the concerned department teaching this course.
5. Following the educational process in cooperation with the Continuous Improvement & Quality Assurance Unit inside the Faculty and reviewing the reports on the instructors.
6. Planning course offering in the beginning of every semester.
7. Holding collegial Meetings with representatives from the departments teaching courses for the program.

Article (6): Education and Student Affairs Committee

The Education and Students Affairs Committee is responsible forstudying all issues related to students, such as:

1. Investigating individual students' requests, and excuses for study periods or exams.
2. Investigating individual students' complaints.
3. Investigating students' admission cases and rules.
4. Investigating students' transfer requests from other universities.
5. Approving students' requests for inter-program transfers.
6. Students' affairs processes and procedures.
7. Promoting students' activities.
8. Coordinating students' Field Training.
9. Any other related issues to students' affairs.

All recommendations of the Education and Students' Affairs Committee are presented to the Council of the Faculty of Engineering for final approval.

The issues related to students' affairs are escalated to the University level in two tracks:

1. Ain Shams University Education and Students' Affairs Committee for students enrolled in the Specialized Programs.

2. Ain Shams University Programs Board for students enrolled in the Inter-Disciplinary Programs.

Article (7): Programs Administration Board

The Programs Administration Board is responsible for:

1. Strategic Planning of the Programs.
2. Marketing activities for the Programs.
3. Conducting feasibility studies of opening and freezing Academic Programs.
4. All financial issues related to the operation of the Programs.
5. Academic Development of the Programs.
6. Any exception to the rules in the Faculty Bylaws and Regulations.
7. International Cooperation with other universities.
8. Suggesting policies to maintain the teaching and learning quality in the Programs.
9. Reviewingreports of the Programs Steering Committees, and reports of the Education and Student Affairs Committee.
10. Handling general appeals from students regarding specific courses.
11. Any other issues related to the operation of the programs.

All recommendations of the Programs Administration Board are presented to the Council of the Faculty of Engineering for final approval.

Article (8): Procedure to add/freeze Programs

- Any Department at the Faculty of Engineering, Ain Shams University can propose a New Specialized Program within the Discipline of this department. More than one department can jointly propose new Inter-Disciplinary Program.
- Any group of 3 faculty members including at least one Professor at the Faculty of Engineering, Ain Shams University can also submit a proposal for a new program.
- The Program proposal should be submitted including all program information as in these bylaws in addition to a feasibility study of the industry and society need for the graduates of the new program. The proposal should also include a review of the available resources inside Ain Shams University to run this program.
- All proposals should be submitted to the Programs Administration Board which studies the proposal and submits a recommendation to the Faculty Council.
- Once approved by the Faculty Council, it is forwarded to the Supreme Council of Universities through Ain Shams University and then added to these bylaws.
- The Faculty Council can, based on the recommendation of the Programs Administration Board, freeze a Program temporarily or permanently if necessary.

Part B: Admission Regulations

Article (9): Enrollment Requirements and Scholarship System

- The Faculty of Engineering, Ain Shams University is a Public University. It offers Higher Education in Specialized Programs for Free (Scholarship from the Government) based on the Egyptian Constitution. The students who benefit from this Free Educaiton are those who have completed The Egyptian High School Diploma (Thanaweya Amma) or equivalent, and enrolled to the Faculty of Engineering through the National Coordination Office in the same year of achieving this Diploma or equivalent. The student keeps his Free Education as long as he fulfills the conditions mandated by the Egyptian Laws for Universities and these Bylaws.
- All Programs in these Bylaws are offered with the Credit-Hour System.
- Programs in these Bylaws are divided into two categories: Specialized and Inter-Disciplinary. The Free Education students are allowed to be enrolled in the Specialized Programs, whereas the Inter-Disciplinary Programs (previously known as New Programs) have separate Tuition Fees decided by the Faculty Council every year.
- Students who are not enrolled directly to the Faculty of Engineering, Ain Shams University, through the National Coordination Office, but has achieved the minimum Engineering Sector requirement, can join the Inter-Disciplinary Programs paying the separate Tuition Fees decided by the Faculty Council every year.
- Students who are enrolled directly to the Faculty of Engineering, Ain Shams University, through the National Coordination Office, can join the Inter-Disciplinary Programs paying the separate Tuition Fees.
- The Council of the Faculty of Engineering, Ain Shams University can award extra scholarships for students who have achieved a minimum GPA, or students with limited financial abilities, according to the rules announced by the Council every year.
- The topThirty students in the Egyptian High School Diploma (Thanaweya Amma – Mathematics Section), are fully exempted from paying any tuition fees if they join the Inter-Disciplinary Programs students. To maintain this exemption in the following semesters, the student should maintain a minimum GPA of 3.3 in every semester, otherwise the student will lose this privilege and the other rules will apply.
- If the Free Education student fails to achieve a minimum Semester GPA of 2.0 for 4 consecutive main semesters, he can be exceptionally allowed to register courses for 2 more semesters paying the separate Tuition Fees decided by the Faculty Council at the year of registering the course.
- If a student enrolled in any of the Specialized Programs fails a course two times, he is allowed to register this course again for 4 more times paying the separate Tuition Fees decided by the Faculty Council every year at the year of registering the course.
- Free Education students are allowed to register in the required courses to achieve the degree awarding requirements for his program. Any registered Credit Hours beyond the Program required Credit Hours for any reason is charged the separate Tuition Fees decided by the Faculty Council every year at the year of registering the course.
- Free Education students can only register courses in the main semesters. However, they can register courses in the summer semester paying the separate Tuition Fees decided by the Faculty Council every yearat the year of registering the course.
- Free Education students have to register a minimum of 12 Credit hours every main semester.

- Any student not enrolled to the Faculty of Engineering, Ain Shams University can register any number of courses paying the separate Tuition Fees decided by the Council of Ain Shams University every year at the year of registering the course. This student is given a Transcript of the courses he has registered in,showing his grades. By any means, he is not awarded a Bachelor Degree from the Faculty of Engineering, Ain Shams University.

Article (10): Placement Tests to newly admitted students.

The study at the Faculty of Engineering requires minimum level of English Language and Mathematics. The Faculty Council can organize a placement test for the students enrolled to the Faculty in English and Mathematics. The Faculty Council can ask the students who fail these tests to take zero credit courses in order to have equal opportunity with other students.

A placement test in Mathematics will be organized for all accepted students except students with an Egyptian High School Diploma (Thanaweya Amma) or IGCSE Certificate. A placement test in English will be organized for all accepted students. The Education and Student Affairs Committee can study any changes in these rules according to the study needs.

Article (11): Tuition Fees for Inter-Disciplinary Programs

- Tuition fees, set per Credit Hour, are specified yearly by the Faculty Council based on the announced Inflation rate. The Faculty Council has to announce these fees before the start of the Academic year.
- The tuition fees are paid every semester (the first and second main semesters) based on the number of credit hours registered by the student, with a minimum of the correspondence of educational service fees of 12 CH each semester, unless the number of credit hours remaining for the fulfilment of the degree is less than that, in which case the student should pay the actual number of registered credit hours.
- The student pays a fee equivalent to 1 CH every main semester for the extracurricular activities inside the campus.
- The educational service fees for the Summer semester are determined based on the actual number of credit hours registered by the student.
- Course Registration is not final until the student pays the educational service fees for the semester.

Article (12): Enrollment to Programs

- The Council of the Faculty of Engineering establishes general rules for admission to the programs considering the student preferences and the principle of equal opportunities as the basis for the admission of students to these programs, taking into consideration the available capacity.
- Free Education students who are enrolled in the Specialized Programs can join the Inter-Disciplinary Programs provided that they achieve a minimum GPA of 3.85 without paying the extra fees associated with the Inter-Disciplinary Programs. They can keep this scholarship as long as they maintain the minimum GPA of 3.85.
- Students enrolled in the Inter-Disciplinary Programs can join the Specialized Programsprovided that they achieve a minimum GPA of 3.7. The Programs Administration Board can lower this limit based on the available capacity of the Specialized Programs.
- Students enrolled to the Inter-Disciplinary Programs enjoy the following advantages:

- Can transfer to the Faculty of Engineering, Ain Shams University if his High School Grade qualifies him to join any Faculty of Engineering at a Public University regardless of the rules of the Geographical Region Distribution.
- Access to new and modern Programs which are needed nowadays in the job market.
- Program Selection on Admission to the Faculty.
- Possibility to join the Specialized Programs of their choice according to the rules set yearly by the Council of the Faculty of Engineering.
- Guaranteed a maximum number of 80 students in the lecture rooms and 40 students in the tutorial classes.
- Possibility to register courses in the summer semester.

Article (13): Student Transfers from other Universities

Students enrolled in a Faculty of Engineering at another Public university are allowed to be transferred to the Faculty of Engineering, Ain Shams University, if they fulfil the following conditions:

- The student must be transferring to Level 1 only from another equivalent level. It is not allowed to transfer students from higher levels to Level 1.
- The student must have a minimum GPA of 2.3 in the Freshman Year if he is transferred from a Credit-Hour System or a minimum Grade of "Good" if he is transferred from a Semester-Based System.
- It is not allowed to transfer students who are dismissed from their Faculty because of exceeding the maximum number of academic probation or failures.
- Transfer requests are processed at Ain Shams University Administration.

The Education and Student Affairs Committee can study any changes in these rules according to the study needs.

Transfers to Specialized Programs:

- Student transferred to Specialized Programs must be registered in the mainstream system in his home university.
- The student must have been awarded the Egyptian High School Diploma (Thanaweya Amma) from a school within the Geographical Area of Ain Shams University.
- The student place of accommodation lies within the Geographical Area of Ain Shams University. This has to be recorded in the student National ID and it has to be more than 12 months old.
- The student is not allowed to change his place of accommodation to another address outside the Geographical Area of Ain Shams University as long as he is a student enrolled at the Faculty of Engineering, Ain Shams University.
- It is not allowed to transfer students from another University in Greater Cairo (Cairo, Shoubra, Helwan, Matareya).
- The student is not allowed to use the University Accommodation City as long as he is a student enrolled at the Faculty of Engineering, Ain Shams University.
- Maximum number of transferred students to Level 1 isnot more than 5% of the total number of students in the same level at the Faculty of Engineering, Ain Shams University.
- The applying students are ranked in a descending order based on their grades in the Freshman year or marks in the preparatory year. If two students are equal, then the High School Diploma mark is considered.

- To join a certain program, the student grade must be more than the minimum grade of this program for the Faculty of Engineering, Ain Shams University students.
- The students are distributed among different programs based on a special coordination provided that the maximum number of transferred students is not than 5% of the total number of students in the same level in this program.
- The student maintains his scholarship of 136 CH.

Transfers to Inter-Disciplinary Programs:

- It is possible to transfer students from any Faculty of Engineering at a public university to the Inter-Disciplinary Programs and pay the applicable Fees.
- It is possible to transfer students from higher levels to Level 1, but with a maximum of 68 CH or their equivalence from the Semester-Based System.
- The student pays equivalence fees of Two Credit Hours as administration fees to process the equivalence request.

Transfers from the Military Technical College:

- The student must have resigned or dismissed for medical reasons only.
- To transfer to Freshman Year, the student musthave achieved the National Coordination Office minimum limit for the Faculty of Engineering, Ain Shams University to join the Specialized Programs, and minimum limit of Public Faculty of Engineering to join the Inter-Disciplinary Programs on the same year that he has obtained the Egyptian High School Diploma (Thanaweya Amma).
- To transfer to a higher level, an equivalence is performed for his courses.

Transfers from Non-Engineering Faculties:

- The student must have achieved the National Coordination Office minimum limit for the Faculty of Engineering, Ain Shams University to join the Specialized Programs, and the minimum limit of Public Faculty of Engineering to join the Inter-Disciplinary Programs on the same year that he has obtained the Egyptian High School Diploma (Thanaweya Amma).

Part C: Study Regulations based on Credit Hour System

The articles in this Part regulates the course teaching, learning and assessment throughout the programs. These articles are based on the 2014 Terms of Reference for the design of Credit-Hour Programs for undergraduate level published by the Engineering Sector Committee, Supreme Council of Universities on 3rd of May 2014.

Article (14): Programs' System

- The official teaching Language is English, and the Faculty of Engineering will ascertain the student's English Language proficiency. Textbooks, assignments, and examinations are all in English.
- The Programs follow the Credit-Hour (CH) system. This is a measure of the contact hours between the teachers and the student per semester. One Credit Hour is equivalent to the course Contact Hours as follows:
    - One Hour weekly lecture for a semester of 15 weeks.
    - Two Hours weekly tutorial for a semester of 15 weeks.
    - Three Hours weekly Laboratory work for a semester of 15 weeks.
- One Contact Hour is divided into 50 minutes actual teaching and 10 minutes break.
- For each course and Program in this curriculum, the European Credit Transfer and Accumulation System (ECTS) is given as a numerical descriptive value of qualification expressed in terms of Student Work Load (SWL). It is defined as "the number of working hours typically required to complete the learning activities of course units in order to achieve their expected learning outcomes". This system was adopted through the Bologna declaration in 1999 at the University of Bologna in Italy to facilitate the mobility of students through Europe.
- The total SWL comprises two components:
    - The structured SWL which is the scheduled teacher-contact hours interventions.
    - The unstructured SWL (USWL) which is the time spent by students in their own self-study, completing course assignments, and preparing for all types of exams, e.g. assessment workload.
- It has been considered as an essential description of the educational qualification recommended in the European Higher Education Area as a key element of the Bologna and Europeans Framework Qualifications in terms of total SWL.
- One ECTS credit corresponds to 25 hours of total student working, and each 15-weeks academic semester should meet 30 ECTS. As an agreed requirement, 750 hours of total SWL are necessary in a full academic semester, or about 50 hours of total SWL/per week.
- Expected values for each semester:
    - 16-19 CH
    - 25-28 Contact hours per week for 15 weeks
    - 750 hours of total student work load
    - 30 ECTS

The distribution of marks is left to course designer to decide. It depends on the nature of the course. Some courses are theoretical, and therefore give more marks to the exams, and some courses are more practical and therefore give more marks to the projects, assignments and labs.

Article (15): Study Levels

Whenever the student completes 20% of the Program requirements (34 Credit Hours), he will be transferred from one level to the next (Level 0 to Level 4). The following Table shows the student status based on the completed number of achieved Credit Hours.

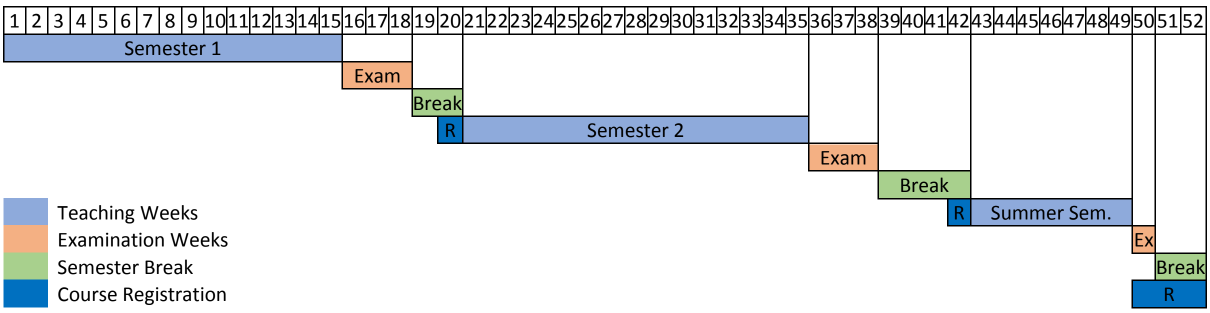
Table 3 Study Levels and relation to the achieved Credit Hours.

Study Level	Student Status	Achieved Credit Hours
0	Freshman	0 CH to less than 34 CH
1	Sophomore	35 CH to less than 68 CH
2	Junior	69 CH to less than 102 CH
3	Senior-1	103 CH to less than 136 CH
4	Senior-2	137 CH to less than 170 CH

Article (16): Academic Semesters and Course Registration

- The academic year comprises two main semesters, and one summer semester:
    - First main semester (Fall): Begins on Saturday of the third week ofSeptember and lasts for 15 weeks of teaching followed by 3 weeks of examinations. Course registration takes place within 3 weeks before the starting day of the semester.
    - Second main semester (Spring): Begins in February and lasts for 15 weeks followed by 3 weeks of examination.Course registration takes place within 1 week before the starting day of the semester.
    - Summer semester: Begins late June or early July and lasts for 7 weeks followed by 1 week of examination.Course registration takes place within 1 week before the starting day of the semester.

Figure 1 Academic Calendar.



- Registration is not final until the full tuition fees of the semester are paid.
- New students' enrolment in the programs takes place all year long, after fulfilling all the programs requirements and paying the enrolment fees, per the student status.
- Registration in the Summer semester is optional.

Article (17): Program Study Duration

- The minimum allowed study duration is nine main semesters.
- The maximum allowed study duration is twenty main semesters (ten years), which does not include frozen semesters for reasons accepted by the Faculty of Engineering Council, after which the student is dismissed from the programs.

Article (18): Terms of Course Registration

- The student may register courses in the main semesters with a maximum total Credit Hours according to the following rules (after approval of the Academic Advisor):
  - Up to 21 Credit Hours or 7 courses, whichever is greater for a student with a GPA larger than or equal to 3.0
  - Up to 18 Credit Hours or 6 courses, whichever is greater for a student with a GPA larger than or equal to 2.0, but less than 3.0
  - Up to 14 Credit Hours or 5 courses, whichever is greater for a student with a GPA less than 2.0
- The student may register courses in the Summer semester in a maximum total Credit Hours according to the following rules (after approval of the Academic Advisor):
  - Up to 9 Credit Hours or 3 courses, whichever is greater for a student with a GPA larger than or equal to 3.0
  - Up to 8 Credit Hours or 2 courses, whichever is greater for a student with a GPA less than 3.0
- The student may register one additional course to the above limits if this will lead to his graduationafter the approval of the academic advisor, if this course is offered in his program. For Inter-Disciplinary Programs, the course will be offered even if it is not normally offered in this academic semester.
- Late registration is not final unless there is a vacancy in the course, and the student should pay additional administrative feesequal to 1 Credit Hour, if applicable, in accordance with the recommendations of the Education and Students AffairsCommittee and approval of the Council of the Faculty of Engineering regarding this issue.
- It is allowed that Non-Degreestudents can register courses provided that they pay the applicable regular tuition fees related to these courses. The student will be given a transcript of the courses he has joined, showing his grades as per these regulations.
- Degree and Non-Degree students can register courses as audit in some courses provided that there is a vacancy in these courses, and after paying the applicable academic service fee, which is three fourth of the courseregular tuition fees.Audit students are not eligible to enter the course final exam.

Article (19): Degree Awarding Requirements

- To obtain the Bachelor of Science Degree in Engineering, the student must successfully complete the required Credit Hours in one of the programs according to the requirements stipulated in Part D, with a GPA at graduation of at least 2.0.
- The student must pass all zero-credit courses in his Program.
- A graduation project is an essential part of all the programs requirements for graduation. The graduation project may be completed over two successive semesters, as per the program requirement, and the student will not graduate unless he fulfills the project pass requirements. The student must earn at least 130 Credit Hours Level to register for the graduation project. If the project is divided along two semesters, the student must register them in their order.
- The student must perform FieldTraining for 12 weeks during his study duration.
- The student can study a number of courses in another University which has a cooperation agreement with Ain Shams University regarding the transfer of Credits. This requires prior approval from the Faculty of Engineering, Ain Shams University. The Credit Hours of these

courses are included in the student's graduation requirements, provided that the total Credit Hours of these courses do not exceed 68Credit Hours.

Article (20): Field Training

- The student must perform FieldTraining for 12 weeks in an industrial or service facility related to the student's program and must be under the full supervision of the faculty. It is also possible to perform the training inside the faculty in a similar environment.
- The training follow-up will be handled by the academic advisor assigned by the Program Steering Committee.
- Identifying a company official contact person.
- The student must submit a technical report to his academic advisor at the end of the training period.
- The company should submit a student's training evaluation form to the academic advisor at the end of the training period.
- The training is divided into periods of 4 weeks at the end of the first, second, and third levels. (Can be in the fourth level as well – open during the semester)
- Training for a period 6 weeks is allowed for only one time during the study duration.
- The field training is evaluated on pass / fail basis and does not count in the cumulative GPA calculation.
- The student should pay the supervision fees for the field training at a rate of 2 Credit Hours, if applicable, each academic year during which he is performing Field Training.

Article (21): Adding and Dropping a course

- The student may add courses in the first week of the main semesters, or the first three days of the summer semester.
- The student can drop courseswith refundable fees, if applicable, until the end of the second week of the main semesters or the end of the first week of the summer semester.
- Adding or Dropping course(s) should not violate the minimum and maximum number of Credit Hours registered per semester.

Article (22): Withdrawal from a course

- The student may withdraw from any course within the first ten weeks of the main semesters or the first five weeks for the Summer semester.
- The student does not fail the withdrawn course, provided that the withdrawal application and approval are finalized within the time limit mentioned in the previous point.
- The student gets a (W) grade for the withdrawn course and is allowed to register that course (full attendance and performing all activities including examinations) in a following semester.
- For elective courses, the student is allowed to change it in a following semester if he fails to pass it or withdraws from it. This is subject to the approval of the academic advisor and the requirements of his program.
- For non-scholarship students, the tuition fees for this course will not be refunded for withdrawn courses. The next time the student registers this course, he will have to pay its fees in full. The student, who withdraws from a whole semester without registering any course must pay the minimum tuition fees which is equivalent to 12 CH.

- For scholarship students, the Credit Hours of the withdrawn course are deducted from his scholarship. The student will be allowed to register this course one more time for free.

Article (23): Incomplete course

- If a student does not attend the final exam of the course in a semester with an excuse that is accepted by the Student Affairs Committee and approved by the Council of the Faculty of Engineering, the course is considered Incomplete.
- The student will get a grade (I) in the course until the exam is carried out in that course. If the student fails to attend the final exam at the next available date, the student will get a grade (F) in that course. Grade (I) will not count in the student'scumulative GPA.
- At the next available examination date, the student takes the exam, after paying a re-examination fees equivalent to one Credit Hour, if applicable. The marks of this final exam are added to the semester-work marks to calculate the overall grade of this course.

Article (24): Student Evaluation

- The marks of each course are distributed as percentages of the total mark, divided into Course Activities, Mid-Term Exam, Practical Exam, and Final Exam.
- The student must attend at least 75% of all course contact hours to be allowed to attend the course final examination.
- For the student to pass a course, the minimum mark that must be earned in the final exam is 30% of the total exam marks, otherwise the student will fail the course irrespective of the total marks he earned in the course and he will get an F grade in this course. This clause does not apply to the courses with no final exam.
- The student fails the course if he obtains an F grade (less than 60% of the course marks) or was not allowed to attend the final examination because of exceeding the absence percentage or cheating … etc or did not attend the final examination without submitting a prior excuse that is accepted by the Education and Student Affairs Committee and approved by the Council of the Faculty of Engineering.
- Zero-Credit courses are marked as Pass or Fail. The student gets a grade but does not contribute to the cumulative GPA. To pass the course, the student should get at least 60% of the course total marks.

Article (25): Course Grades

The GPA of each course is calculated based on the marksa student collects during his study of this course (Student Activities – Mid Term Exam – Practical Exam – Final Exam). The following table shows how to calculate the GPA based on the collected marks. The student must get a minimum Grade D in order to pass the course and be considered in the calculation of the Cumulative GPA.

Table 4 Course grades and equivalent GPA.

Marks % Collected	Grade	Points
More than 97%	A+	4.0
93% to less than 97%	A	
89% to less than 93%	A-	3.7
84% to less than 89%	B+	3.3
80% to less than 84%	B	3.0
76% to less than 80%	B-	2.7
73% to less than 76%	C+	2.3
70% to less than 73%	C	2.0
67% to less than 70%	C-	1.7
64% to less than 67%	D+	1.3
60% to less than 64%	D	1.0
Less than 60%	F	0.0

For other courses where the student is registered as a listener (audit), or is only required to pass (zero credit courses), are not included in the cumulative GPA, the course grades will be as follows:

Table 5 Grades of zero credit courses.

Grade	Explanation
AU	Listener (Audit)
P	Pass
F	Fail
W	Withdrawn
I	Incomplete

Article (26): Course Repeating

- The student can repeat a course for improvement if his grade satisfies the minimum passing requirement, according to the following rules:
  - The student gets the higher grade of the course after repeating. This grade is the one that will be accounted for in the cumulative GPA, on condition that the improvement should be shown in the student's transcript.
  - The maximum number of times that the student can repeat for repeating is five times during his study duration, except for improving courses with the purpose of getting out of the academic probation or satisfying the graduation requirements.
  - The student should pay the full credit hours fees for the improving course.
- If the student fails a course (gets F grade), he should repeat the course (full attendance and performing all activities including examinations), according to the following rules:
  - The maximum grade of the repeated course is B+.
  - The student gets the grade of the course after repeating. This grade is the one that will be accounted for in the cumulative GPA, on condition that the repeating should be shown in the student's transcript.
  - The student should pay the full credit hours fees for the repeated course.
- If a student repeats a course, he is required to repeat all course assessment criteria and will be completely re-evaluated. The course grade is calculated from scratch.

Article (27): Study Dismissal and Academic Probation

- A student gets an academic probation if his cumulative GPA at any main semester is less than 2.0.
- A student will be dismissed from the Faculty of Engineering, Ain Shams University if he gets cumulative GPA less than 2.0 in six consecutive semesters excluding Summer Semesters. If the student's cumulative GPA exceeds 2.0 in any semester including summer semester, then the number of consecutive academic probation is reset.
- The student will be dismissed from the Faculty of Engineering, Ain Shams University if he fails to achieve the graduation requirements during the maximum study duration, which is ten years.
- The student who is exposed to study dismissal due to his inability to raise his cumulative GPA to at least 2.0 will be offered an additional and final chance to register in 2 consecutive main semesters and a summer semester to raise his cumulative GPA to at least 2.0 and achieves the graduation requirements, provided that he has successfully completed at least 80% of the total number of credit hours required for graduation and there is a chance for the student to raise his cumulative GPA to at least 2.0.

Article (28): Calculation of the Cumulative Grade Point Average (GPA)

- Course points achieved by the student are calculated as the number of Credit Hours of this course multiplied by the course grade points according to Table 4.
- In any semester, the total points earned by the student are calculated as equal to the sum of the courses points the student earned in this semester.
- The Cumulative GPA at the end of any semester is calculated as the total points achieved by the student in all courses studied divided by the total number of Credit Hours of these courses, taking into consideration the rules relevant to the repeated and improved courses.

$$Cumulative\ GPA = \frac{\sum_{Courses} Grade\ Points * Credit\ Hours}{\sum_{Courses} Credit\ Hours}$$

- The Semester GPA is calculated as the total points achieved by the student in his courses of this semester divided by the total number of Credit Hours of these courses.
- The Graduation Cumulative GPA is the Cumulative GPA at Graduation, after fulfilling all the graduation requirements. The student cannot get the degree unless he achieves at least a cumulative GPA of 2.0.
- The ranking of the graduate is determined based on the Graduation Cumulative GPA. In case of equal Graduation Cumulative GPA between two or more students, the ranking will be based on their total accumulative marks, taking into consideration the rules relevant to the repeated and improved courses.
- The student's Transcript should include all registered courses during the study duration, including these he failed, withdrew from, or improved.

Article (29): Declaration of Honor

- For a student to achieve the declaration of honor, he has to fulfill the following conditions:
    - Maintain a cumulative GPA of 3.3 throughout his study at the Program.
    - Does not fail any course throughout his study at the Program.
    - Did not get any penaltythroughout his study at the Faculty

Article (30): Minimum Number of Students for Course Opening

- The minimum number of students required to open a course is 10 students, or 75% of the number of students registered in this program level, whichever is less.
- The minimum number of students required to open an elective course is 5 students or 25% of the number of students in this program level, whichever is less.
- Course opening is subject to the availability of teaching staff and the proper allocation of facilities.
- The Programs Administration Board may provide exceptions to these limits if there is a necessity.

Article (31): Academic Advisor

- Every student is assigned an Academic Advisor who follows-up the student academic progress and assists him in selecting the courses each semester.
- There can be more than one Academic Advisor in the Program based on the number of students enrolled in the Program.
- The Program Academic Advisor is responsible for:
    - Helping the student to choose his academic path and helps him to select courses each semester.
    - Helping the student with the choice of the Field Training.
    - Helping the student with the choice of concentration and graduation project.
- The Academic Advisor may ask the student to repeat courses which he has already passed or ask him to register in additional courses to raise his cumulative GPA to that required for graduation.

Article (32): Appeals

- The student can submit an appeal to review his course marks within a week from grades announcement, and after paying the required fees in accordance with the faculty regulations regarding this issue.
- In case of general complaint from a course result, the concerned committee reviews the students' marks and give a decision regarding the marks of this course.

Article (33): Student Transfer between Credit Hour System and Semester-Based System

- It is possibleto transfer students from another Engineering program with semester-based system (either inside or outside the Faculty of Engineering, Ain Shams University) to any of the programs in these regulations, according to the admission regulations in Part B.
- Course equivalence will be performed between the courses already the student passed in the Semester-Based program and the equivalent courses in the programsoffered here.
- The following table is used to calculate the equivalent grades when transferring the student from the Semester-Based system to the Credit-Hour system.

Table 6 Equivalent grades when moving from Semester Based System to Credit Hour System.

From Semester Based System	To Credit-Hour System	
Equivalent Percentage	**Points**	**Grade**
More than 95%	4.0	A+
90% to less than 95%		A
85% to less than 90%	3.7	A-
80% to less than 85%	3.3	B+
75% to less than 80%	3.0	B
71% to less than 75%	2.7	B-
68% to less than 71%	2.3	C+
65% to less than 68%	2.0	C
60% to less than 65%	1.7	C-
55% to less than 60%	1.3	D+
50% to less than 55%	1.0	D
Less than 50%	0.0	F

Article (34): General Provisions

- These regulations apply to the newly admitted students to the Faculty of Engineering, Ain Shams University starting Fall 2018 semester.
- Current students at the Faculty of Engineering can join these Programs and an equivalence can be made for the courses they have already passed.
- For any topic not covered by these regulations, the applicable Law of Universities and its amendments are taken as a reference, and if not covered by the Law, then it should be presented to the Programs Administration Boardto take the appropriate recommendation(s)for presentation to the Council of the Faculty of Engineering for approval before submission to the University Council.

Part D: Details of the Offered Programs

Ain Shams University, upon the request of the Faculty of Engineering Council, awards the Bachelor of Science (B.Sc.) Degree in one of the Programs listed in Table 7, which are the Programs offered by the Faculty of Engineering, Ain Shams University. The programs are divided into Specialized and Inter-Disciplinary programs.

Table 7 List of Undergraduate Programs offered by the Faculty of Engineering, Ain Shams University.

Engineering Programs	Specialized Programs	Mechanical Engineering	1	Design and Production Engineering Program
			2	Mechanical Power Engineering Program
			3	Automotive Engineering Program
			4	Mechatronics Engineering Program
		Architectural Engineering	5	Architectural Engineering Program
		Electrical Engineering	6	Electrical Power and Machines Engineering Program
			7	Electronics and Communication Engineering Program
			8	Computer and Systems Engineering Program
		Civil Engineering	9	Structural Engineering Program
			10	Water Engineering and Hydraulic Structures Program
			11	Utilities and Infrastructure Program
	Inter-Disciplinary Programs		12	Materials Engineering Program
			13	Manufacturing Engineering Program
			14	Mechatronics Engineering and Automation Program
			15	Landscape Architecture Program
			16	Environmental Architecture and Urbanism Program
			17	Housing and Urban Development Program
			18	Communication Systems Engineering Program
			19	Energy & Renewable Energy Engineering Program
			20	Computer Engineering and Software Systems Program
			21	Building Engineering Program
			22	Civil and Infrastructure Engineering Program

According to the Supreme Council of Universities Terms of Reference for Undergraduate Engineering Programs, the courses in any program are divided into the following categories:

1. University requirements.
2. Faculty requirements.
3. Discipline requirements.
4. Program requirements.

Table 8 shows the distribution of Credit Hours among different requirements for both Specialized and Inter-Disciplinary programs. For Inter-Disciplinary Programs, the 114 Credit Hours are divided between the different disciplines constituting this Program.

Table 8Division of Credit Hours among the four requirements.

	University requirements	Faculty requirements	Discipline requirements	Program requirements
Specialized Programs	14 CH 8.5%	42 CH 24%	63 – 80 CH 37.5% – 47.5%	51 – 34 CH 30% – 20%
Inter-Disciplinary Programs			114 CH 67.5%	

Figure 2 shows the different levels of competences as published in National Academic Reference Standards (NARS-2018). These Levels of competences determine the allocation of courses in different competency level with respect to the level requirements.

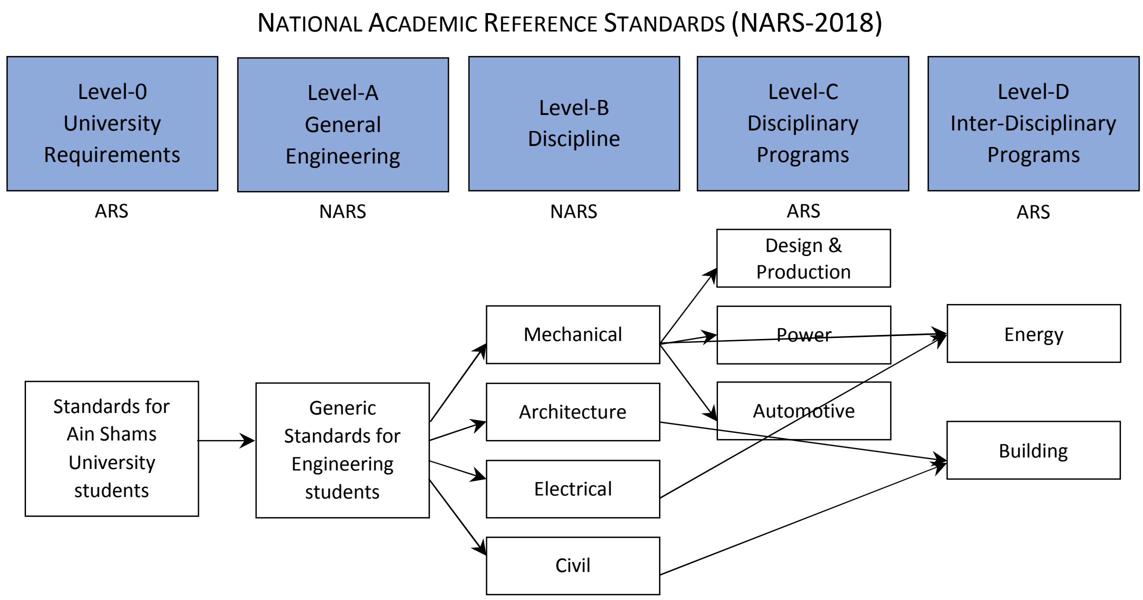


Figure 2 Different Levels of Competences as per NARS 2018, as published by NAQAAE.

Table 9 summarizes the overall data about the programs included in these bylaws. The rest of this Part D will show the list of standards for each level and the courses required to a achieve these standards for each program.

Table 9 List of overall data about the programs.

#	Program	NC	Credits and SWL			Total Contact Hours				4 Requirements %				Type of Courses %						
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SS	BM	BS	EK	BE	EA	PT
1	Design and Production Engineering	60	170	297	7425	127	88	65	280	8	25	37	30	8.2	2.4	19.4	4.1	28.8	30.0	5.3
2	Mechanical Power Engineering	60	170	297	7425	127	93	54	274	8	25	37	30	8.2	2.4	19.4	4.1	29.4	29.1	5.6
3	Automotive Engineering	61	170	291	7275	129	85	66	280	8	25	37	30	8.2	2.4	19.4	4.1	30.0	28.8	5.0
4	Mechatronics Engineering	61	170	297	7425	128	94	58	280	8	25	37	30	8.2	2.4	19.4	4.1	30.0	28.8	5.6
5	Architecture Engineering	62	170	299	7475	93	162	21	275	8	25	37	30	10.0	2.4	18.5	4.1	25.5	29.6	5.8
6	Electrical Power& Machines	61	170	300	7500	130	98	36	264	8	25	35	32	8.2	2.4	20.6	4.1	30.0	25.6	5.3
7	Electronics and Communications	61	170	300	7500	130	90	47	267	8	25	35	32	8.2	2.4	21.5	4.1	27.4	27.4	5.3
8	Computer and Systems Engineering	62	170	298	7450	130	84	49	263	8	25	35	32	8.2	2.4	21.8	4.1	25.6	27.9	5.3
9	Structural Engineering	68	172	277	6925	135	105	27	267	8	25	39	28	8.0	2.3	21.6	4.0	29.3	27.3	5.0
10	Water Engineering and Hydraulic Structures	69	172	297	7425	139	101	31	271	8	25	39	28	8.1	2.3	21.8	4.1	29.8	28.6	4.1
11	Utilities and Infrastructure	66	172	279	6975	134	104	28	266	8	25	39	28	8.0	2.3	21.6	4.0	29.6	28.9	7.0
12	Materials Engineering	62	170	295	7375	129	80	62	271	8	25	67		8.2	2.4	21.8	4.1	29.7	26.8	5.3
13	Manufacturing Engineering	62	170	298	7450	129	84	63	276	8	25	67		8.2	2.4	20.2	4.1	25.3	25.4	4.1
14	Mechatronics Engineering and Automation	58	170	299	7450	130	93	57	280	8	25	67		8.2	2.4	19.6	4.1	30.0	29.9	5.3
15	Landscape Architecture	63	170	300	7500	90	168	21	279	8	25	67		8.2	2.4	21.9	4.1	29.1	27.2	5.3
16	Environmental Architecture and Urbanism	65	170	298	7450	94	161	21	276	8	25	67		8.2	2.4	21.8	4.1	29.7	26.8	5.3

17	Housing and Urban Development Program	62	170	300	7500	92	164	21	277	8	25	67	8.2	2.4	20.9	4.1	27.4	30.0	5.3
18	Communication Systems Engineering	60	170	300	7500	127	92	47	266	8	25	67	8.2	2.4	20.6	4.1	29.5	28.5	4.9
19	Energy and Renewable Energy Engineering	60	170	300	7500	126	99	36	260	8	25	67	8.2	2.4	20.6	4.1	29.7	28.8	4.4
20	Computer Engineering & Software Systems	58	170	300	7500	130	80	62	272	s	25	67	8.2	2.4	20.0	4.1	28.8	29.7	5.0
21	Building Engineering	62	170	300	7500	125	111	28	264	8	25	67	8.2	2.4	21.8	4.1	29.7	27.4	4.7
22	Civil and Infrastructure Engineering	66	170	300	7500	130	111	29	270	8	25	67	8.2	2.4	21.5	4.1	29.1	28.2	4.7

NC Total number of Courses
CH Credit Hour
ECTS European Credit Transfer System
SWL Student Work Load
Lec Lectures
Tut Tutorials
Lab Laboratory
TT Total

UR University Requirement
FR Faculty Requirement
DR Discipline Requirement
PR Program Requirement

SS Social Sciences & Humanities
BM Business Management
BS Math & Basic Sciences
EK Engineering Knowledge
BE Basic Engineering Sciences
EA Engineering Applications & Design
PT Project and Training

University Requirements

The university is considered a core of Human Thinking at its highest level, and the source of investment and development of human resources. It is concerned with the rise of the Arabian Civilization and the Historical Heritage of the Egyptian Society, and its traditions. It is also concerned with the education of Religion, Morals and Nationalism (Egyptian National Law for Universities, Law 49 for Year 1972).Therefore, Ain Shams University graduate should be:

0. Aware ofnational, regional and international contemporary issues,to have an intellectual and enlightened personality and to interact effectively in the community through different communication skills.

To achieve this goal, Ain Shams University has designed a number of coursesplanned to build the student personality, develop his skills, and increase his awareness of different topics.These courses are called University Requirements. The Faculty of Engineering Ain Shams University has selected some of these courses to be offered within the Engineering Programs. These courses are:

Table 10 List of University requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
ASU011	Technical English Language	0	n/a	n/a	n/a	n/a	n/a	n/a
ASU111	Human Rights	2	2	50	2	1	0	3
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2
-	ASU Elective (1)	2	3	75	2	1	0	3
-	ASU Elective (2)	2	2	50	2	0	0	2
Total		14	17	425	12	6	0	18
Pool of ASU Elective (1) Courses								
ASU321	Innovation and Entrepreneurship	2	3	75	2	1	0	3
ASU322	Language Course – can accept equivalent certificates	2	3	75	2	1	0	3
ASU323	Introduction to Accounting	2	3	75	2	1	0	3
ASU324	History of Engineering & Technology	2	3	75	2	1	0	3
Pool of ASU Elective (2) Courses								
ASU331	Human Resource Management	2	2	50	2	0	0	2
ASU332	History of Architecture	2	2	50	2	0	0	2
ASU333	Introduction to Marketing	2	2	50	2	0	0	2
ASU334	Building Safety and Fire Protection	2	2	50	2	0	0	2
ASU335	Literature and Arts	2	2	50	2	0	0	2
ASU336	Business Administration	2	2	50	2	0	0	2

A placement test in English Language will be conducted for all admitted students to the Faculty of Engineering. If the student passes this test, then he will be exempted from taking the English Course. The English course is a pre-requisite for all Faculty requirements courses.

For ASU322 – Language course, any non-English language is accepted including Arabic. If a student has an equivalent certificate, he is exempted from taking this course. Examples of equivalent certificates: TOEFL, IELTS … etc.

History of Architecture Course is not eligible for students enrolled in Architecture Engineering Program, Landscape Architecture Program, Environmental Architecture and Urbanism Program, and Housing and Urban Development Program.

Faculty Requirements

All the programs offered at the Faculty of Engineering, Ain Shams University are Engineering Programs. The graduates have the privilege of being Engineers and are automatically enrolled in the Egyptian Engineering Syndicate (EES). The graduates are also entitled to take the Fundamentals of Engineering Exam offered by the National Council of Examiners for Engineering and Surveying (NCEES), based on the agreement between EES and NCEES.

According to the National Academic Reference Standards (NARS-2018), The Engineering Graduate must be able to (A-Level):

- A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
- A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
- A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
- A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
- A5. Practice research techniques and methods of investigation as an inherent part of learning.
- A6. Plan, supervise and monitor implementation of engineering projects.
- A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
- A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
- A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
- A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

To achieve these Intended Learning Outcomes, a set of courses must be completed as a Faculty Requirement. These courses are divided into Basic Science Courses and Basic Engineering Courses.

Table 11 List of Faculty requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
PHM011	Basic Mathematics	0	n/a	n/a	n/a	n/a	n/a	n/a
PHM012	Mathematics (1)	3	5	125	3	2	0	5
PHM013	Mathematics (2)	3	5	125	3	2	0	5
PHM021	Vibration and Waves	3	5	125	3	1	1	5
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5
PHM031	Statics	3	5	125	2	2	1	5
PHM032	Dynamics	3	5	125	2	2	1	5
PHM041	Engineering Chemistry	3	5	125	2	1	2	5
PHM111	Probability and Statistics	2	4	100	2	2	0	4
ENG111	Training	0	n/a	n/a	n/a	n/a	n/a	n/a
MDP081	Production Engineering	3	5	125	2	0	3	5
MDP011	Engineering Drawing	3	6	150	1	3	2	6
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6
CSE031	Computing in Engineering	2	4	100	2	0	0	2
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3
-	Structures and Properties of Materials Elective	2	4	100	2	1	1	4
-	Engineering Economy Elective	2	4	100	2	1	0	3
-	Project Management Elective	2	4	100	2	1	0	3
Total		42	76	1900	34	23	14	71
Pool of Structures and Properties of Materials Elective Courses								
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4
EPM211	Properties of Electrical Materials	2	4	100	2	1	1	4
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4
Pool of Engineering Economy Elective Courses								
MDP231	Engineering Economy	2	4	100	2	1	0	3
ARC471	Feasibility Studies	2	4	100	2	1	0	3
ARC463	Renewable Energy Systems and Economics	2	4	100	2	1	0	3
UPL271	Society and Housing Economics	2	4	100	2	1	0	3
UPL472	Urban Economics	2	4	100	2	1	0	3
CEI261	Engineering Economics and Management	2	4	100	2	1	0	3
CES172	Engineering Economics and Finance	2	4	100	2	1	0	3
Pool of Project Management Elective Courses								
MDP232	Industrial Project Management	2	4	100	2	1	0	3
ARC371	Architecture Project Management	2	4	100	2	1	0	3
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3
CSE441	Software Project Management	2	4	100	2	1	0	3
CES171	Construction Management	2	4	100	2	1	0	3
CES271	Project Management Essentials	2	4	100	2	1	0	3

A placement test in Mathematics will be conducted for all admitted students except students with an Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE). If the student passes this test, then he will be exempted from taking Basic Mathematics Course. The Basic Mathematics course is a pre-requisite for all Faculty requirements courses.

Discipline Requirements

According to the National Academic Reference Standards (NARS-2018), each discipline graduate (Mechanical – Architectural – Electrical – Civil), has to meet specific competences.

Mechanical Engineering Requirements

In addition to the Competencies for all Engineering Programs the Basic Mechanical Engineering graduate must be able to (B-Level):

B1m. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.

B2m. Carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.

B3m. Select conventional mechanical equipment according to the required performance.

B4m. Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain mechanical equipment and systems.

To achieve these Intended Learning Outcomes, a set of courses must be completed as a Basic Mechanical Engineering Requirement.

Table 12 List of Basic Mechanical Engineering Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5
PHM131	Rigid body dynamics	2	4	100	2	1	1	4
MEP111	Thermal Physics	2	4	100	1	2	0	3
MEP211	Thermodynamics	4	6	150	3	2	1	6
MEP212	Heat Transfer	4	8	200	2	2	3	7
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6
MDP112	Machine Construction	3	5	125	2	2	0	4
MDP211	Machine Elements Design	4	8	200	3	2	2	7
MDP212	Mechanics of Machines	4	6	150	3	3	1	7
MDP311	Mechanical Vibrations	4	7	175	3	2	1	6
MDP152	Metallurgy and Material Testing	3	5	125	3	1	1	5
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5
MCT211	Automatic Control	3	5	125	3	1	1	5
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6
ECE215	Introduction to electronics	2	4	100	2	1	1	4
	Mechanical Engineering Requirement Elective	2	4	100	2	1	1	4
Total		63	110	2750	48	32	24	104
Pool of Mechanical Engineering Requirement Elective								
MDP331	Maintenance Planning and Scheduling	2	4	100	2	1	0	3
MEA261	Introduction to Automotive	2	4	100	2	0	2	4
MCT312	Industrial Automation	2	4	100	2	1	1	4

Architectural Engineering Requirements

In addition to the Competencies for all Engineering Programs the BasicArchitectural Engineering graduate must be able to (B-Level):

- B1a. Create architectural, urban and planning designs that satisfy both aesthetic and technical requirements, using adequate knowledge of: history and theory, related fine arts, local culture and heritage, technologies and human sciences.
- B2a. Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.
- B3a. Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.
- B4a. Transform design concepts into buildings and integrate plans into overall planning within the constraints of: project financing, project management, cost control and methods of project delivery; while having adequate knowledge of industries, organizations, regulations and procedures involved.
- B5a. Prepare design project briefs and documents; and understand the context of the architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.

To achieve these Intended Learning Outcomes, a set of courses must be completed as a Basic Architectural Engineering Requirement.

Table 13 List of Basic Architectural Engineering Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8
ARC211	Building Type Design Studio	4	8	200	0	8	0	8
ARC321	Theory and Philosophy of Contemporary Architecture	3	5	125	3	0	0	3
ARC131	History of Arts and Architecture (1): Ancient Civilizatio	3	4	100	3	0	0	3
ARC132	History of Arts and Architecture (2): History of Islamic and Western Architecture	3	5	125	2	2	0	4
ARC141	Architectural Representation	3	5	125	1	4	0	5
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5
ARC351	Working Design (1): Execution Drawings Coordination, annotation and Coding	3	6	150	1	4	0	5
ARC352	Working Design (2): Blow-Ups Detailing, items specifications and BOQs	3	6	150	1	4	0	5
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3
UPL211	Context and Place Design Studio	4	8	200	0	8	0	8
UPL212	Principles of Urban Design and Landscape	3	4	100	2	2	0	3
UPL311	Urban and Landscape Design Studio	4	8	200	0	8	0	8
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4
UPL331	Planning and Urban Upgrading	3	5	125	1	4	0	5
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4
CEP113	Surveying	2	4	100	1	1	1	3
MEP241	Technical Installations	2	3	75	1	2	0	3
General Architectural Requirements Total		63	110	2750	27	74	1	101

Electrical Engineering Requirements

In addition to the Competencies for all Engineering Programs the BasicElectrical Engineering graduate must be able to (B-Level):

- B1e. Apply general knowledge about generation, transmission and distribution of electrical power system.
- B2e. Select and analyze appropriate control techniques for electrical/electronic engineering systems.
- B3e. Design and implement elements, modules, sub-systems or systems using technological and professional tools.
- B4e. Estimate and measure the performance of an electrical/electronic system and circuit under specific input excitation and evaluate its suitability for a specific application.
- B5e. Identify needs, plan and manage resources, and gather information for solving a specific electrical/electronic problem and document and communicate this solution efficiently.

To achieve these Intended Learning Outcomes, a set of courses must be completed as a BasicElectricalEngineering Requirement.

Table 14 List of BasicElectricalEngineering Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4
EPM111	Electrical Circuits (1)	4	7	175	3	2	1	6
EPM112	Electromagnetic Fields	3	5	125	3	1	0	4
EPM113	Electrical measurements	3	5	125	2	2	1	5
EPM213	Energy and Renewable Energy	3	6	150	3	1	1	5
ECE211	Electronics	3	5	125	3	1	1	5
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5
ECE252	Fundamentals of Communication Systems	3	6	150	2	2	0	4
CSE111	Logic Design	3	5	125	3	1	1	5
CSE131	Computer Programming	3	6	150	3	0	2	5
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
CSE271	System Dynamics and Control Components	4	6	150	3	2	1	6
CSE371	Control Engineering	3	5	125	2	1	1	4
MEP214	Thermal Power Engineering	3	5	125	2	2	0	4
	Electrical Engineering Elective	3	6	150	2	2	0	4
	Electrical Circuits Elective	3	6	150	2	2	0	4
	Networks Elective	3	5	125	2	2	0	4
General Electrical Requirements Total		60	104	2600	48	30	12	90
Pool of Electrical Engineering Elective Courses								
EPM214	Electrical Systems Simulation	3	6	150	2	2	1	5
CSE212	Computer Organization	3	6	150	2	2	0	4
Pool of Electrical Circuits Elective Courses								
EPM212	Electrical Circuits (2)	3	6	150	2	2	1	5
ECE212	Digital Circuits	3	6	150	2	2	0	4
Pool of Networks Elective Courses								
ECE352	Telecommunication networks	3	5	125	2	2	0	4
CSE351	Computer Networks	3	5	125	2	2	0	4
CSE353	Industrial Networks	3	5	125	2	2	1	5

Civil Engineering Requirements

In addition to the Competencies for all Engineering Programs the BASIC CIVIL Engineering graduate must be able to (B-Level):

- B1c. Select appropriate and sustainable technologies for construction of buildings, infrastructures and water structures; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics and Fluid Mechanics.
- B2c. Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures; and at least three of the following civil engineering topics: Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbors; or any other emerging field relevant to the discipline.
- B3c. Plan and manage construction processes; address construction defects, instability and quality issues; and maintain safety measures in construction and materials.
- B4c. Deal with biddings, contracts and financial issues including project insurance and guarantees; and assess environmental impacts of civil engineering projects.

To achieve these Intended Learning Outcomes, a set of courses must be completed as a Basic Civil Engineering Requirement.

Table 15 List of Basic Civil Engineering Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5
CES111	Structural Mechanics (1)	4	4	100	3	2	0	5
CES112	Structural Mechanics (2)	4	4	100	3	2	0	5
CES211	Structural Analysis (1)	3	3	75	2	2	0	4
CES212	Structural Analysis (2)	3	3	75	2	2	0	4
CES221	Concrete Design (1)	2	3	75	2	1	0	3
CES222	Concrete Design (2)	2	3	75	2	1	0	3
CES223	Design Principles	1	2	50	1	1	0	2
CES321	Design of Concrete Floors	3	4	100	2	2	0	4
CES322	Design of Concrete Halls	3	4	100	2	2	0	4
CES341	Design and Behavior of Steel Structures (1)	3	5	125	2	2	0	4
CES342	Design and Behavior of Steel Structures (2)	3	5	125	2	2	0	4
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4
CES251	Concrete Technology (1)	3	4	100	2	2	2	6
CES252	Concrete Technology (2)	3	4	100	3	1	1	5
CES261	Geology and Geotechnical Engineering	2	3	75	2	1	1	4
CES262	Geotechnical Engineering (1)	2	3	75	2	1	1	4
CES361	Geotechnical Engineering (2)	2	3	75	2	1	0	3
CEP111	Plane Surveying (1)	2	4	100	2	1	1	4
CEP112	Plane Surveying (2)	3	5	125	2	1	2	5
CEP211	Topographic Surveying (1)	2	5	125	2	1	1	4
CEI111	Fluid Mechanics	2	4	100	2	1	1	4
CEI112	Hydraulics (1)	2	4	100	2	1	1	4
CEI211	Hydraulics (2)	2	4	100	2	1	1	4
CEI221	Irrigation and Drainage Engineering	4	5	125	3	2	0	5
CEI131	Civil Drawings	2	5	125	1	3	0	4
Total		**68**	**103**	**2575**	**55**	**39**	**13**	**107**

Program #1: Design and Production Engineering Program

Program Description

The Design and Production Engineering program prepares students for entry level professional practice in mechanical design and production engineering, both locally and internationally.

The Design and Production Engineering program is one of the oldest engineering programs in Egyptian universities. The program flourished with the boom in Egyptian industry during the sixties of the twentieth century. Recently, there is an increasing need for the modernization of industry in Egypt to cope with the global challenges of designing and producing cost effective products that can compete with the international market. Consequently, the Design and Production Engineering program needs to be modernized as well.The program developed at Ain Shams University equip students with necessary competencies contemporary to the current industry. It also inspires graduates for self-learning to cope with the requirements of ever-changing career pathafter their graduation.

Career Prospects

Design and Production Engineering is one of the most recognized disciplines in Egyptian industry. Design and Production engineers are needed in many industries aiming todesign and produceall kinds of products, machines and equipment. Graduates work in all industrial sectors including engineering, metallurgical, petrochemical, textiles, furniture, etc. They can work as engineers in research and development, operations management, quality control, tool design, work study, cost analysis, process control, heat treatment, etc.

Graduates can be specialized in a specific field of the following concentrations: Manufacturing engineering, Mechanical design, Industrial engineering and operations management, or Materials engineering.

Program Concentrations

The program qualifies graduates to work as Design and Production engineers. The graduate can be specialized in one of the following four concentrations:

1. Mechanical Design
2. Industrial Engineering and Operations Management
3. Materials Engineering
4. Manufacturing Engineering

The program concentration is achieved by 12 credit hours including 6 credit hours of courses and 6 credit hours of the graduation project, all related to the specific concentration.

1. Mechanical Design: Graduates are more specialized in the design of mechanical systems. Graduates demonstrate additional abilities to model, analyze, and design mechanical components and systems using the most up-to-date tools of integrated systems.

2. Industrial Engineering and Operations Management: Graduates are more specialized in Industrial engineering and operations management. Graduates demonstrate additional abilities to analyze, design, integrate, operate, evaluate, control, automate, and implement methods and techniques to manage industrial systems.

3. Materials Engineering: Graduates are more specialized in materials engineering. Graduates demonstrate additional abilitiesto select, prepare, analyze, treat, and test materials for specific applications.

4. Manufacturing Engineering: Graduates are more specialized in manufacturing processes. Graduates demonstrate additional abilities to select and link different manufacturing processes to certain design requirement to achieve desired levels of quality, product and process performance.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Mechanical Discipline (B-Level), the Design and Production Engineering Program graduate must be able to (C-Level):

C1. Implement basic theories to production processes including new technologies in manufacturing to select proper processes and process parameters for specific products.
C2. Design systems, machines, tools, and products implementing proper standards and developing the necessary calculations, construction and working drawings
C3. Implement basics of industrial engineering to analyze, plan and design production systems.
C4. Select materials suitable for specific application.
C5. Demonstrate additional abilities related to the field of the concentration within Design and Production Engineering as listed below.

Concentration	**Graduate attributes**
Mechanical design	C5a. Demonstrate additional abilities to model, analyze, and design mechanical components and systems using the most up-to-date tools of integrated systems.
Industrial Engineering	C5b. Demonstrate additional abilities to analyze, design, integrate, operate, evaluate, control, automate, and implement methods and techniques to manage industrial systems.
Materials Engineering	C5c. Demonstrate additional abilities to select, prepare, analyze, treat, and test materials for specific applications.
Manufacturing	C5d. Demonstrate additional abilities to select and link different manufacturing processes to certain design requirement to achieve desired levels of quality, product and process performance.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 16 List of Design and Production Engineering Program Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Mechanical Engineering Requirements	63	110	2750	48	32	24	104
MDP312	Mechanical System Design	3	5	125	2	2	2	6
MDP381	Theory of Metal Forming	3	5	125	2	2	1	5
MDP382	Theory of Metal Cutting	3	5	125	2	2	1	5
MDP383	Metal Forming Machines, Technology and Dies	3	5	125	2	2	1	5
MDP384	Metal Cutting Machines and Technology	3	6	150	2	2	2	6
MDP481	Design of Tools and Production Facilities	3	4	100	2	2	0	4
MDP482	Metrology and Measuring Instruments	4	8	200	3	0	5	8
MDP483	Computerized Numerical Control Machine Tools	2	4	100	2	1	1	4
MDP332	Work Study	3	6	150	2	2	0	4
MDP333	Operations Research	3	6	150	2	2	0	4
MDP431	Operations Management	3	6	150	2	2	0	4
MDP432	Facilities Planning	3	7	175	2	2	0	4
MDP433	Quality Control	3	5	125	2	2	0	4
	Design & Production Concentration Elective (1)	3	5	125	2	2	1	5
	Design & Production Concentration Elective (2)	3	5	125	2	2	1	5
MDP401	Mechanical Design & Production Graduation Project (1)	3	6	150	1	0	6	7
MDP402	Mechanical Design & Production Graduation Project (2)	3	6	150	1	0	6	7
	Program Requirements Total	170	297	7425	127	88	65	280
Pool of Mechanical Design Concertation Elective Courses								
MDP411	Introduction to Finite Elements	3	5	125	2	2	0	4
MDP412	Noise and Vibration Control	3	5	125	2	2	1	5
MDP413	Design Optimization	3	5	125	3	1	1	5
MDP414	Product Design and Development	3	5	125	2	2	1	5
MDP415	Selected Topics in Mechanical Design	3	5	125	2	2	1	5
Pool of Industrial Engineering Concertation Elective Courses								
MDP434	Quality Systems and Assurance	3	5	125	2	2	0	4
MDP435	Industrial Systems Modelling and Simulation	3	5	125	2	0	3	5
MDP436	Production Planning and Control	3	5	125	2	2	0	4
MDP437	Ergonomics	3	5	125	2	2	0	4
Pool of Materials Engineering Concertation Elective Courses								
MDP256	Phase Transformation and Heat Treatment	3	5	125	2	2	2	6
MDP451	Failure Analysis	3	5	125	3	0	1	4
MDP452	Material and Process Selection	3	5	125	3	0	1	4
MDP453	CompositesTechnology	3	5	125	3	0	1	4
MDP454	Corrosion	3	5	125	3	0	1	4
MDP455	Renewable Materials	3	5	125	2	2	2	6
Pool of Manufacturing Concertation Elective Courses								
MDP484	Product Life Cycle Management	3	5	125	2	1	2	5
MDP485	Advanced Topics in CNC Machine Tools	3	5	125	2	2	1	5
MDP486	Selected Topics in Manufacturing	3	5	125	2	1	2	5
MDP487	Computer Integrated Manufacturing	3	5	125	2	2	1	5
MDP488	Advanced Manufacturing Technology	3	5	125	2	2	0	5
MDP489	Selected Topics in Forming	3	5	125	2	1	2	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4	PHM041
PHM131	Rigid body dynamics	2	4	100	2	1	1	4	PHM032
MEP111	Thermal Physics	2	4	100	1	2	0	3	PHM041
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6	MDP011
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP081
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	
Total		16	29	725	12	9	7	28	
Semester 4									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
MEP211	Thermodynamics	4	6	150	3	1	1	5	MEP111
MDP112	Machine Construction	3	5	125	2	2	0	4	PHM031 MDP111
MDP212	Mechanics of Machines	4	6	150	3	3	1	7	PHM131
MDP152	Metallurgy & Material testing	3	5	125	3	1	1	5	MDP151
	Elective (1)	2	2	50	2	1	0	3	
Total		18	28	700	15	10	3	28	
Semester 5									
MDP231	Engineering Economy	2	4	100	2	1	0	3	
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5	MDP152
Total		17	30	750	12	9	6	27	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MDP232	Industrial Project management	2	4	100	2	1	0	3	
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6	MEP111
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	MEP211
MDP311	Mechanical Vibrations	4	7	175	3	2	1	6	PHM032
	Mechanical Requirement Elective	2	4	100	2	1	0	3	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
Total		17	31	775	13	8	5	26	
Semester 7									
MDP333	Operations Research	3	6	150	2	2	0	4	PHM013 PHM111
MCT211	Automatic Control	3	5	125	3	1	1	5	MEP211
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	
MDP312	Mechanical System Design	3	5	125	2	2	2	6	MDP211
MDP383	Metal Forming Technology, Machines and Dies	3	5	125	2	2	1	5	MDP181
MDP384	Metal Cutting Machines and Technology	3	6	150	2	2	2	6	MDP181 MDP211
Total		17	31	775	13	10	7	30	
Semester 8									
MDP381	Theory of Metal Forming	3	5	125	2	2	1	5	MDP181
MDP382	Theory of Metal Cutting	3	5	125	2	2	1	5	MDP181
MDP332	Work Study	3	6	150	2	2	0	4	PHM111
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5	MCT211 MEP221
	Design & Production Concentration Elective (1)	3	5	125	2	2	1	5	
	ASU Elective (2)	2	2	50	2	1	0	3	
Total		17	28	700	13	10	4	27	
Semester 9									
MDP483	Computerized Numerical Controlled Machines	2	4	100	2	1	1	4	MDP382
MDP482	Metrology and Measuring Instruments	4	8	200	3	0	5	8	
MDP431	Operations Management	3	6	150	2	2	0	4	MDP331
	Design & Production Concentration Elective (2)	3	5	125	2	2	1	5	
MDP401	Mechanical Design & Production Graduation Project (1)	3	6	150	1	0	6	7	Elec(1)
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
Total		17	31	775	12	5	13	30	
Semester 10									
ASU111	Human Rights	2	2	50	2	1	0	3	
MDP432	Facilities Planning	3	7	175	2	2	0	4	MDP333
MDP433	Quality Control	3	5	125	2	2	0	4	PHM111
MDP481	Design of Tools and Production Facilities	3	4	100	2	2	0	4	MDP382
MDP402	Mechanical Design & Production Graduation Project (2)	3	6	150	1	0	6	7	MDP401
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		17	27	675	11	9	6	26	

Program #2: Mechanical Power Engineering Program

Program Description

The program is commissioned to provide an engineer that works in the field of power supply to industry and domestic needs in addition to the energy utilization and conversion into forms that are liable for assisting the human activity as well as for providing human comfort. All Factories and corporations in the industry urgently need powerful schemes of managing their power supplies and operate their equipment in a highly efficient form of energy utilization. The program is thus devoted to the study of the nature and behavior of thermo-fluids. Topics of courses cover the technology of energy release, conversion and efficient use. Applications involve the forms of mass and energy delivery and their transport phenomena. Smart management and legal non-harmful use of energy require the employment of automatic control methodology as well as the pollution reduction techniques.

Career Prospects

The graduate of the program is expected to get a job in one of the following positions:

1. A Power Generation Station
2. An Air Conditioning Company
3. Petroleum Prospecting and Service Companies
4. Food Factories
5. A Water Desalination Plant
6. Paper and Textile Factories
7. Projects employing Heavy Equipment hydraulic and pneumatic machines

Program Concentrations

The program qualifies graduates to work as Mechanical Power engineers. The graduate can be specialized in one of the following four concentrations:

1. Energy Generation
2. Energy Efficiency and Sustainability
3. Process and Equipment Design
4. Environment, Services and Systems

The program concentration is achieved by 21 credit hours including 15 credit hours of courses and 6 credit hours of the graduation project, all related to the specific concentration.

1. Energy Generation: This is the concentration for the graduate engineer to work in power generation stations. Petroleum Prospecting and Service Companies relies on such graduate for operation and maintenance of their power houses in the prospection field. The core of this concentration also includes the transmission of energy, desalinated water for industrial activities and human needs local production of energy in remote areas, economical aspects of energy generation from fossil and nuclear fuels. It additionally includes systems to provide vehicle propulsions in automotive and aircrafts, power handling and energy storage, heat recovery boilers. The core of this concentration is the build-up and operation of internal combustion engines and externally added heat engines.

The graduation project should focus on the construction details and the performance maps of the turbines, compressors, pumps, boilers and other parts of thermal power plants and internal combustion engines. Other examples of graduation projects can be energy generation for domestic uses and compressor work requirements for cooling loads in air conditioning projects.

2. Energy Efficiency and Sustainability: This is the concentration for the graduate engineer to work in the power stations that rely on renewable energies such as wind farms, stations of solar collectors, water tidal and wave energy. This graduate is also directed to the work on energy management and energy storage. The core of this concentration includes the efficient use of energy, clean energy technology, renewable energies, incineration systems, energy recovery and renewable fuels. This is the concentration for the graduate engineer to work in management departments of large projects as well as in the control sections of power generation plants. The graduate is also required to work in water desalination units.

The graduation project should focus on the design and testing of all possible uses of renewable energies. The different configurations of solar concentrators can be examined, and the different techniques of biomass use are required to be highlighted. In addition, the different mechanisms of delivering power from the water tidal and wave energies can be compared. Other examples of graduation projects can be the design and operation of a refrigeration and air conditioning system that is driven by renewable energy resources.

3. Process and Equipment Design: This is the concentration for the graduate engineer to work in the heavy equipment field of utilization in the construction and infra-structure projects. This graduate will be also involved in the control systems of factories. The graduate of this concentration works in air-conditioning companies, food factories that involve refrigeration or deep freezing. The graduate may be also involved in medicine industry. The graduation project should focus on the construction and performance evaluation of fan coils, metallic pipes configurations that are found in heat exchangers and refrigeration units. The core of this concentration includes Industrial control, management, design and selection and matching of equipment, modeling of systems, integration of equipment, innovative prototypes of machinery, quality and safety of mechanical systems.

The graduation project should focus on the fluid flow features of hydraulic and pneumatic systems in addition to highlighting their aspects upon getting used in the automatic control processes. Other examples of graduation projects can be design and selection of air conditioning equipment.

4. Environment, Services and Systems: This is the concentration for the graduate engineer to minimize the pollution from Power stations. The graduate is required to operate and maintain the different equipment such as the furnaces of steam generation that is needed in textile factories and food companies. The graduate is also required for Petroleum Prospection and Service Companies and Projects that use electrical generators with Diesel Engine Coupling. The graduate is also needed for the air-conditioning requirements for building services. The core of this concentration includes smart systems, maintenance heating ventilation and air conditioning as related to building services and petroleum pipelines as related to petroleum industry services in addition to water distribution systems.

The graduation project should focus on the numerical simulation or the measurements of the performance parameters of the energy service systems. Other examples of graduation projects can be heating, ventilation and air-conditioning systems, plumbing systems, automation and monitoring of advanced systems, design and cathodic protection of petroleum pipelines.

5. Nuclear Reactors: This is the concentration for the graduate engineer to work in nuclear power generation stations. The national projects rely on such graduate for operation and maintenance of their power generation systems as produced from nuclear energy resources. The core of this concentration also focuses on the thermal hydraulics associated with the operation of nuclear reactors. Special care is devoted to the nuclear safety. Care is additionally given to overcoming the corrosion problems in the nuclear reactor metallic structures as well as the technologies of the management of the waste disposal. Aligned with the general thermal designs for the transmission of energy, this concentration handles the heat transfer calculations of the steam generation systems and the critical heat fluxes to the water-steam containers. The concentration also deals with the economical aspects of such energy generation from nuclear fuels.

The graduation project should focus on the construction details and the performance maps of the turbines, pumps, boilers and other parts of nuclear power plants. Other examples of graduation projects can be the design of heat recovery boilers, heat exchangers and steam pipes in addition to the ventilation and air conditioning systems in nuclear power plants.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Mechanical Discipline (B-Level), the Mechanical Power Engineering Program graduate must be able to (C-Level):

C1. Describe the performance parameters of power producing and power absorbing machines
C2. Determine the rates of heating or cooling associated with the engineering processes.
C3. List the Main Causes of Power Losses in Engines, Turbines, Compressors and Pumps
C4. Analyze the different causes of power loss that is associated with industrial activities
C5. Identify the functional relationships of the parts installed to control the output of power equipment
C6. Select the proper size of an engine or a pumping machine for the delivery purposes in industry, power generation and domestic use.
C7. Choose the optimum operating conditions for the heat and mass transport media to accomplish the highest efficiency of energy utilization
C8. Perform the dimensional analysis required to assure the matching among the different components of engines and power stations
C9. Use Engineering Soft-wares to simulate the flow field and predict the thermal structures of mechanical power systems.
C10. Demonstrate additional abilities related to the field of the concentration within Mechanical Power Engineering as listed below.

Concentration	Graduate attributes
Energy Generation	C10a. Demonstrate additional abilities to select and link different systems that provide the energy for the industrial and domestic use.
Energy Efficiency and Sustainability	C10b. Demonstrate additional abilities to manage the power supply and enhance the efficiency of energy conversion.
Process and Equipment Design	C10c. Demonstrate additional abilities to analyze, design, integrate and operate the different energy sub-systems.
Environment, Services and Systems	C10d. Demonstrate additional abilities to devote the proper system to fit the required function in the industrial integrity.
Nuclear Energy Technology	C10e. Nuclear Reactors Demonstrate additional abilities to operate and maintain thermal and hydraulic systems in nuclear power plants.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 17 List of Mechanical Power EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Mechanical Engineering Requirements	63	110	2750	48	32	24	104
MEP311	Combustion	3	6	150	2	2	1	5
MEP312	Fundamentals of Internal Combustion Engines	3	6	150	2	2	1	5
MEP313	Thermal Power Plants	3	6	150	2	2	1	5
MEP314	Power Plant Technology	4	6	150	3	2	0	5
MEP411	Control Systems of Internal Combustion Engines	3	6	150	2	2	1	5
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5
MEP331	Digital Control	2	4	100	2	0	1	3
MEP332	Process Control	3	6	150	2	2	1	5
MEP341	Refrigeration and Air Conditioning	3	5	125	2	2	0	4
	Mechanical Power Concentration Elective (1)	3	5	125	2	2	0	4
	Mechanical Power Concentration Elective (2)	3	5	125	2	2	0	4
	Mechanical Power Concentration Elective (3)	3	5	125	2	2	0	4
	Mechanical Power Concentration Elective (4)	3	5	125	2	2	0	4
	Mechanical Power Concentration Elective (5)	3	5	125	2	2	0	4
MEP491	Mechanical Power Graduation Project (1)	3	6	150	1	2	4	7
MEP492	Mechanical Power Graduation Project (2)	3	6	150	1	2	4	7
	Program Requirements Total	170	297	7425	127	93	54	274
Pool of Energy Generation Concentration Elective Courses								
MEP412	Heat Engines	3	5	125	2	2	0	4
MEP413	Gas Fueled Engines	3	5	125	2	2	0	4
MEP414	Biomass and Waste Conversion Technology	3	5	125	2	2	0	4
MEP423	Hydro-Tidal and Wave Energies	3	5	125	2	2	0	4
MEP425	Aircraft Propulsion	3	5	125	2	2	0	4
MEP426	Solar Energy	3	5	125	2	2	0	4
MEP427	Wind Energy	3	5	125	2	2	0	4
MEP444	Economics of Energy Conversion	3	5	125	2	2	0	4
MEP451	Nuclear Energy	3	5	125	2	2	0	4
EPM353	Power Electronics and Motor Drives	3	5	125	2	2	1	5
Pool of Energy Efficiency and Sustainability Concentration Elective Courses								
MEP421	Sustainable Energy	3	5	125	2	2	0	4
MEP422	Energy Storage Technology	3	5	125	2	2	0	4
MEP425	Aircraft Propulsion	3	5	125	2	2	0	4
MEP426	Solar Energy	3	5	125	2	2	0	4
MEP427	Wind Energy	3	5	125	2	2	0	4
MEP428	Hydraulic Transmission	3	5	125	2	2	0	4
MEP433	Management of Mechanical Power Projects	3	5	125	2	2	0	4
MEP434	Water Desalination and Distillation	3	5	125	2	2	0	4
MEP444	Economics of Energy Conversion	3	5	125	2	2	0	4
MEP445	Environmental Impact of Mechanical Power Projects	3	5	125	2	2	0	4

Pool of Process and Equipment Design Concentration Elective Courses								
MEP425	Aircraft Propulsion	3	5	125	2	2	0	4
MEP428	Hydraulic Transmission	3	5	125	2	2	0	4
MEP432	Computational Fluid Dynamics	3	5	125	2	2	0	4
MEP433	Management of Mechanical Power Projects	3	5	125	2	2	0	4
MDP435	Design of Mechanical Power Units	3	5	125	2	2	0	4
MEP442	Thermodynamics of Materials	3	5	125	2	2	0	4
MDP411	Introduction to Finite Elements	3	5	125	2	2	0	4
MDP451	Failure Analysis	3	5	125	3	0	1	4
MDP453	Material and Process Selection	3	5	125	3	0	1	4
Pool of Environment Services and Systems Concentration Elective Courses								
MEP424	Water Distribution Networks	3	5	125	2	2	0	4
MEP431	Fire Fighting	3	5	125	2	2	0	4
MEP434	Water Desalination and Distillation	3	5	125	2	2	0	4
MEP441	Applied Building Services Technology	3	5	125	2	2	0	4
MEP443	Petroleum Pipelines	3	5	125	2	2	0	4
MEP346	Refrigerators and AC Systems and Equipment	3	5	125	2	2	0	4
MDP333	Operations Research	3	6	150	2	2	0	4
MDP455	Corrosion	3	5	125	3	0	1	4
MCT131	Introduction to Mechatronics	3	6	150	2	2	2	6
MCT233	Dynamic Modeling and Simulation	3	6	150	2	2	1	5
Pool of Nuclear Energy Technology Concentration Elective Courses								
MEP422	Energy Storage Technology	3	5	125	2	2	0	4
MEP444	Economics of Energy Conversion	3	5	125	2	2	0	4
MEP445	Environmental Impact of Mechanical Power Projects	3	5	125	2	2	0	4
MEP451	Nuclear Energy	3	5	125	2	2	0	4
MEP452	Thermal Aspects of Nuclear Reactors	3	5	125	2	2	0	4
MEP453	Nuclear Reactions and Interaction with Matter	3	5	125	2	2	0	4
MEP454	Radioactive Waste Management	3	5	125	2	2	0	4
MEP455	Methods of Nuclear Risk Analysis	3	5	125	2	2	0	4
MDP453	Material and Process Selection	3	5	125	3	0	1	4
MDP455	Corrosion	3	5	125	3	0	1	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4	PHM041
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
PHM131	Rigid body dynamics	2	4	100	2	1	1	4	PHM032
MEP111	Thermal Physics	2	4	100	1	2	0	3	PHM041
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6	MDP011
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP081
Total		16	29	725	12	9	6	27	
Semester 4									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
MEP211	Thermodynamics	4	6	150	3	1	1	5	MEP211
MDP112	Machine Construction	3	5	125	2	2	0	4	PHM031 MDP111
MDP212	Mechanics of Machines	4	6	150	3	3	1	7	PHM131
MDP152	Metallurgy & Material testing	3	5	125	3	1	1	5	MDP151
	ASU Elective (1)	2	2	50	2	1	0	3	
Total		18	28	700	15	10	3	28	
Semester 5									
MDP231	Engineering Economy	2	4	100	2	1	0	3	
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5	MDP152
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	
Total		17	30	750	12	9	7	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MDP232	Industrial Project management	2	4	100	2	1	0	3	
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6	MEP111
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	MEP211
MDP311	Mechanical Vibrations	4	7	175	3	2	1	6	PHM032
	Mechanical Requirement Elective	2	4	100	2	1	0	3	
MCT211	Automatic Control	3	5	125	3	1	1	5	MEP211
Total		17	32	800	14	7	6	27	
Semester 7									
MEP311	Combustion	3	6	150	2	2	1	5	MEP211 MEP212
MEP312	Fundamentals of Internal Combustion Engines	3	6	150	2	2	1	5	MEP211 MEP212
MEP313	Thermal Power Plants	3	6	150	2	2	1	5	MEP211 MEP212
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5	MEP211 MEP221
MEP331	Digital Control	2	4	100	2	0	1	3	MCT211
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	PHM022
Total		16	32	800	12	9	6	27	
Semester 8									
MEP314	Power Plant Technology	4	6	150	3	2	0	5	MEP313
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5	MEP211 MEP221
MEP341	Refrigeration and Air-Conditioning	3	5	125	2	2	0	4	MEP211 MEP212
MEP332	Process Control	3	6	150	2	2	1	5	MEP331
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5	MCT211 MEP221
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
Total		18	30	750	14	9	3	26	
Semester 9									
MEP411	Control Systems of Internal Combustion Engines	3	6	150	2	2	1	5	MEP312
	Mechanical Power Elective (1)	3	5	125	2	2	0	4	MEP211 MEP221
	Mechanical Power Elective (2)	3	5	125	2	2	0	4	MEP221
MEP491	Mechanical Power Graduation Project (1)	3	6	150	1	2	4	7	
ASU111	Human Rights	2	2	50	2	1	0	3	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
Total		17	28	600	11	11	5	27	
Semester 10									
	Mechanical Power Elective (3)	3	5	125	2	2	0	4	MEP221
	Mechanical Power Elective (4)	3	5	125	2	2	0	4	MEP221
	Mechanical Power Elective (5)	3	5	125	2	2	0	4	MEP221
MEP492	Mechanical Power Graduation Project (2)	3	6	150	1	2	4	7	MEP491
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
	ASU Elective (2)	2	2	50	2	1	0	3	
Total		17	27	575	11	11	4	26	

Program #3: Automotive Engineering Program

Program Description

The automotive engineering program will equip the students with the knowledge and skills required to the needs in the advanced areas of automotive industry both locally and globally. The program is designed to meet the great advancements in the fields of vehicle design, dynamics, powertrain, control systems and maintenance engineering. The automotive industry is one of the key industries that boosts economies for developing and developed countries.

Career Prospects

Automotive engineering career opportunities are increasingly in high demand for both individual mobility and transportation of goods and people. The potential careers in vehicle design is expanding specially for the automotive assembly feeding industries. The emerging companies that works on automotive intelligence and control systems are expanding and Egypt is becoming one of the main hubs for automotive embedded systems that is acquiring more automotive engineers with the right skills. With the environmental challenges and new trends for automotive powered systems, engineers with good computational methods and software packages skills as well as practical testing knowledge are globally and locally in demand for new technologies validation and verification. With the growth of the number of cars, the maintenance engineering for automotive careers will be always needed for passenger, commercial and earth moving equipment. Finally, there will be always a chance for race cars enthusiasts to pursue their careers knowing that Ain Shams University participates annually in multiple international car racing events such as Formula Student.

Program Concentrations

The program qualifies its graduates to work as automotive engineers by large and students can select from four fields concentrations to suit the graduate career intentions. As all industrial automotive product development is carried out in team-based environment, the graduation project is used to provide a work environment that closely resembles that found in industry where students work a team composed of many different competencies.

The student may choose three courses where two courses are picked from the same concentration, and the third course is picked from another concentration. The automotive engineering concentrations are:

1. Maintenance and Manufacturing: This concentration provides the student with the required knowledge to construct the layout of an automotive service for optimum jobs handling. Furthermore, vehicles manufacturing, and assembly production lines are studied to understand the process workflow in addition to the associated quality control. Additionally, vehicles repair, and painting techniques are addressed.

2. Performance: This concentration aims to address the modern technologies of commercial vehicles and earth moving equipment in terms of design and performance. Race cars, in addition to motorcycles and tricycles, engineering and their components are studied.

3. Powertrain: Engine management is studied in terms of control scheme, sensors, fuel map and tuning. Engine emissions are analyzed where the components of the exhaust gas are identified and neutralized. Different alternative fuels are studied while highlighting their main advantages and disadvantages. Also, vehicle powertrain concepts are dynamics are addressed.

4. Automotive Mechatronics (Autotronics): Considering their vital rule in the present smart vehicles, different automotive mechatronic systems (e.g. X-By-Wire systems) are introduced and studied highlighting their components, control logics, fail-safe and fault-tolerance schemes. Moreover, the communication (i.e. network) between the different systems and each other is addressed.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Mechanical Discipline (B-Level), the Automotive Engineering Program graduate must be able to (C-Level):

C1. Identify and discuss vehicles as complex systems from technical and social perspectives through a broad platform in automotive engineering
C2. Analyze new technical challenges and create technical advancements in the automotive industry in four focus areas: powertrain, performance, autotronics and maintenance
C3. Synthesize and evaluate automotive systems and products in terms of direct use and lifecycle analysis and take environmental and economic aspects into consideration
C4. Utilize automotive-related IT and product development tools.
C5. Demonstrate the skills needed to manage and contribute to team-based engineering activities and projects in a multi-discipline environment through application and practice.
C6. Demonstrate additional abilities related to the field of the concentration within Automotive Engineering as listed below.

Concentration	Graduate attributes
Maintenance and Manufacturing	C6a. Blueprint an automotive service center and/or workshop layout and analyze the vehicle production line.
Performance	C6b. Identify the main components and design of commercial vehicles, earth moving equipment, race cars, motorcycles and tricycles, and analyze their performance.
Powertrain	C6c. Define and analyze the general engine control scheme, identify the possible alternative fuels and demonstrate the powertrain components and their dynamics.
Automotive Mechatronics (Autotronics)	C6d. Describe the different automotive mechatronic systems and programmatically apply the understanding of their control logic to exemplary real-life case studies.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 18 List of Automotive EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Mechanical Engineering Requirements	63	110	2750	48	32	24	104
MEA211	Aerodynamics of Road Vehicles	2	4	100	2	1	0	3
MEA311	Automotive Engineering	3	5	125	2	2	0	4
MEA312	Road Vehicle Dynamics	3	5	125	2	2	0	4
MEA221	Vehicle Design & Simulation (1)	3	5	125	2	2	0	4
MEA321	Vehicle Design & Simulation (2)	3	5	125	2	2	2	6
MEA331	Automotive Maintenance Engineering	3	5	125	2	0	3	5
MEA431	Automotive After Sales Services	2	4	100	2	1	0	3
MEA241	Automotive Engines	3	5	125	2	2	2	6
MEA341	Automotive Fuel Systems	3	5	125	2	2	1	5
MEA342	Design and Simulation of Automotive Engines	3	5	125	2	2	2	6
MEA351	Automotive Mechatronic Systems	3	5	125	2	2	2	6
MEA451	Vehicle safety systems and accident analysis	2	4	100	2	0	2	4
CSE131	Computer Programming	3	6	150	3	0	2	5
	Automotive Concentration Elective (1)	3	5	125	2	2	0	4
	Automotive Concentration Elective (2)	3	5	125	2	2	0	4
	Automotive Concentration Elective (3)	3	5	125	2	2	0	4
MEA491	Automotive Graduation Project (1)	3	5	125	1	0	6	7
MEA492	Automotive Graduation Project (2)	3	5	125	1	0	6	7
Total		170	291	7275	129	85	66	280
Pool of Maintenance and Manufacturing Concertation Elective Courses								
MEA432	Workshop Planning & Vehicle Repair Technologies	3	5	125	2	2	0	4
MEA461	Vehicle Manufacturing and Assembly	3	5	125	2	2	0	4
MDP434	Quality Systems and Assurance	3	5	125	2	2	0	4
Pool of Performance Concertation Elective Courses								
MEA411	Earth Moving Equipment &Commercial Vehicle Technology	3	5	125	2	2	0	4
MEA412	Race Car Technology	3	5	125	2	2	0	4
MEA413	Motorcycle and Tricycle Technology	3	5	125	2	2	0	4
Pool of Powertrain Concertation Elective Courses								
MEA441	Engine Management Systems	3	5	125	2	2	0	4
MEA442	Alternative Fuels and Emissions Control Systems	3	5	125	2	2	0	4
MEA443	Powertrain Characterization& Measurement Systems	3	5	125	2	2	0	4
Pool of Automotive Mechatronics (Autotronics) Concertation Elective Courses								
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
MCT421	Embedded Systems for Automotive	3	5	125	2	1	3	5
MEA452	Automotive Control Systems	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	PHM022
MEP111	Thermal Physics	2	4	100	1	2	0	3	PHM041
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4	
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
MDP111	Mechanical Engineering Drawing	3	5	125	1	3	2	6	CEP011
Total		17	29	725	12	12	4	28	
Semester 4									
MDP152	Metallurgy and Material Testing	3	5	125	3	1	1	5	MDP151
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP021
MEP211	Thermodynamics	4	6	150	3	2	1	6	MEP111
PHM131	Rigid Body Dynamics	2	4	100	2	1	1	4	PHM032
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	PHM022
MDP112	Machine Construction	3	5	125	2	2	0	4	MDP111 PHM031
Total		17	29	725	15	7	6	28	
Semester 5									
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MDP212	Mechanics of Machines	3	7	175	3	3	1	7	PHM131
MEP221	Fluid Mechanics and Turbomachinery	4	7	175	3	2	1	6	MEP111
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5	MDP131
MEA261	Introduction to Automotive	2	4	100	2	0	2	4	MDP112
Total		16	30	750	13	9	7	29	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
MDP311	Mechanical Vibrations	4	7	175	3	2	1	6	PHM032
MEA241	Automotive Engines	3	5	125	2	2	2	6	MEP211
MEA221	Vehicle Design and Simulation (1)	3	5	125	2	2	0	4	MDP211
MEA211	Aerodynamics of Road Vehicles	2	4	100	2	1	0	3	MEP221
Total		16	29	725	11	9	6	26	
Semester 7									
MEA311	Automotive Engineering	3	5	125	2	2	0	4	MEA241
MDP232	Industrial Project Management	2	4	100	2	1	0	3	
MEA312	Road Vehicle Dynamics	3	5	125	2	2	0	4	MDP311
MEA321	Vehicle Design and Simulation (2)	3	5	125	2	2	2	6	MEA221
MCT211	Automatic Control	3	5	125	3	1	1	5	
MEA341	Automotive Fuel Systems	3	5	125	2	2	1	5	MEA241
Total		17	29	725	13	10	4	27	
Semester 8									
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5	MEP221 MDP311
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	
MEA351	Automotive Mechatronic Systems	3	5	125	2	2	2	6	ECE215 MCT211
MEA331	Automotive Maintenance Engineering	3	5	125	2	0	3	5	MEA261
MEA342	Design and Simulation of Automotive Engines	3	5	125	2	2	2	6	MEA241 MDP211
CSE131	Computer Programming	3	5	125	3	0	2	5	
Total		17	30	750	13	5	13	31	
Semester 9									
	Automotive Elective (1)	3	5	125	2	2	0	4	
	Automotive Elective (2)	3	5	125	2	2	0	4	
MEA431	Automotive After Sales Services	2	4	100	2	1	0	3	MEA331
MEA451	Vehicle Safety Systems and Accident Analysis	2	4	100	2	0	2	4	MEA221
ASU111	Human Rights	2	2	50	2	1	0	3	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
MEA491	Graduation Project (1)	3	5	125	1	0	6	7	
Total		18	29	725	13	8	8	29	
Semester 10									
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
	ASU Elective (1)	2	3	75	2	1	0	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
	Automotive Elective (3)	3	5	125	2	2	0	4	
MEA492	Graduation Project (2)	3	5	125	1	0	6	7	
MDP231	Engineering Economy	2	4	100	2	1	0	3	
Total		17	25	625	13	6	6	25	

Program #4: Mechatronics Engineering Program

Program Description

The Mechatronics engineering program is a multidisciplinary field of science that includes a combination of mechanical engineering, Electronics, computer engineering. This program is capable to enrich the student's basic theoretical and practical knowledge of mechatronics system components, and design methodologies of mechatronics systems.

Career Prospects

The graduate of the program is expected to get a job in one of the following positions:

1. Embedded systems
2. Projects using Heavy earthmoving equipment and hydraulic and pneumatic machines
3. Sales engineer for robotics and automation
4. automated manufacturing and production systems,
5. Control engineer
6. Maintenance engineer
7. Robotics and automation industry

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Mechanical Discipline (B-Level), the Mechatronics Engineering Program graduate must be able to (C-Level):

- C1. Illustrate the basic concepts and theories of mathematics, sciences, engineering projection and their applications within the field of mechatronics engineering
- C2. Analyze mechatronic system using scientific, mathematical and computer-based models and asses the limitations of particular cases.
- C3. Identify and classify the performance of mechatronic systems and components through the use of analytical methods and Modelling techniques
- C4. Interpret experimental and other numerical input/output data from dynamic systems
- C5. Design a mechatronic system using systems approach to meet a given specification and requirements.
- C6. Integrate a wide range of analytical tools, techniques, equipment, and software packages to design and develop mechatronic systems.
- C7. Exercise creative approaches to the analysis and solution of problems in mechatronic engineering.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 19 List of Mechatronics Engineering Program Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Mechanical Engineering Requirements	63	110	2750	48	32	24	104
MCT411	Hybrid Control Systems	3	5	125	2	2	1	5
MCT131	Introduction to Mechatronics	3	6	150	2	1	2	5
MCT232	Industrial Electronics	3	5	125	2	2	1	5
MCT234	Modeling and Simulation of Mechatronics systems	2	4	100	1	2	1	4
MCT333	Mechatronic Systems Design	3	6	150	1	1	2	4
MCT334	Sensors and Measurement Systems	3	5	125	2	2	1	5
MCT344	Industrial Robotics	3	5	125	2	2	1	5
MCT443	Design of Autonomous systems	3	5	125	2	2	1	5
CSE131	Computer Programming	3	6	150	3	0	2	5
CSE111	Logic Design	3	5	125	3	1	1	5
CSE483	Computer Vision	3	5	125	3	1	1	5
CSE473	Computational Intelligence	2	4	100	2	1	1	4
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
EPM353	Power Electronics and Motor Drives	3	5	125	2	2	1	5
	Mechatronics Program Elective (1)	3	5	125	2	2	1	5
	Mechatronics Program Elective (2)	2	4	100	1	2	1	4
MCT491	Mechatronics Graduation Project (1)	3	7	175	1	4	0	5
MCT492	Mechatronics Graduation Project (2)	3	7	175	1	4	0	5
Total		170	297	7425	128	94	58	280
Pool 1 of Mechatronics Engineering Elective Courses								
CSE231	Advanced Computer Programming	3	5	125	2	0	2	4
MCT412	Motion Control	3	5	125	2	2	1	5
MCT421	Embedded systems for Automotive	3	5	125	2	1	3	5
MDP494	Advanced Manufacturing Technology & Prototyping	3	5	125	2	2	1	5
MDP411	Introduction to Finite element	3	5	125	2	2	0	4
CSE353	Industrial Networks	3	5	125	2	2	1	5
Pool 2 of Mechatronics Engineering Elective Courses								
MCT413	Modelling and Control of Electro-Hydraulic Systems	2	4	100	1	2	1	4
MCT433	MEMS Design	2	4	100	1	2	1	4
MCT434	Engineering Optimization	2	4	100	1	2	1	4
MCT444	Mechatronics in Rehabilitation Technology	2	4	100	1	2	1	4
MCT445	Mechatronics in Automotive Application	2	4	100	1	2	1	4
MCT449	Selected topics of mechatronics	2	4	100	1	2	1	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	PHM022
MEP111	Thermal Physics	2	4	100	2	1	1	4	PHM041
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4	PHM041
PHM131	Rigid Body Dynamics	2	4	100	2	1	1	4	PHM032
MCT131	Introduction to Mechatronics	3	5	150	2	1	2	5	
Total		17	29	750	14	8	6	28	
Semester 4									
MDP111	Mechanical Engineering Drawing	3	5	125	1	3	2	6	MDP011
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP081
MEP211	Thermodynamics	4	6	150	3	2	1	6	MEP111
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
CSE131	Computer Programming	3	6	150	3	0	2	5	
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	
Total		17	30	750	14	8	8	30	
Semester 5									
CSE111	Logic Design	3	5	125	3	1	1	5	
MDP152	Metallurgy and Material Testing	3	5	125	3	1	1	5	MDP151
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	MEP211
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
MDP212	Mechanics of Machines	4	5	150	2	3	1	6	PHM131
MDP112	Machine Construction	3	5	125	2	2	0	4	MDP111 PHM031
Total		18	29	750	13	9	6	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MEP221	Fluid Mechanics and Turbo-Machinery	4	6	150	3	2	1	6	MEP111
MCT232	Industrial Electronics	3	5	125	2	2	1	5	ECE215
MDP231	Engineering Economy	2	4	100	2	1	0	3	
MDP311	Mechanical Vibrations	4	7	175	3	2	1	6	PHM131
MDP251	Casting and Welding (1)	3	5	125	2	2	1	5	MDP152
MDP232	Industrial Project Management	2	4	100	2	1	0	3	
Total		18	31	775	15	9	4	28	
Semester 7									
MCT334	Sensors and Measurement Systems	3	5	125	2	2	1	5	MEP231 MCT232
MCT312	Industrial Automation	2	4	100	2	1	1	4	MEP231
EPM353	Power Electronics and motor Drives	3	5	125	2	2	1	5	
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MCT311	Hydraulic and Pneumatic Control	3	5	125	3	1	1	5	MEP221
MCT235	Modelling & Simulation of Mechatronics Syst.	2	4	100	2	1	1	4	MDP311
Total		17	31	775	14	9	7	30	
Semester 8									
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	
MCT211	Automatic Control	3	5	125	3	1	1	5	MEP231
ASU324	Marketing	2	2	50	2	0	0	2	
MCT333	Mechatronic Systems Design	3	6	150	1	1	2	4	MCT234 MCT131
MCT344	Industrial Robotics	3	5	125	2	2	1	5	MDP212
Total		18	31	775	13	7	11	31	
Semester 9									
	Mechatronics Program Elective (1)	3	5	125	2	2	1	5	
CSE473	Computational Intelligence	2	4	100	2	1	1	4	
MCT491	Mechatronics Graduation Project (1)	3	7	175	0	0	5	5	MCT333
MCT443	Design of Autonomous systems	3	5	125	2	2	1	5	MCT344
MCT411	Hybrid Control Systems	3	5	125	2	2	1	5	MCT211
CSE483	Computer Vision	3	5	125	3	1	1	5	
Total		17	31	775	12	7	10	29	
Semester 10									
MCT492	Mechatronics Graduation Project (2)	3	7	175	0	0	5	5	MCT491
ASU314	Business Administration	2	2	50	2	1	0	3	
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
	Mechatronics Program Elective (2)	2	4	100	1	2	1	4	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		14	21	525	10	5	6	21	

Program #5: Architectural Engineering Program

Program Description

Throughout history, architecture was witness to the most significant reflections of culture and civilization. In today's world, architects are compelled to challenge critical global issues through holding responsibility of the built environment, responding to societal needs and conserving natural resources. The program is committed to offering well-rounded future generations of skilled professional architects through an education that is rooted in culture, sustained with theory and progressive with technologically advanced methods. This program dedicated to sustain creativity with knowledge and practice.

Career Prospects

It is intended that graduates of the Architectural Engineering program will acquire critical thinking and enhance design creativity in order to take a leading role in the professional practice. Graduates will be eligible to work in architectural design firms; in design, tender documents, as well as urban design and detailed planning. Moreover, they will be qualified for working in construction industry, building technology, rehabilitation, conservation of buildings, urban context, and physical planning. Additionally, they can be enrolled in graduate studies in universities or research centers.

Program Concentrations

The program of Architectural engineering encourages undergraduate students, in the beginning of Level 4, to participate in one of four concentrations responding to the professional demands:

1. Architecture.
2. Building Technology.
3. Urban Design.
4. Urban Planning.

These concentrations develop abilities and specialized skills that would serve students in the workplace and beyond.The concentrations require that the student has passed compulsory and elective courses in levels 1,2 and 3 along with the prerequisite courses needed. Students will be addressed 8 credit hours "Graduation Project".

1. Architecture Concentration: The Architecture Concentration allows students to develop a comprehensive broad understanding of the concepts and methods for advanced design, technical and professional aspects of design of built environments.

2. Building Technology Concentration: The Building Technology Concentration introduces students to building science & technologies. It enables them to develop an understanding of building performance requirements and building construction process; starting from the design development phase and ending with the tender documents preparation phase.

3. Urban Design Concentration: The Urban Design concentration main goal is to apply innovations to reform urban design practice to meet the dynamic new urban problems. This Concentration allows students to have a well-developed understanding of urban places and the inter-dependencies of the fabric of buildings, landscapes, public ways, social interactions and the environmental context that shape them.

4. Urban Planning Concentration: Urban planning Concentration aims to broaden students' appreciation of planning and urban theory whilst providing them with the necessary skills to engage in critical and creative problem-solving and to think critically in analytical ways across the different city scales, from strategic to local. This concentration allows students to explore international practices in urban development policy, planning and management that address contemporary spatial, socio-economic and political transformations in cities.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Architectural Discipline (B-Level), the Architectural Engineering Program graduate must be able to (C-Level):

- C1. Apply digital architecture software to produce, render, and present in design.
- C2. Demonstrate deep understanding of the advanced construction materials, methods and techniques.
- C3. Recognize different design methods and approaches.
- C4. Identify contemporary housing problems and apply polices, and designs.
- C5. Apply advanced lighting, acoustics, and smart systems techniques in design.
- C6. Demonstrate additional abilities related to the field of the concentration within Architectural Engineering Program as listed below.

Concentration	**Graduate attributes**
Architecture	C6a. Demonstrate comprehensive ability to design innovative architectural projects based on the most contemporary trends and theories of architecture. C7a. Apply digital technologies and software as design aiding tools to generate parametrically designed sophisticated architectural forms and Information modeling in design.
Building Technology	C6b. Demonstrate comprehensive ability to design architectural buildings of sophisticated technical systems and advanced/mega structure systems. C7b. Apply digital technologies and software as design evaluation and optimizing tools for architectural buildings. C8b. Produce a full set of tender documents for complex projects. C9b. Demonstrate an understanding of the buildings rehabilitation process needs & procedures.
Urban Design	C6c. Demonstrate comprehensive ability to design urban projects that exist in thematic/heritage context with deep responsiveness to environmental issues and problems that face the society and built areas. C7c. Apply digital technologies and software as urban design aiding tools for geo/spatial Information modeling and analyzing. C8c. Solve the urban mobility that serve urban context that ensure its sustainability.
Urban Planning	C6d. Demonstrate comprehensive ability to analyze and solve the urban planning problems with the necessary skills to engage in critical and creative problem-solving. C7d. Solve conflicts between the engineering systems that serve urban context and its urban values. C8d. Demonstrate understanding of the economic forces of urban context and its dynamics

Admission Policy

To maintain thequality and excellency of the "Architectural Engineering Program", the candidate students applying to the program, either Freshman students who have passed Level 0, or Sophomores transferred from other programs, should qualify to the program needs.

Passing the course of "Projection and Engineering Graphics" is a must for all applicant students. These students should alsosuccessfully pass an aptitude test that indicates their validity and ability to join the program. This exam will be assessed blindly by a jury of professors of architecture. The exam will evaluate the following skills and talents for each student:

1. The Imagination skills.
2. The ability to express visually.
3. The ability to read images.
4. The ability to think creatively.
5. The ability to read and conduct basic and simple architectural drawings.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 20 List of Architectural Engineering ProgramRequirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Architecture Engineering Requirements	63	110	2750	27	74	1	101
ARC142	Digital Presentation of the Built Environment	2	4	100	1	0	3	4
ARC221	Design Methods	3	4	100	2	2	0	4
ARC241	Modeling of the Built Environment	2	5	125	1	0	3	4
ARC251	Building (3): Advanced Construction and Finishing works	3	5	125	2	3	0	5
ARC311	Smart Systems Design Studio	4	8	200	0	8	0	8
ARC361	Lighting in Architecture	2	3	75	1	2	0	3
ARC362	Acoustics in Architecture	2	3	75	1	2	0	3
UPL351	Housing Studies	3	4	100	1	4	0	5
-	Architecture Engineering Elective (1)	2	4	100	1	2	0	3
-	Architecture Engineering Elective (2)	2	4	100	1	2	0	3
-	Concentration Elective Courses	26	52	1300	9	34	0	43
Total		170	299	7475	93	162	21	275
Pool of Architecture Engineering Elective Courses								
ARC322	Architectural Criticism and Project Evaluation	2	4	100	1	2	0	3
ARC323	Built Environment Accessibility	2	4	100	1	2	0	3
ARC341	Photography and Architecture	2	4	100	1	2	0	3
ARC363	Renewable Energy and Buildings	2	4	100	2	1	0	3
UPL335	Site Analysis (Spatial Analysis and Land Mapping)	2	4	100	1	2	0	3
UPL371	Human Behavior and the Built Environment	2	4	100	1	2	0	3
UPL381	Introduction to Geographic Information Systems	2	4	100	1	2	0	3
Pool of Architecture Concentration Courses (Compulsory)								
ARC411	Thematic design studio	4	8	200	0	8	0	8
ARC421	Ergonomics (Designing Livable Spaces) & Interior Design Principles	2	3	75	1	2	0	3
ARC441	Building Information Modeling (BIM)	3	5	125	1	4	0	5
ARC442	Principles of Parametric Design	3	4	100	2	2	0	4
ARC491	Architect. & Building Tech. Graduation Project (1)	2	4	100	1	2	0	3
ARC492	Architect. & Building Tech. Graduation Project (2)	6	18	450	0	12	0	12
	Architect. / Building Tech. Concentration Elective (1)	3	5	125	2	2	0	4
	Architect. / Building Tech. Concentration Elective (2)	3	5	125	2	2	0	4

Pool of Building Technology Concentration Courses (Compulsory)								
ARC412	Technological Design Studio	4	8	200	0	8	0	8
ARC451	Working Design (3): Execution Documents Complexity	3	5	125	1	4	0	5
ARC461	Daylighting and Thermal Performance	3	4	100	2	2	0	4
ARC464	Sustainable Rehabilitation of the Built Environment	2	3	75	1	2	0	3
ARC491	Architect. & Building Tech. Graduation Project (1)	2	4	100	1	2	0	3
ARC492	Architect. & Building Tech. Graduation Project (2)	6	18	450	0	12	0	12
	Architect. / Building Tech. Concentration Elective (1)	3	5	125	2	2	0	4
	Architect. / Building Tech. Concentration Elective (2)	3	5	125	2	2	0	4
Pool of Architecture / Building Technology Concentration Elective Courses (*Except if compulsory in students' study Program)								
ARC422	Human Aspects in Architecture	3	5	125	2	2	0	4
ARC423	Identity and Contemporaneity in Middle East Architecture	3	5	125	2	2	0	4
ARC424	Introduction to Modern Art Movements	3	5	125	2	2	0	4
ARC441	Building Information Modeling (BIM)*	3	5	125	1	4	0	5
ARC472	Maintenance of Buildings	3	5	125	2	2	0	4
ARC473	Building Life Cycle Assessment	3	5	125	2	2	0	4
UPL435	Urban and Architectural Heritage	3	5	125	2	2	0	4
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4
Pool of Urban Design Concentration Courses (Compulsory)								
UPL411	Mega Projects Urban Design Studio	4	8	200	0	8	0	8
UPL434	Sustainable Urban Mobility	2	3	75	1	2	0	3
UPL461	Contemporary Environmental Issues	3	4	100	2	2	0	4
UPL481	Urban Informatics	3	5	125	1	4	0	5
UPL491	Urban Design Graduation Project (1)	2	4	100	1	2	0	3
UPL492	Urban Design Graduation Project (2)	6	18	450	0	12	0	12
	Urban Design Concentration Elective (1)	3	5	125	2	2	0	4
	Urban Design Concentration Elective (2)	3	5	125	2	2	0	4
Pool of Urban Design Concentration Elective Courses								
ARC441	Building Information Modeling (BIM)	3	5	125	1	4	0	5
UPL433	Land Management and Land Subdivision	3	5	125	2	2	0	4
UPL435	Urban and Architectural Heritage	3	5	125	2	2	0	4
UPL451	Housing Studies & Real Estate Development	3	5	125	2	2	0	4
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4
UPL472	Urban Sociology & Human Settlements	3	5	125	2	2	0	4
Pool of Urban Planning Concentration Courses (Compulsory)								
UPL421	Town and Regional Planning	2	3	75	1	2	0	3
UPL431	Strategic Action Planning Studio	4	8	200	0	8	0	8
UPL432	Urban Engineering	3	4	100	2	2	0	4
UPL481	Urban Informatics	3	5	125	1	4	0	5
UPL493	Urban Planning Graduation Project (1)	2	4	100	1	2	0	3
UPL494	Urban Planning Graduation Project (2)	6	18	450	0	12	0	12
	Urban Planning Concentration Elective (1)	3	5	125	2	2	0	4
	Urban Planning Concentration Elective (2)	3	5	125	2	2	0	4
Pool of Urban Planning Concentration Elective Courses								
UPL423	City Governance & Land Management	3	5	125	2	2	0	4
UPL433	Land Management and Land Subdivision	3	5	125	2	2	0	4
UPL436	Urban Renewal	3	5	125	2	2	0	4
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4
UPL473	Urban Sociology and Human Settlements	3	5	125	2	2	0	4
UPL482	Introduction to Geo Design	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6	CEP011
ARC131	History of Arts and Architecture (1): Ancient Civilizations	3	4	100	3	0	0	3	---
ARC141	Architectural Representation	3	5	125	1	4	0	5	CEP011
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5	CEP011
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3	PHM031
PHM111	Probability and Statistics	2	4	100	1	2	0	3	---
	ASU Elective (2)	2	2	50	2	0	0	2	---
Total		18	30	750	11	16	0	27	
Semester 4									
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8	CEP011
ARC132	History of Arts and Architecture (2): History of Islamic And Western Architecture	3	5	125	2	2	0	4	ARC131
ARC142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4	---
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5	ARC151
CEP113	Surveying	2	4	100	1	1	1	3	---
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	---
Total		17	30	750	8	16	4	28	
Semester 5									
ARC221	Design Methods	3	4	100	2	2	0	4	ARC112
ARC241	Modeling of The Built Environment	2	5	125	1	0	3	4	ARC142
ARC251	Building (3): Advanced Construction and Finishing Works	3	5	125	2	3	0	5	ARC152
UPL211	Context and Place Design Studio	4	8	200	0	8	0	8	ARC112
UPL212	Principles of Urban Design and Landscape	3	4	100	2	2	0	4	---
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4	---
Total		17	30	750	9	16	4	29	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
ARC211	Building Type Design Studio	4	8	200	0	8	0	8	ARC111
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3	---
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4	---
MEP241	Technical Installations	2	3	75	1	2	0	3	MDP011
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4	CES115
	Architectural Engineering Elective (1)	2	4	100	1	2	0	3	---
	ASU Elective (1)	2	3	75	2	0	0	2	---
Total		18	30	750	9	18	0	27	
Semester 7									
ARC321	Theory and Philosophy of Contemporary Architecture	3	5	125	3	0	0	3	---
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5	ARC152 MEP241 CES225
ARC361	Lighting in Architecture	2	3	75	1	2	0	3	PHM022
UPL311	Urban and Landscape Design Studio	4	8	200	0	8	0	8	UPL211
UPL351	Housing Studies	3	4	100	1	4	0	5	UPL221
	Architectural Engineering Elective (2)	2	4	100	1	2	0	3	---
Total		17	30	750	7	20	0	27	
Semester 8									
ARC311	Smart Systems Design Studio	4	8	200	0	8	0	8	ARC211 ARC321
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5	ARC351
ARC362	Acoustics in Architecture	2	3	75	1	2	0	3	PHM022
ARC371	Architecture Project Management	2	4	100	2	1	0	3	---
UPL331	Planning and Urban Upgrading	3	5	125	1	4	0	5	UPL221
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	---
Total		17	30	750	7	21	0	28	

Architecture Concentration									
Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 9									
ARC411	Thematic Design Studio	4	8	200	0	8	0	8	ARC311
ARC421	Ergonomics (Designing Livable Spaces) and Interior Design Principles	2	3	75	1	2	0	3	---
ARC441	Building Information Modeling (BIM)	3	5	125	1	4	0	5	ARC241 ARC351
ARC442	Principles of Parametric Design	3	4	100	2	2	0	4	ARC241 ARC321
ARC471	Feasibility Studies	2	4	100	2	1	0	3	---
ARC491	Architect. & Building Tech. Graduation Project (1)	2	4	100	1	2	0	3	ASU112
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	---
Total		18	30	750	9	19	0	28	
Semester 10									
ARC492	Architect. & Building Tech. Graduation Project (2)	6	18	450	0	12	0	12	ARC491
	Architectural Engineering Elective (1)	3	5	125	2	2	0	4	---
	Architectural Engineering Elective (2)	3	5	125	2	2	0	4	---
ASU111	Human Rights	2	2	50	2	1	0	3	---
Total		14	30	750	6	17	0	23	

Building Technology Concentration									
Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 9									
ARC412	Technological Design Studio	4	8	200	0	8	0	8	ARC311 ARC351 ARC362
ARC451	Working Design (3): Execution Documents Complexity	3	5	125	1	4	0	5	ARC352
ARC461	Daylighting and Thermal Performance	3	4	100	2	2	0	4	ARC241 ARC261
ARC464	Sustainable Rehabilitation of The Built Environment	2	3	75	1	2	0	3	---
ARC471	Feasibility Studies	2	4	100	2	1	0	3	---
ARC491	Architect. & Building Tech. Graduation Project (1)	2	4	100	1	2	0	3	ASU112
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	---
Total		18	30	750	9	19	0	28	
Semester 10									
ARC492	Architect. & Building Tech. Graduation Project (2)	6	18	450	0	12	0	12	ARC491
	Architectural Engineering Elective (1)	3	5	125	2	2	0	4	---
	Architectural Engineering Elective (2)	3	5	125	2	2	0	4	---
ASU111	Human Rights	2	2	50	2	1	0	3	---
Total		14	30	750	6	17	0	23	

Urban Design Concentration									
Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 9									
UPL411	Mega Projects Urban Design Studio	4	8	200	0	8	0	8	UPL311
UPL434	Sustainable Urban Mobility	2	3	75	1	2	0	3	PHM 032
UPL461	Contemporary Environmental Issues	3	4	100	2	2	0	4	---
UPL471	Urban Economics	2	4	100	2	1	0	3	---
UPL481	Urban Informatics	3	5	125	1	4	0	5	(CSE031) ARC142
UPL491	Urban Design Graduation Project (1)	2	4	100	1	2	0	3	ASU112 UPL311
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	---
Total		18	30	750	9	19	0	28	
Semester 10									
UPL492	Urban Design Graduation Project (2)	6	18	450	0	12	0	12	UPL411 UPL491
	Architectural Engineering Elective (1)	3	5	125	2	2	0	4	---
	Architectural Engineering Elective (2)	3	5	125	2	2	0	4	---
ASU111	Human Rights	2	2	50	2	1	0	3	---
Total		14	30	750	6	17	0	23	

Urban Planning Concentration									
Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 9									
UPL421	Town and Regional Planning	2	3	75	1	2	0	3	UPL221
UPL431	Strategic Action Planning Studio	4	8	200	0	8	0	8	UPL311
UPL432	Urban Engineering	3	4	100	2	2	0	4	PHM022 PHM032
UPL471	Urban Economics	2	4	100	1	2	0	3	---
UPL481	Urban Informatics	3	5	125	1	4	0	5	(CSE031) ARC142
UPL493	Urban Planning Graduation Project (1)	2	4	100	1	2	0	3	ASU112 UPL311
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	---
Total		18	30	750	8	20	0	28	
Semester 10									
UPL494	Urban Planning Graduation Project (2)	6	18	450	0	12	0	12	UPL431 UPL493
	Architectural Engineering Elective (1)	3	5	125	2	2	0	4	---
	Architectural Engineering Elective (2)	3	5	125	2	2	0	4	---
ASU111	Human Rights	2	2	50	2	1	0	3	---
Total		14	30	750	6	17	0	23	

Program #6: Electrical Power and Machines Engineering Program

Program Description

The Electrical Power and Machines EngineeringProgram is designed to qualify its graduates for both fundamental and modern trends in electrical power systems, design, operation and control. The program is structured in a hierarchical manner based on strong mathematical and physics background while moving gradually up to the fundamental electrical engineering subjects. Then, reaching to the major specialty courses of power systems design, operation, installation, control and economics. The program pays significant attention to the renewable electrical energy resources as well as the smart grid operation & control with the objective of environmental conservation and economical aspects. The program adapts the updated approaches and methodology in teaching and learning activities and assessment with focus on achieving balance between academic background and professional skills of the graduates. Students in the program are centered of focus by implanting self-learning attitude, peer discussions, and courses embedded engineering skills. The assessment techniques are devised in a way to avoid passing the courses unless the student gets the intended learning outcomes.

Career Prospects

The prospect market of the Electrical Power and Machines Engineering Program graduate is widespread. Electrical power networks planning, design, and installation in urban areas, hospitals, touristic, educational and administrative buildings is a sizable market for the graduates in engineering contracting, and manufacturing firms. Industrial control and maintenance of electrical motors, traction, escalators, and elevators are covered within the program profession. Electrical power utilities; distribution, transmission, and generation are as well as major market labor for the graduals.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Electrical Engineering Discipline (B-Level), the Electrical Power and Machines Engineering Program graduate must be able to (C-Level):

- C1. Identify and formulate engineering problems to solve problems in the field of electrical power and machines engineering.
- C2. Analyze the performance of electric power generation, control and distribution systems.
- C3. Design and perform experiments, as well as analyze and interpret experimental results related to electrical power and machines system.
- C4. Test and examine components, equipment and system of electrical power and machines.
- C5. Integrate electrical, electronic and mechanical components and equipment with transducers, actuators and controllers in creatively computer-controlled systems.
- C6. Apply modern techniques, skills and engineering tools to electrical power and machines engineering systems.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 21 List of Electrical Power and Machines Engineering ProgramRequirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Electrical Engineering Requirements	60	104	2600	48	30	12	90
EPM321	Transformer and DC Machines	3	6	150	2	2	1	5
EPM322	Alternating Current Machines	3	6	150	2	2	1	5
EPM331	Electrical Transmission Systems	3	5	125	2	2	0	4
EPM332	Power System Analysis (1)	3	6	150	2	2	1	5
EPM333	Electrical Distribution Systems	3	5	125	2	2	0	4
EPM431	Operation and Control of Power Systems	3	6	150	2	2	1	5
EPM432	Electrical Installation and Energy Utilization	3	6	150	2	2	1	5
EPM341	High Voltage Engineering	3	6	150	2	2	1	5
EPM342	Switchgear Engineering and substations	3	5	125	2	2	0	4
EPM351	Power Electronics (1)	3	6	150	2	2	1	5
EPM352	Power Electronics (2)	3	6	150	2	2	1	5
EPM451	Electrical Drives Systems	3	5	125	2	2	1	5
EPM461	Protection Engineering	3	5	125	2	2	1	5
	Electrical Power and Machines Elective (1)	2	5	125	2	1	0	3
	Electrical Power and Machines Elective (2)	2	5	125	2	1	0	3
	Electrical Power and Machines Elective (3)	3	5	125	2	2	0	4
	Electrical Power and Machines Elective (4)	2	5	125	2	1	0	3
EPM491	Electrical Power & Machines Graduation Project (1)	3	5	125	1	4	0	5
EPM492	Electrical Power & Machines Graduation Project (2)	3	5	125	1	4	0	5
Total		170	300	7500	130	98	36	264
Pool of Electrical Power and Machines Elective (1) Courses								
EPM421	Special Machines	2	5	125	2	1	0	3
EPM433	Power Systems Stability	2	5	125	2	1	0	3
Pool of Electrical Power and Machines Elective (2) Courses								
EPM452	Advanced Applications in Power Electronics	2	5	125	2	1	0	3
EPM453	Power Quality	2	5	125	2	1	0	3
Pool of Electrical Power and Machines Elective (3) Courses								
EPM422	Industrial Automation Systems	3	5	125	2	2	0	4
EPM434	Planning of Electrical Networks	3	5	125	2	2	0	4
Pool of Electrical Power and Machines Elective (4) Courses								
EPM423	Power Generating Stations	2	5	125	2	1	0	3
EPM462	Advanced Protection in Power Systems	2	5	125	2	1	0	3

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5	PHM013 PHM022
EPM111	Electrical Circuits (1)	4	7	175	3	2	1	6	PHM022
CSE111	Logic Design	3	5	125	3	1	1	5	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
Total		18	30	750	16	10	3	29	
Semester 4									
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4	
MEP214	Thermal Power Engineering	3	5	125	2	2	0	4	PHM041 PHM121
EPM112	Electromagnetic Fields	3	5	125	3	1	0	4	PHM013 PHM022
EPM113	Electrical Measurements	3	5	125	2	2	1	5	EPM111
MDP231	Engineering Economy	2	4	100	2	1	0	3	
CSE131	Computer Programming	3	6	150	3	0	2	5	
Total		17	30	750	14	8	3	25	
Semester 5									
EPM211	Properties of Electrical Materials	2	4	100	2	1	1	4	PHM022
EPM212	Electrical Circuits (2)	3	6	150	2	2	1	5	EPM111
ECE211	Electronics	3	5	125	3	1	1	5	PHM122
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5	PHM111 PHM113
CSE271	System Dynamics and Control Components	4	6	150	3	2	1	6	
	ASU Elective (1)	2	3	75	2	1	0	3	
Total		18	30	750	16	8	4	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
EPM213	Energy and Renewable Energy	3	6	150	3	1	1	5	EPM112
EPM214	Electrical Systems Simulation	3	6	150	2	2	1	5	EPM212
ECE252	Fundamentals of Communication systems	3	6	150	2	2	0	4	ECE251
CSE353	Industrial Networks	3	5	125	2	2	1	5	
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	CSE111 CSE131
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	13	10	5	28	
Semester 7									
EPM321	Transformers and DC Machines	3	6	150	2	2	1	5	EPM212 EPM112
EPM331	Electrical Transmission Systems	3	5	125	2	2	0	4	EPM212
EPM341	High Voltage Engineering	3	6	150	2	2	1	5	EPM112
EPM351	Power Electronics (1)	3	6	150	2	2	1	5	PHM122 ECE211
CSE371	Control Engineering	3	5	125	2	1	1	4	ECE251
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	2	
Total		17	30	750	12	9	4	25	
Semester 8									
EPM322	Alternating Current Machines	3	6	150	2	2	1	5	EPM321
EPM332	Power System Analysis	3	6	150	2	2	1	5	EPM331
EPM333	Electrical Distribution Systems	3	5	125	2	2	0	4	EPM111
EPM342	Switchgear Engineering and Substations	3	5	125	2	2	0	4	EPM341
EPM352	Power Electronics (2)	3	6	150	2	2	1	5	EPM351
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		17	30	750	12	10	3	25	
Semester 9									
EPM431	Operation and Control of Power Systems	3	6	150	2	2	1	5	EPM332 EPM213
EPM461	Protection Engineering	3	5	125	2	2	1	5	EPM332 EPM342
	Electrical Power and Machines Elective (1)	2	5	125	2	1	0	3	
	Electrical Power and Machines Elective (2)	2	5	125	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
EPM491	Electrical Power & Machines Graduation Project (1)	3	5	125	1	4	0	5	
Total		16	30	750	11	12	2	25	
Semester 10									
EPM432	Electrical Installations and Energy Utilization	3	6	150	2	2	1	5	EPM333
EPM451	Electrical Drives Systems	3	5	125	2	2	1	5	EPM322 EPM352
	Electrical Power and Machines Elective (3)	3	5	125	2	2	0	4	
	Electrical Power and Machines Elective (4)	2	5	125	2	1	0	3	
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3	
EPM492	Electrical Power & Machines Graduation Project (2)	3	5	125	1	4	0	5	EPM491
Total		16	30	750	11	12	2	25	

Program #7: Electronics and Communication Engineering Program

Program Description

The Electronics and Communication Engineering Program is where electronics, microwave and photonics, and communication engineering mergetogether to prepare the Electronics and Communication Engineer of the future.

Career Prospects

Students who earn their ECE BSc degree gain a profound understanding of electronicsand communication engineering built on a thorough background of physical science, mathematics and technology. Coursework prepares students for careers in government agencies, all local and international industries – from photonic and electronic integrated circuit design, to traditional ICT companies -- or for future study in graduate schools.

Program Concentrations

The program qualifies graduates to work as electronics and communications engineers. The graduate can be specialized in one of the following three concentrations:

1. Electronics
2. Microwave and Photonics
3. Communication Engineering

The student must select four technical elective courses for a total of 12 credit hours. The program concentration is achieved by 15 credit hours; 9 credit hours of technical elective courses and 6 credit hours of the graduation project, all related to the specific concentration.

1. Electronics: Graduates are more specialized in the design of electronic systems. Graduates demonstrate additional abilities to model, analyze,design and buildelectronic circuits and systems.

2. Microwave and Photonics: Graduates are more specialized in the design of photonic and microwave systems. Graduates demonstrate additional abilities to model, analyze,design and build photonic and microwave components and systems.

3. Communication Engineering: Graduates are more specialized in the design of communication engineering systems. Graduates demonstrate additional abilities to model, analyze,design and build communication engineering systems and networks.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Electrical Engineering Discipline (B-Level), the Electronics and Communications Program graduate must be able to (C-Level):

- C1. Understand the underlying physical phenomena and limitations of the performance of components and systems in electronics and communication engineering.
- C2. Demonstrate the ability to model and analyze components and systems in electronics and communication engineering and identify the software tools required to optimize theirperformance.
- C3. Design and compare between alternative components and systems in electronics and communication engineering.

C4. Demonstrate the knowledge about measurement equipment and demonstrate the ability to use them to characterize components and systems in electronics and communication engineering.

C5. Demonstrate the knowledge about state of the art of components and systems in electronics and communication engineering.

C6. Demonstrate additional abilities related to the field of the concentration within electronics and communication engineering as listed below.

Concentration	**Graduate attributes**
Electronics	6a. Demonstrate additional abilities to model, analyze,design and buildelectronic circuits and systems.
Microwave and Photonics	6b. Demonstrate additional abilities to model, analyze, design, and build photonic and microwave components and systems.
Communication Engineering	6c. Demonstrate additional abilities to model, analyze, design, and build communication engineering systems and networks.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 22 List of Electronics and CommunicationProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Electrical Engineering Requirements	60	104	2600	48	30	12	90
PHM212	Complex, Special Functions and Numerical Analysis	3	5	125	2	2	0	4
ECE311	Advanced Semiconductor Devices	2	4	100	2	1	0	3
ECE312	Analog Circuits (1)	3	5	125	2	2	1	5
ECE313	Analog Circuits (2)	3	6	150	2	2	1	5
ECE314	VLSI Design	3	6	150	2	2	1	5
ECE331	Electromagnetic Waves	3	6	150	2	2	1	5
ECE332	Waveguides	3	6	150	2	2	1	5
ECE431	Optoelectronics	3	5	125	2	2	1	5
ECE432	Antenna Engineering and Propagation	2	4	100	2	1	0	3
ECE433	Microwave Circuits and Systems	3	6	150	2	2	1	5
ECE351	Analog and Digital Communication Systems	3	5	125	2	2	0	4
ECE353	Wireless Communication Networks	3	6	150	2	2	1	5
ECE451	Digital Signal Processing Basics	2	4	100	2	1	1	4
	Electronics & Communication Elective (1)	3	5	125	2	2	0	4
	Electronics & Communication Elective (2)	3	5	125	2	2	0	4
	Electronics & Communication Elective (3)	3	5	125	2	2	0	4
	Electronics & Communication Elective (4)	3	5	125	2	2	0	4
ECE491	Graduation Project (1)	3	7	175	1	0	6	7
ECE492	Graduation Project (2)	3	8	200	1	0	6	7
Total		170	300	7500	130	90	47	267
Pool of Electronics Concentration Elective Courses								
ECE411	Integrated circuits technology	3	5	125	2	2	0	4
ECE412	Analog integrated circuits design	3	5	125	2	2	0	4
ECE413	ASIC Design and Automation	3	5	125	2	2	0	4
ECE414	RF Design	3	5	125	2	2	0	4
ECE415	Electronic Instrumentation	3	5	125	2	2	0	4
ECE416	MEMS Design	3	5	125	2	2	0	4
ECE417	Low Power Digital Design	3	5	125	2	2	0	4
ECE418	Selected Topics in Electronics	3	5	125	2	2	0	4
Pool of Microwave and Photonics Concentration Elective Courses								
ECE434	Optical Communication Systems	3	5	125	2	2	0	4
ECE435	Fundamentals of Photonics	3	5	125	2	2	0	4
ECE436	Micro Photonic Systems	3	5	125	2	2	0	4
ECE437	Selected Topics in Electromagnetics	3	5	125	2	2	0	4
Pool of Communications Concentration Elective Courses								
ECE452	Information Theory and Coding	3	5	125	2	2	0	4
ECE453	Modern Communication Systems	3	5	125	2	2	0	4
ECE454	Satellite Communication Systems	3	5	125	2	2	0	4
ECE455	Selected Topics in Communication Systems	3	5	125	2	2	0	4
ECE456	Selected Topics in Signal Processing	3	5	125	2	2	0	4
ECE457	Selected Topics in Telecommunication Networks	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5	PHM013 PHM022
EPM111	Electrical Circuits (1)	4	7	150	3	2	1	6	PHM022
CSE111	Logic Design	3	5	125	3	1	1	5	
ASU112	Report writing and communication skills	3	4	125	2	2	0	4	
Total		18	30	750	16	10	3	29	
Semester 4									
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4	
MEP214	Thermal Power Engineering	3	5	125	2	2	0	4	PHM041 PHM022
EPM112	Electromagnetic Fields	3	5	125	3	1	0	4	PHM013 PHM022
EPM113	Electrical measurements	3	5	125	2	2	1	5	EPM111
MDP231	Engineering Economy	2	4	100	2	1	0	3	
CSE131	Computer Programming	3	6	150	3	0	2	5	
Total		17	30	750	14	8	3	25	
Semester 5									
EPM211	Properties of Electrical Material	2	4	100	2	1	1	4	PHM022
ECE211	Electronics	3	5	125	3	1	1	5	PHM122
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5	PHM111 PHM113
CSE271	System Dynamics and Control Components	4	6	150	3	2	1	6	
CSE212	Computer organization	3	6	150	2	2	0	4	CSE111 CSE131
-	ASU Elective 1	2	3	75	2	0	0	3	
Total		18	30	750	15	8	3	27	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
PHM212	Complex, Special functions &Numerical Analysis	3	5	125	2	2	0	4	PHM113
EPM213	Energy and Renewable Energy	3	6	150	3	1	1	5	EPM112
ECE252	Fundamentals of Communication Systems	3	6	150	2	2	0	4	ECE251
ECE212	Digital circuits	3	6	150	2	2	0	4	CSE111
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	13	10	3	26	
Semester 7									
ECE311	Advanced semiconductor devices	2	4	100	2	1	0	3	ECE211
ECE312	Analog Circuits (1)	3	5	125	2	2	1	5	ECE211
ECE331	Electromagnetic waves	3	6	150	3	1	1	5	PHM212 EPM112
ECE351	Analog and Digital Communication Systems	3	5	125	2	2	0	4	ECE252
ECE352	Telecommunication networks	3	5	125	2	2	0	4	ECE252
CSE371	Control Engineering	3	5	125	2	1	1	4	
Total		17	30	750	13	9	3	25	
Semester 8									
ECE313	Analog Circuits (2)	3	6	150	2	2	1	5	ECE312
ECE314	VLSI design	3	6	150	2	2	1	5	ECE212
ECE332	Waveguides	3	6	150	2	2	1	5	PHM212 ECE331
ECE353	Wireless Communication Networks	3	6	150	2	2	1	5	ECE351
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	3	
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3	
Total		16	30	750	12	9	4	26	
Semester 9									
ECE431	Optoelectronics	3	5	125	2	2	1	5	ECE311 ECE332
ECE432	Antenna Engineering and Propagation	2	4	100	2	1	0	3	ECE332
ECE451	Digital Signal Processing Basics	2	4	100	2	1	1	4	ECE251
	Electronics & Communication Elective (1)	3	5	125	2	2	0	4	
	Electronics & Communication Elective (2)	3	5	125	2	2	0	4	
ECE491	Graduation Project (1)	3	7	175	1	0	6	7	125CH
Total		16	30	750	11	8	8	27	
Semester 10									
ECE433	Microwave circuits and systems	3	6	150	2	2	1	5	ECE332
	Electronics & Communication Elective (3)	3	5	125	2	2	0	4	
	Electronics & Communication Elective (4)	3	5	125	2	2	0	4	
ECE492	Graduation Project (2)	3	8	200	1	0	6	7	ECE491
	ASU Elective (2)	2	2	50	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		16	30	750	11	9	7	27	

Program #8: Computer and Systems Engineering Program

Program Description

The Computer and Systems Engineering Program is where Engineering, Hardware, Software, and Information merge together to prepare the Computer and Systems Engineer of the future.

Career Prospects

Computer and Systems Engineering is currently one of the most rapidly growing engineering disciplines worldwide. With the advances in fields such as smart systems, artificial intelligence, internet of things, computer networks and security, autonomous vehicles, deep learning, VLSI Systems and others.Graduates from the department are in high demand from the industry, not only from companies in Egypt, but also from all over the world. Computer and Systems engineers are needed in many industries such as embedded systems, hardware design, computer networks, computer security, intelligent systems, and software development.

Graduates can be specialized in a specific field of the following disciplines: Computer Design, Computer Software, Computer Networks & Security, and Systems & Artificial Intelligence.

Program Concentrations

The program qualifies graduates to work as Computer and Systems engineers. The graduate can be specialized in one of the following four concentrations:

1. Computer Design
2. Computer Software
3. Computer Networks
4. Systems and Artificial Intelligence

The concentration focus is achieved by 16 Credit Hours including 10 Credit Hours of elective courses and 6 credit hours as the graduation project, all related to the specific concentration. The student must select two level 3 elective courses from the same course group to identify the focus.The student is then allowed to select any three level 4 technical elective courses based on the academic advising process.

1. Computer Design: This specialty prepares the graduate to work in the field of hardware engineering, including embedded systems, digital circuit design, electronic design automation and hardware-based systems.

2. Computer Software: This track prepares the graduate to work as Software Engineer, in different disciplines and it focuses on the engineering part of software development and management.

3. Computer Networks: The graduate will be able to design, inspect, and operate different types of data and telecommunication networks. The graduate is also involved in the field of security, forensics and Internet of Things.

4. Systems and Artificial Intelligence: The graduate will be prepared with the necessary competences to work as a system engineer, including automation, control and Artificial Intelligence.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Electrical Engineering Discipline (B-Level), the Computer and Systems Engineering Program graduate must be able to (C-Level):

C1. Design and implement elements, modules, sub-systems or systems using technological and professional tools.
C2. Select and analyze appropriate control techniques for digital engineering systems.
C3. Estimate and measure the performance of a digital system and circuit under specific input excitation and evaluate its suitability for a specific application.
C4. Identify needs, plan and manage resources, and gather information for solving a specific digital problem and document and communicate this solution efficiently.
C5. Identify problems, critically review facts, recognize the root causes, and provide multiple, practical and sound solutions.
C6. Define the blueprint for the product/service development plan with structured work streams, time scales and milestones ensuring optimization of activities, resources and cost.
C7. Select suitable technical options for digital systems and services design while optimizing cost and quality.
C8. Carry out design, development, testing, debugging, operation and maintenance of digital systems/services such as computer systems, circuit boards, software systems, and mixed (embedded) systems.
C9. Establish an environment to build, test and release digital systems in a more rapid, frequent and reliable manner by emphasizing the collaboration and communication of developers and operations team members.
C10. Organize information and knowledge resources in an optimal format.
C11. Undertake research and supports new solutions to provide for concepts, ideas, product/service improvement.
C12. Demonstrate additional abilities related to the field of the discipline within Computer and Systems Engineering as listed below.

Concentration	Graduate attributes
Computer Design	C12a. Demonstrate additional abilities to model, analyze, design and verification of computer systems at the level of system architecture.
Computer Software	C12c. Demonstrate additional abilities to design and integrate software solutions.
Computer Networks	C12b. Demonstrate additional abilities to model, analyze, and design networks and distributed systems while maintaining their security.
Systems and Artificial Intelligence	C12d. Demonstrate additional abilities to model, design and integrate computer-operated systems including analog, digital and intelligent systems.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 23 List of Computer and Systems Engineering ProgramRequirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Electrical Engineering Requirements	60	104	2600	48	30	12	90
PHM211	Discrete Mathematics	2	4	100	2	2	0	4
CSE231	Advanced Computer Programming	3	5	125	2	0	2	4
CSE311	Computer Architecture	3	5	125	2	1	1	4
CSE331	Data Structures and Algorithms	3	5	125	2	2	1	5
CSE332	Design and Analysis of Algorithms	3	5	125	2	2	1	5
CSE333	Database Systems	3	5	125	2	1	1	4
CSE334	Software Engineering	3	5	125	2	2	0	4
CSE335	Operating Systems	3	5	125	2	2	0	4
CSE352	Parallel and Distributed Systems	3	5	125	2	2	0	4
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	1	1	4
CSE439	Design of Compilers	3	5	125	2	2	0	4
CSE451	Computer Networks and Security	3	5	125	2	1	1	4
CSE472	Artificial Intelligence	3	5	125	2	2	0	4
	Computer and Systems Elective (1)	2	5	125	2	1	1	4
	Computer and Systems Elective (2)	2	5	125	2	1	1	4
	Computer and Systems Elective (3)	2	5	125	2	1	1	4
	Computer and Systems Elective (4)	2	5	125	2	1	1	4
	Computer and Systems Elective (5)	2	5	125	2	1	1	4
CSE491	Computer & Systems Engineering Graduation Proj. (1)	3	6	150	0	0	5	5
CSE492	Computer & Systems Engineering Graduation Proj. (2)	3	6	150	0	0	5	5
Total		170	298	7450	130	84	49	263
Pool of Computer Design Concentration Elective Courses								
CSE312	Electronic Design Automation	2	5	125	2	1	1	4
CSE313	Digital Systems Testing and Verification	2	5	125	2	1	1	4
CSE314	Parallel and Cluster Computing	2	5	125	2	1	1	4
CSE413	Real-Time Operating systems	2	5	125	2	1	1	4
CSE414	Digital VLSI Systems	2	5	125	2	1	1	4
CSE415	Fault Tolerant Computing	2	5	125	2	1	1	4
CSE416	Selected Topics in Computer Design	2	5	125	2	1	1	4
Pool of Computer Software Concentration Elective Courses								
CSE336	Software Design Patterns	2	5	125	2	1	1	4
CSE337	Software Testing	2	5	125	2	1	1	4
CSE346	Advanced Database Systems	2	5	125	2	1	1	4
CSE437	Selected Topics in Software	2	5	125	2	1	1	4
Pool of Computer Networks Concentration Elective Courses								
CSE357	Networks Operation and Management	2	5	125	2	2	0	4
CSE358	Pervasive Computing and Internet of Things	2	5	125	2	2	0	4
CSE452	Wireless Networks	2	5	125	2	2	0	4
CSE453	Digital Forensics	2	5	125	2	2	0	4
CSE454	Quantum Communication and Security	2	5	125	2	2	0	4
CSE455	High-Performance Computing	2	5	125	2	2	0	4
CSE459	Selected Topics in Computer Networks	2	5	125	2	2	0	4

Pool of Computer Systems and Artificial Intelligence Concentration Elective Courses								
CSE372	Simulation of Engineering Systems	2	5	125	2	1	1	4
CSE373	Digital Control Systems	2	5	125	2	1	1	4
CSE374	Digital Image Processing	2	5	125	2	1	1	4
CSE375	Machine Learning and Pattern Recognition	2	5	125	2	1	1	4
CSE376	Digital Signals Processing	2	5	125	2	1	1	4
CSE471	Robotic Systems	2	5	125	2	1	1	4
CSE473	Computational Intelligence	2	5	125	2	1	1	4
CSE475	Biomedical Engineering	2	5	125	2	1	1	4
CSE476	Fundamentals of Big-Data Analytics	2	5	125	2	1	1	4
CSE477	Fundamentals of Deep Learning	2	5	125	2	1	1	4
CSE478	Selected Topics in Systems and Artificial Intelligence	2	5	125	2	1	1	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5	PHM013 PHM022
EPM111	Electrical Circuits (1)	4	7	175	3	2	1	6	
CSE111	Logic Design	3	5	125	3	1	1	5	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
Total		18	30	750	16	10	3	29	
Semester 4									
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4	PHM121
MEP214	Thermal Power Engineering	3	5	125	2	2	0	4	PHM041 PHM022
EPM113	Electrical measurements	3	5	125	2	2	1	5	
EPM112	Electromagnetic Fields	3	5	125	3	1	0	4	
MDP231	Engineering Economy	2	4	100	2	1	0	3	
CSE131	Computer Programming	3	6	150	3	0	2	5	
Total		17	30	750	14	8	3	25	
Semester 5									
EPM211	Properties of Electrical materials	2	4	100	2	1	1	4	PHM022
ECE211	Electronics	3	5	125	3	1	0	4	PHM122
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5	PHM111 PHM113
CSE271	System Dynamics and Control Components	4	6	150	3	2	1	6	
	ASU Elective (1)	2	3	75	2	1	0	3	
CSE212	Computer Organization	3	6	150	2	2	0	4	CSE111 CSE131
Total		18	30	750	15	9	2	26	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
EPM213	Energy and Renewable Energy	3	6	150	3	1	1	5	EPM112
ECE252	Fundamentals of Communication Systems	3	6	150	2	2	0	4	ECE251
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	CSE111 CSE131
ASU111	Human Rights	2	2	50	2	1	0	3	
CSE231	Advanced Computer Programming	3	5	125	2	0	2	4	CSE131
ECE212	Digital Circuits	3	6	150	2	2	0	4	CSE111
Total		17	30	750	13	8	5	26	
Semester 7									
PHM211	Discrete Mathematics	2	4	100	2	2	0	4	
CSE331	Data Structures and Algorithms	3	5	125	2	2	1	5	CSE231
CSE335	Operating Systems	3	5	125	2	2	0	4	CSE212
CSE351	Computer Networks	3	5	125	2	2	0	4	
CSE371	Control Engineering	3	5	125	2	1	1	4	ECE251
	Computer and Systems Elective (1)	2	5	125	2	1	1	4	
Total		16	29	725	12	10	3	25	
Semester 8									
CSE311	Computer Architecture	3	5	125	2	2	0	4	CSE212
CSE332	Design and Analysis of Algorithms	3	5	125	2	2	1	5	CSE331
CSE333	Database Systems	3	5	125	2	1	1	4	CSE331
CSE334	Software Engineering	3	5	125	2	2	0	4	CSE131
CSE352	Parallel and Distributed Systems	3	5	125	2	2	0	4	CSE351
	Computer and Systems Elective (2)	2	5	125	2	1	1	4	
Total		17	30	750	12	10	3	25	
Semester 9									
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	1	1	4	CSE211 CSE335
CSE439	Design of Compilers	3	5	125	2	2	0	4	CSE131
CSE441	Software Project Management	2	4	100	2	1	0	3	CSE334
CSE472	Artificial Intelligence	3	5	125	2	2	0	4	PHM111 CSE131
	Computer and Systems Elective (3)	2	5	125	2	1	1	4	
CSE491	Computer Engineering Graduation Project (1)	3	6	150	0	0	5	5	
Total		16	30	750	10	7	7	24	
Semester 10									
CSE451	Computer Networks and Security	3	5	125	2	1	1	4	CSE351
	Computer and Systems Elective (4)	2	5	125	2	1	1	4	
	Computer and Systems Elective (5)	2	5	125	2	1	1	4	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	3	
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
CSE492	Computer Engineering Graduation Project (2)	3	6	150	0	0	5	5	CSE491
Total		17	29	725	12	5	8	25	

Program #9: Structural Engineering Program

Program Description

The program aims to supply the students with the advanced concepts of structure design.Student will have basics of steel bridges, concrete bridges and water tanks design, according to recent design codes versions. Also, Student will have basics of dynamic, earthquake and steel behavior analysis, using recent design codes versions. Management of project recourses, risk, safety is essential knowledge for structure engineers.

Career Prospects

Structure engineers have versatile opportunities in design companies, construction companies, consulting firms, research entities and educational institutes or other similar organizations. Possible jobs are design engineer, field engineer, construction developer, research assistant, quality engineer, and technical sales engineer.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Civil Discipline (B-Level), the Structural Engineering Program graduate must be able to (C-Level):

- C1. Identify principles in the advanced structural analysis, computer design, steel structure behavior.
- C2. Identify principles in the finite element and earthquake engineering.
- C3. Identify principles in structure analysis programming and dynamic analysis of structures.
- C4. Design special concrete structures and prestressed concrete structures.
- C5. Design special steel structures and strengthening of structures with essential repairs.
- C6. Design different types of structure foundations.
- C7. Consider construction techniques, insulation works and rock mechanics.
- C8. Demonstrate knowledge in the fields of management project resources, risk, safety and legal issues in construction.
- C9. Demonstrate knowledge in the fields of composite, materials of special concrete types, ground improvement and geotechnical engineering using computer.
- C10. Demonstrate knowledge in the fields of masonry structures, steel plated structures, steel structures construction and space steel structures.
- C11. Identify principles in the fields of fluid mechanics, hydraulics, irrigation and drainage, hydrology, water resources, and apply principles of GIS in water engineering.
- C12. Plan and design irrigation and drainage systems, hydraulic networks, sustainable drainage systems and pump stations.
- C13. Use wide-range of analytical tools, techniques, equipment, and software packages in the field of surveying, remote sensing, transportation engineering and water and sanitation facilities.
- C14. Demonstrate knowledge and understanding and carry out maintenance of all elements for different types of roads, airports, pavements and traffic systems
- C15. Demonstrate knowledge, understanding and application of transportation planning and traffic engineering models and systems at various planning scales.

C16. Identify principles in the fields of surveying, geodesy, photogrammetry, remote sensing, roads and airport systems, traffic engineering, transportation planning, railway engineering, water and waste water systems and their codes of practice and standards.
C17. Plan and design of roads and highways, railways, transport systems, traffic management systems, water and waste water networks and treatment facilities and produce civil drawings.
C18. Consider environmental issues in transportation planning and traffic engineering, water and waste water systems, solid waste management, conduct field and laboratory measurements, and assess environmental impact of Utilities and Infrastructure engineering projects.
C19. Demonstrate knowledge and understanding of water and waste water networks and treatment facilities and demonstrate knowledge of environment pollution and solid waste management.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 24 List of Structural EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Civil Engineering Requirements	68	103	2575	55	39	13	107
CES311	Structural Analysis (3)	3	3	75	2	2	0	4
CES312	Structural Dynamics	3	3	75	2	2	0	4
CES362	Foundation Engineering (1)	3	3	75	2	2	0	4
CES411	Advanced Structural Analysis	2	3	75	2	1	0	3
CES421	Design of Prestressed Concrete and Bridges	3	5	125	2	2	0	4
CES422	Special Topics in Concrete Design	3	5	125	2	2	0	4
CES441	Design of Steel Bridges (1)	3	5	125	2	2	0	4
CES442	Design of Steel Bridges (2)	2	4	100	2	1	0	3
CES451	Repair and Strengthening of Structures	2	3	75	2	1	0	3
CES461	Foundation Engineering (2)	2	3	75	2	1	0	3
CES471	Construction Project Management	3	4	100	2	2	0	4
CEI333	Design of Irrigation Structures	2	4	100	2	1	0	3
CEP322	Transportation and Roads Engineering	2	5	125	2	1	0	3
CEP352	Sanitary Engineering	3	5	125	2	2	0	4
-	Structural Engineering Elective Course (1)	2	4	100	2	1	0	3
-	Structural Engineering Elective Course (2)	2	4	100	2	1	0	3
-	Structural Engineering Elective Course (3)	2	4	100	2	1	0	3
CES491	Graduation Project (1)	2	5	125	0	4	0	4
CES492	Graduation Project (2)	4	9	225	0	8	0	8
Total		172	277	6925	135	105	27	267
Pool of Structural Engineering Elective Courses (1)								
CES313	Computer Aided Structural Design	2	4	100	2	1	0	3
CES323	Construction Techniques	2	4	100	2	1	0	3
CES343	Behavior of Steel Structures	2	4	100	2	1	0	3
CES351	Advanced Composite Materials	2	4	100	2	1	0	3
CES363	Geotechnical Site Characterization	2	4	100	2	1	0	3

CES371	Management of Project Resources	2	4	100	2	1	0	3

Pool of Structural Engineering Elective Courses (2)								
CES412	Finite Element Method	2	4	100	2	1	0	3
CES413	Earthquake Engineering	2	4	100	2	1	0	3
CES414	Dynamic Floor Vibrations	2	4	100	2	1	0	3
CES423	Design of Concrete Bridges	2	4	100	2	1	0	3
CES424	Masonry Structures	2	4	100	2	1	0	3
CES443	Steel Plated Structures	2	4	100	2	1	0	3
CES444	Construction of Steel Structures	2	4	100	2	1	0	3
Pool of Structural Engineering Elective Courses (3)								
CES452	Special Types of Concrete	2	4	100	2	1	0	3
CES453	Sustainability of Construction and Building Physics	2	4	100	2	1	0	3
CES462	Ground Improvement	2	4	100	2	1	0	3
CES463	Computer Applications in Geotechnical Engineering	2	4	100	2	1	0	3
CES472	Risk and Safety Management	2	4	100	2	1	0	3
CES473	Construction Contracts and Cost Estimation	2	4	100	2	1	0	3

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
CES111	Structural Mechanics (1)	4	4	100	3	2	0	5	PHM032
CES151	Structures & Properties of Construction Matrls	2	4	100	2	1	1	4	PHM032
CEI111	Fluid Mechanics	2	4	100	2	1	1	4	PHM032
CEP111	Plane Surveying (1)	2	4	100	2	1	1	4	CEP011
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
Total		18	28	700	15	11	3	29	
Semester 4									
CES112	Structural Mechanics (2)	4	4	100	3	2	0	5	CES111
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4	CES151
CES171	Construction Management	2	4	100	2	1	0	3	PHM032
CEI261	Engineering Economics and Management	2	4	100	2	1	0	3	PHM111
CEI112	Hydraulics (1)	2	4	100	2	1	1	4	CEI111
CEI131	Civil Drawings	2	5	125	1	3	0	4	CEP011
CEP112	Plane Surveying (2)	3	5	125	2	1	2	5	CEP111
Total		17	30	750	14	10	4	28	
Semester 5									
CES211	Structural Analysis (1)	3	3	75	2	2	0	4	CES112
CES221	Concrete Design (1)	2	3	75	2	1	0	3	CES112
CES251	Concrete Technology (1)	3	4	100	2	2	2	6	CES151
CES261	Geology and Geotechnical Engineering	2	3	75	2	1	1	4	CES112
CEI211	Hydraulics (2)	2	4	100	2	1	1	4	CEI112
CEP211	Topographic Surveying (1)	2	5	125	2	1	1	4	CEP112
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM111
Total		18	28	700	15	10	5	30	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CES212	Structural Analysis (2)	3	3	75	2	2	0	4	CES211
CES222	Concrete Design (2)	2	3	75	2	1	0	3	CES221
CES223	Design Principles	1	2	50	1	1	0	2	CES221
CES252	Concrete Technology (2)	3	4	100	3	1	1	5	CES251
CES262	Geotechnical Engineering (1)	2	3	75	2	1	1	4	CES261
CEI221	Irrigation and Drainage Engineering	4	5	125	3	2	0	5	CEI211
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
Total		17	22	550	15	8	2	25	
Semester 7									
CES311	Structural Analysis (3)	3	3	75	2	2	0	4	CES212
CES321	Design of Concrete Floors	3	4	100	2	2	0	4	CES222
CES341	Design and Behavior of Steel Structures (1)	3	5	125	2	2	0	4	CES212
CES361	Geotechnical Engineering (2)	2	3	75	2	1	0	3	CES262
CEP322	Transportation and Roads Engineering	2	5	125	2	1	0	3	PHM112
CEI333	Design of Irrigation Structures	2	4	100	2	1	0	3	CEI221 CES222
-	ASU Elective (1)	2	2	75	2	1	0	3	
Total		17	26	675	14	10	0	24	
Semester 8									
-	ASU Elective (2)	2	2	50	2	0	0	2	
ASU111	Human Rights	2	2	50	2	1	0	3	
CES312	Structural Dynamics	3	3	75	2	2	0	4	CES311
CES322	Design of Concrete Halls	3	4	100	2	2	0	4	CES321
CES342	Design and Behavior of Steel Structures (2)	3	5	125	2	2	0	4	CES341
CES362	Foundation Engineering (1)	3	3	75	2	2	0	4	CES361
-	Structural Engineering Elective (1)	2	4	100	2	1	0	3	
Total		18	23	575	14	10	0	24	
Semester 9									
CES411	Advanced Structural Analysis	2	3	75	2	1	0	3	CES312
CES421	Design of Prestressed Concrete and Bridges	3	5	125	2	2	0	4	CES322 /CES324/
CES441	Design of Steel Bridges (1)	3	5	125	2	2	0	4	CES342
CES461	Foundation Engineering (2)	2	3	75	2	1	0	3	CES362
-	Structural Engineering Elective Course (2)	2	4	100	2	1	0	3	CES411 /CES471/
CES471	Construction Project Management	3	4	100	2	2	0	4	CES322
CES491	Graduation Project (1)	2	5	125	0	4	0	4	Elect.(1)
Total		17	29	725	12	13	0	25	
Semester 10									
CES422	Special Topics in Concrete Design	3	5	125	2	2	0	4	CES421
CES442	Design of Steel Bridges (2)	2	4	100	2	1	0	3	CES441
-	Structural Engineering Elective Course (3)	2	4	100	2	1	0	3	CES451 /CES461/
CEP352	Sanitary Engineering	3	5	125	2	2	0	4	CEI211
CES451	Repair and Strengthening of Structures	2	3	75	2	1	0	3	CES252 CES222
CES492	Graduation Project (2)	4	9	225	0	8	0	8	CES491
Total		16	30	750	10	15	0	25	

Program #10: Water Engineering and Hydraulic Structures Program

Program Description

The Nile River in Egypt has supported the longest civilization over the world. Water engineers deal with the control and utilization of water by society. The program aims at providing well educated civil engineers with special expertise in the physical processes of water flow essential to the understanding, protection, and improvement of the environment. The program also aims at preparing its graduates to appreciate sustainable integrated water systems. This will support preparing engineers that can meet the present and future challenges in Egypt, the Arab Countries and the River Nile riparian countries are facing.

Career Prospects

Water engineers use their expertise in areas such as hydraulics, hydrology, fluid mechanics, coastal and river engineering, water resources management and planning, and mathematics and computer analysis to solve problems associated with the control and use of water and developing sustainable water systems. This includes flood control and protection, urban infrastructure systems, hydraulic structures, hydroelectric power development, road and pipeline river crossings, irrigation, drainage, coastal and bank erosion protection, and marine and river navigation facilities.Graduates of the program can work with

1. Government authorities,
2. Design firms designing different water systems,
3. Urban infrastructure authorities,
4. Coastal engineers developing coastal environment systems,
5. Roads drainage design either with authorities or design firms
6. Water resources management authority.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Civil Discipline (B-Level), the Water Engineering and Hydraulic Structures Program graduate must be able to (C-Level):

- C1. Identify principles in the fields of fluid mechanics, hydraulics, irrigation and drainage, hydrology, water resources, and apply principles of GIS in water engineering.
- C2. Design and analyze crossing structures, control structures, navigation structures, harbor structures, storage work and produce civil drawings.
- C3. Consider environmental issues in hydraulics, coastal engineering, ground water and surface water hydrology, river engineering, water quality, climate change, conduct field and laboratory measurements, and assess environmental impact of water engineering projects.
- C4. Plan and design irrigation and drainage systems, hydraulic networks, sustainable drainage systems and pump stations.
- C5. Demonstrate knowledge in the fields of water concrete structures, foundation of water structures, sanitary works, roadways and transportation systems and their codes of practice and standards.
- C6. Use some computer programs and information technology in the field of water engineering and hydraulic structures.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 25 List of Water Engineering and Hydraulic StructuresProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Civil Engineering Requirements	68	103	2575	55	39	13	107
CEI411	Hydraulics of Networks	3	5	125	2	1	2	5
CEI331	Design of Irrigation Works	2	5	125	2	1	0	3
CEI332	Hydraulic Structures (1)	2	5	125	2	1	0	3
CEI431	Hydraulic Structures (2)	2	5	125	2	1	0	3
CEI432	Hydraulic Structures (3)	2	5	125	2	1	0	3
CEI341	Coastal Engineering	2	4	100	2	1	0	3
CEI441	Port Engineering and Navigation	2	4	100	2	1	0	3
CEI351	Environmental Hydrology	2	5	125	2	1	0	3
CEI451	Ground Water Hydrology	2	5	125	2	1	0	3
CEI361	Water Resources Engineering	2	5	125	2	1	0	3
CEI461	Geographical Information Systems in Water Engineering	2	5	125	2	0	2	4
CEP212	Engineering Surveying	3	5	125	2	2	0	4
CEP322	Transportation and Roads Engineering	2	5	125	2	1	0	3
CEP352	Sanitary Engineering	3	5	125	2	2	0	4
CES465	Foundation Engineering of Water Structures (1)	3	5	125	2	2	0	4
	Water Engineering Program Elective (1)	2	4	100	2	1	0	3
	Water Engineering Program Elective (2)	2	4	100	2	1	0	3
	Water Engineering Program Elective (3)	2	4	100	2	1	0	3
	Water Engineering Program Elective (4)	2	4	100	2	1	0	3
CEI491	Graduation Project	6	12	300	0	12	0	12
Total		172	297	7425	139	101	31	271
Pool of Water EngineeringProgram Elective (1) Courses								
CEI413	Environmental Hydraulics	2	4	100	2	1	0	3
CEI442	Coastal Environment Engineering	2	4	100	2	1	0	3
CEI462	Water Quality	2	4	100	2	1	0	3
CEI464	Climate Change Adaptation in Water Resources field	2	4	100	2	1	0	3
Pool of Water Engineering Program Elective (2) Courses								
CEI412	Pump Station Engineering	2	4	100	2	1	0	3
CEI414	River Engineering	2	4	100	2	1	0	3
CEI415	Lab and Field Measurements in Water Resources field	2	4	100	2	1	0	3
CEI433	Dams Engineering	2	4	100	2	1	0	3
CEI465	Non-Conventional Water Resources	2	4	100	2	1	0	3
Pool of Water Engineering Program Elective (3) Courses								
CEI421	Sustainable Drainage Systems	2	4	100	2	1	0	3
CEI422	Advanced Irrigation Engineering	2	4	100	2	1	0	3
CEI434	Advanced Hydraulic Structures	2	4	100	2	1	0	3
CEI443	Inland Navigation	2	4	100	2	1	0	3
CEI463	Environmental Impact Assessment for Water Engineering Projects	2	4	100	2	1	0	3
Pool of Water Engineering Program Elective (4) Courses								
CES426	Design of Water Concrete Structures	2	4	100	2	1	0	3
CES466	Foundation Engineering of Water Structures (2)	2	4	100	2	1	0	3

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
PHM111	Probabilities and Statistics	2	4	100	2	2	0	4	
CES111	Structural Mechanics (1)	4	4	100	3	2	0	5	PHM031
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4	PHM032
CEP111	Plane Surveying (1)	2	4	100	2	1	1	4	
CEI111	Fluid Mechanics	2	4	100	2	1	1	4	PHM013 PHM032
ASU111	Human Rights	2	2	50	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		17	25	650	15	10	3	28	
Semester 4									
CES112	Structural Mechanics (2)	4	4	100	3	2	0	5	CES111
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4	CES151
CEP112	Plane Surveying (2)	3	5	125	2	1	2	5	CEP111
CEI112	Hydraulics (1)	2	4	100	2	1	1	4	CEI111
CEI131	Civil Drawing	2	5	125	1	3	0	4	CEP011
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
	ASU Elective (1)	2	3	75	2	1	0	2	
Total		19	31	775	15	11	4	29	
Semester 5									
CES211	Structural Analysis (1)	3	3	75	2	2	0	4	CES112
CES221	Concrete Design (1)	2	3	75	2	1	0	3	CES112
CES251	Concrete Technology (1)	3	4	100	2	2	2	6	CES151
CEP211	Topographic Surveying (1)	2	5	125	2	1	1	4	CEP112
CEI211	Hydraulics (2)	2	4	100	2	1	1	4	CEI112
CES261	Geology and Geotechnical Engineering	2	3	75	2	1	1	4	CES112
CEI261	Engineering Economics and Management	2	4	100	2	1	0	3	
Total		16	26	650	14	9	5	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CES212	Structural Analysis (2)	3	3	75	2	2	0	4	CES211
CES222	Concrete Design (2)	2	3	75	2	1	0	3	CES221
CES252	Concrete Technology (2)	3	4	100	3	1	1	5	CES251
CES223	Design Principles	1	2	50	1	1	0	2	CES221
CEP212	Engineering Surveying	3	5	125	2	2	0	4	CEP211
CEI221	Irrigation and Drainage Engineering	4	5	125	3	2	0	5	CEI211
CES262	Geotechnical Engineering (1)	2	3	75	2	1	1	4	CES261
Total		18	25	625	15	10	2	27	
Semester 7									
CES321	Design of Concrete Floors	3	4	100	2	2	0	4	CES222
CES341	Design and Behavior of Steel Structures (1)	3	5	125	2	2	0	4	CES212
CES361	Geotechnical Engineering (2)	2	3	75	2	1	0	3	CES262
CEI331	Design of Irrigation Works	2	5	125	2	1	0	3	CEI221 CES212
CEI351	Environmental Hydrology	2	4	100	2	1	0	3	CEI221
CEP322	Transportation and Roads Engineering	2	5	125	2	1	0	3	PHM111
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	
Total		17	30	750	14	10	0	24	
Semester 8									
CES322	Design of Concrete Halls	3	4	100	2	2	0	4	CES321
	ASU Elective (2)	2	2	50	2	0	0	2	
CES342	Design and Behavior of Steel Structures (2)	3	5	125	2	2	0	4	CES341
CEI341	Coastal Engineering	2	3	75	2	1	0	3	CEI211 /CEI212/ CES361 /CES364/
CEI332	Hydraulic Structures (1)	2	5	125	2	1	0	3	CEI331 CES222
CEI361	Water Resources Engineering	2	4	100	2	1	0	3	CEI351
CEP352	Sanitary Engineering	3	5	125	2	2	0	4	CEI211
Total		17	28	700	14	9	0	23	
Semester 9									
CEI411	Hydraulics of Networks	3	5	125	2	1	2	5	CEI361
CEI431	Hydraulic Structures (2)	2	5	125	2	1	0	3	CEI332 CES361
CEI461	Geographical Information Systems in WaterEngineering	2	4	100	2	0	2	4	CEP211
CES465	Foundation Engineering of Water Structures (1)	3	5	125	2	2	0	4	CES361
	Water Engineering Elective Course (1)	2	4	100	2	1	0	3	
	Water Engineering Elective Course (2)	2	4	100	2	1	0	3	
CEI441	Port Engineering and Navigation	2	4	100	2	1	0	3	CEI341
Total		16	31	775	14	7	4	25	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 10									
CEI451	Ground Water Hydrology	2	4	100	2	1	0	3	CEI211 /CEI212/ CES361 /CES364/
CEI432	Hydraulic Structures (3)	2	5	125	2	1	0	3	CEI332 CES361
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	None
	Water Engineering Elective Course (3)	2	4	100	2	1	0	3	
	Water Engineering Elective Course (4)	2	4	100	2	1	0	3	
CEI495	Graduation Project	7	12	300	3	8	0	11	Elect.(1) /Elect.(2)/
CES171	Construction Management	2	4	100	2	1	0	3	None
Total		19	35	875	15	13	0	28	

Program #11: Utilities and InfrastructureProgram

Program Description

Utilities and infrastructure (formerly Public Works Engineering) is the heart of public utilities and infrastructure development programs in cities as well as national levels. Utilities and Infrastructure engineers deal with providing effective, efficient and sustainable public infrastructure. The Utilities and Infrastructure program aims at providing well educated civil engineers with special expertise in sustainable Utilities and Infrastructure planning and infrastructure management, surveying engineering, water and waste water networks, water and waste water treatment, solid waste management, highway and airport engineering, transportation planning, traffic engineering and railway engineering. The program also aims at preparing its graduates to appreciate sustainable integrated Utilities and Infrastructure systems. This will support preparing engineers that can meet present and future challenges in Egypt, the Arab countries and world community are facing to provide sustainable and efficient Utilities and Infrastructure.

Career Prospects

Utilities and Infrastructure engineers use their expertise in areas such as surveying, structural engineering, environmental engineering, sanitary engineering, transportation planning, traffic engineering, highways and airport engineering, railway engineering as well as mathematics and computer analysis to solve problems associated with the planning, design, construction, operation and maintenance of Utilities and Infrastructure systems. These systems include roads, airports, highway networks, transport systems, railway systems, traffic management, water and waste water networks, water and waste water treatment facilities and solid waste management. Graduates of this program can work with:

- Government authorities
- Municipalities
- Urban infrastructure organizations
- Consulting firms in civil engineering and construction
- Civil engineering contractors and project managers
- Water and sanitation utility companies
- Transport authorities and operating companies
- Environmental engineering organizations
- Water regulatory authority

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level) and the competencies for the Civil Discipline (B-Level), the Utilities and Infrastructure Program graduate must be able to (C-Level):

C1. Identify principles in the fields of surveying, geodesy, photogrammetry, remote sensing, roads and airport systems, traffic engineering, transportation planning, railway engineering, water and waste water systems and their codes of practice and standards.

C2. Plan and design of roads and highways, railways, transport systems, traffic management systems, water and waste water networks and treatment facilities and produce civil drawings.

C3. Consider environmental issues in transportation planning and traffic engineering, water and waste water systems, solid waste management, conduct field and laboratory measurements, and assess environmental impact of public works engineering projects.

C4. Use wide-range of analytical tools, techniques, equipment, and software packages in the field of surveying, remote sensing, transportation engineering and water and sanitation facilities.

C5. Demonstrate knowledge and understanding and carry out maintenance of all elements for different types of roads, airports, pavements and traffic systems

C6. Demonstrate knowledge, understanding and application of transportation planning and traffic engineering models and systems at various planning scales.

C7. Demonstrate knowledge, understanding, and utilization of plane and topographical surveying techniques, processes and equipment, photogrammetry and the Global Positioning system (GPS) in engineering projects

C8. Demonstrate knowledge and understanding of railway engineering and train operations systems

C9. Demonstrate knowledge and understanding of water and waste water networks and treatment facilities and demonstrate knowledge of environment pollution and solid waste management.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 26 List of Utilities and Infrastructure ProgramRequirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
	Civil Engineering Requirements	68	103	2575	55	39	13	107
CEP212	Engineering Surveying	3	5	125	2	2	0	4
CEP311	Topographical Surveying (2)	2	4	100	2	1	1	4
CEP411	Geodetic Surveying	3	4	100	2	2	0	4
CEP321	Transportation Planning	3	5	125	2	2	0	4
CEP421	Traffic Engineering	3	4	100	2	2	0	4
CES425	Design of Civil Structures	3	5	125	2	2	0	4
CEP331	Roads and Airport Engineering	3	5	125	2	2	0	4
CEP431	Highway Construction Technology	3	4	100	2	2	0	4
CEP341	Railway Engineering (1)	3	5	125	2	2	0	4
CEP351	Water and Waste Water Networks	3	5	125	2	2	0	4
CEP451	Water and Waste Water Treatment	3	5	125	2	2	0	4
CES464	Geotechnical Engineering for Infrastructures	2	4	100	2	1	0	3
	Utilities and Infrastructure Elective (1)	2	4	100	2	1	0	3
	Utilities and Infrastructure Elective (2)	2	4	100	2	1	0	3
	Utilities and Infrastructure Elective (3)	2	4	100	2	1	0	3
	Utilities and Infrastructure Elective (4)	2	4	100	2	1	0	3
CEP491	Utilities and Infrastructure Graduation Project	6	12	300	1	10	0	11
Total		172	279	6975	134	104	28	266
Pool of Utilities and Infrastructure Elective (1) Courses								
CEP412	Hydrographic Surveying	2	4	100	2	1	0	3
CEP441	Railway Engineering (2)	2	4	100	2	1	0	3
CEP452	Environmental Engineering	2	4	100	2	1	0	3
Pool of Utilities and Infrastructure Elective (2) Courses								
CEP413	Geographic Information Systems	2	4	100	2	1	0	3
CEP422	Traffic Management Systems	2	4	100	2	1	0	3
CEP454	Solid Waste Management	2	4	100	2	1	0	3
Pool of Utilities and Infrastructure Elective (3) Courses								
CEP423	Traffic Studies and Analysis	2	4	100	2	1	0	3
CEP432	Road and Airport Maintenance	2	4	100	2	1	0	3
CEP453	Sludge Management	2	4	100	2	1	0	3
Pool of Utilities and Infrastructure Elective (4) Courses								
CEP415	Surveying with Satellites	2	4	100	2	1	0	3
CEP433	Airport Planning and Design	2	4	100	2	1	0	3
CEP443	Railway Signaling Systems	2	4	100	2	1	0	3

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
CES111	Structural Mechanics (1)	4	4	100	3	2	0	5	PHM032
CES151	Structures & Properties of Construction Matrls	2	4	100	2	1	1	4	PHM032
CEP111	Plane Surveying (1)	2	4	100	2	1	1	4	
CEI111	Fluid Mechanics	2	4	100	2	1	1	4	PHM013 PHM032
	ASU Elective (1)	2	3	75	2	1	0	3	
ASU211	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		17	27	675	15	10	3	28	
Semester 4									
CES112	Structural Mechanics (2)	4	4	100	3	2	0	5	CES111
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4	CES151
CEP112	Plane Surveying (2)	3	5	125	2	1	2	5	CEP111
CEI112	Hydraulics (1)	2	4	100	2	1	1	4	CEI111
CEI131	Civil Drawings	2	5	125	1	3	0	4	CEP011
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013 PHM111
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	
Total		20	32	800	15	12	4	31	
Semester 5									
CES211	Structural Analysis (1)	3	3	75	2	2	0	4	CES112
CES221	Concrete Design (1)	2	3	75	2	1	0	3	CES112
CES251	Concrete Technology (1)	3	4	100	2	2	2	6	CES151
CEP211	Topographic Surveying (1)	2	5	125	2	1	1	4	CEP112
CEI211	Hydraulics (2)	2	4	100	2	1	1	4	CEI112
CES261	Geology and Geotechnical Engineering	2	3	75	2	1	1	4	CES112
CEI261	Engineering Economics and Management	2	4	100	2	1	0	3	PHM111
Total		16	26	650	14	9	5	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CES212	Structural Analysis (2)	3	3	75	2	2	0	4	CES211
CES222	Concrete Design (2)	2	3	75	2	1	0	3	CES221
CES223	Design Principles	1	2	50	1	1	0	2	CES221
CES252	Concrete Technology (2)	3	4	100	3	1	1	5	CES251
CEP212	Engineering Surveying	3	5	125	2	2	0	4	CEP211
CEI221	Irrigation and Drainage Engineering	4	6	150	3	2	0	5	CEI211
CES262	Geotechnical Engineering (1)	2	3	75	2	1	1	4	CES261
Total		18	26	650	14	11	3	28	
Semester 7									
CES321	Design of Concrete Floors	3	4	100	2	2	0	4	CES222
CES341	Design and Behavior of Steel Structures (1)	3	5	125	2	2	0	4	CES212
CES361	Geotechnical Engineering (2)	2	3	75	2	1	0	3	CES262
CEP341	Railway Engineering (1)	3	5	125	2	2	0	4	
CEP331	Roads and Airport Engineering	3	5	125	2	2	0	4	
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		18	26	650	14	10	0	24	
Semester 8									
CES322	Design of Concrete Halls	3	4	100	2	2	0	4	CES321
CES342	Design and Behavior of Steel Structures (2)	3	5	125	2	2	0	4	CES341
	ASU Elective (2)	2	2	50	2	0	0	2	
CEP321	Transportation Planning	3	5	125	2	2	0	4	PHM111
CEP351	Water and Waste Water Networks	3	5	125	2	2	0	4	CEI211
CEP311	Topographic Surveying (2)	2	4	100	2	1	1	4	CEP211
Total		16	25	625	12	9	1	22	
Semester 9									
CES471	Construction Project Management	3	4	100	2	2	0	4	CES322
CES425	Design of Civil Structures	3	5	125	2	2	0	4	CES322
CEP451	Water and Waste Water Treatment	3	5	125	2	2	0	4	CEP351
CEP411	Geodetic Surveying	3	5	125	2	2	0	4	CEP212 CEP311
	Utilities and Infrastructure Elective Course (1)	2	4	100	2	1	0	3	
	Utilities and Infrastructure Elective Course (2)	2	4	100	2	1	0	3	
CEP421	Traffic Engineering	3	4	100	2	2	0	4	CEP321
Total		19	31	775	14	12	0	26	
Semester 10									
CES464	Geotechnical Engineering for Infrastructures	2	4	100	2	1	0	3	CES361
CEP431	Highway Construction Technology	3	4	100	2	2	0	4	CEP331
	Utilities and Infrastructure Elective Course (3)	2	4	100	2	1	0	3	
	Utilities and Infrastructure Elective Course (4)	2	4	100	2	1	0	3	
CEP491	Graduation Project	6	12	300	1	10	0	11	Elect. (1) /Elect. (2)/
Total		15	28	700	9	15	0	24	

Program #12: Materials Engineering Program

Program Description

The program aims to supply the students with the basic and global concepts of science and technology in order to comprehend the relation between materials' structure and its properties and applications, which will open the field to develop and manufacture materials with special properties that suits the required application. This will help in developing various industries and setting specifications and criteria for quality assurance. Materials engineering applications incorporates different metals, ceramics, plastics, composite materials, semiconductors and other materials that could be used in electronics, communication, environmental, medicine, biotechnology, nanotechnology and other applications. Now this field attracts global attention which makes it important to be included into the higher educational system in Egypt.

Career Prospects

Materials engineers have versatile opportunities in manufacturing, petrochemical, ore extraction, consulting firms, research entities and educational institutes or other similar organizations. Possible jobs are Material engineer, design engineer, metallurgist, product developer, research assistant, quality engineer, biomedical engineer, patent examiner and technical sales engineer.

Duties of material engineer are: material selection, material design, processing, testing and characterization of materials and data, quality control, training and documentation.

Program Concentrations

Material engineering program covers a wide spectrum of materials. However, elective courses of 15 Credit Hours in addition to the graduation projects are given to the student for selection in one of the following fields:

1. Metallurgy: extraction of ferrous and nonferrous alloys, forming, casting and welding technologies, material characterization and non-destructive testing.

2. Polymer: polymer materials and its composites, processing, testing, lubricants, sealants, packaging materials.

3. Ceramics: building materials, glass, ceramic technologies and nano technologies, biomedical materials and environmental aspects.

The student should select 5 electives (at least 3 from one concentration).

Agreements with another University

By fulfilling the required 170 CH (including the graduation project) plus the twelve obligatory training weeks, the student earns a Bachelor of Science in Material Engineering. However, the student has the chance to get a double degree from Ain Shams University and Clausthal University of Technology in Germany. This double degree is according to the agreement between both universities, where the student gets a Bachelor of Science in Material Science and Engineering.

Germany is known for its distinguished level of engineering as well as education. In comparison with other European and American universities, the tuition fees of the German Universities are attractive and tolerable. The student is required to pay his living expenses during his stay in Germany.

The student who decides to apply for the double degree will be required to:

- Pass all the Materials Engineering Program required courses at Ain Shams University according to the study plan except for the 15 Credit Hours Elective Courses and the Graduation Project. This accounts for only 149 Credit Hours.

- Pass B2 level of the German language according to the common European framework of reference for Languages
- In Clausthal University, the student will join the university as a normal student and study the five electives (available in Clausthal University and equivalent to those in Ain Shams university) plus the graduation project in order to get his double Bachelor degree. This normally requires two semesters.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Landscape Architecture Program graduate must be able to (D-Level):

D1. Apply general math, science and engineering skills to the solution of engineering problems related to materials,

D2. Analyze the relationship between structure, properties, processing and design of materials and their final impact on the product design and performance,

D3. Understand systems applicable to the material engineering discipline by applying the concepts of: Thermodynamics, Fluid Mechanics, heat and mass transfer and engineering chemistry, solid Mechanics, material processing, material Properties, measurements, and mechanical Design

D4. Develop, prepare and characterize new materials by applying concepts of homogeneity and polymorphism, phase transformation, crystalline structures and reaction kinetics,

D5. Select, Model, analyze, design, treat and test material systems of monolithic composite and hybrid materials in engineering systems such as mechanical, biomedical, electronic, communication and advanced building systems,

D6. Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain industrial equipment and systems.

D7. Have the experimental and computational skills for a professional career as team member or leader in multidisciplinary engineering projects using organization tools,

D8. Be aware of the value of sustainable learning and environmental/social issues surrounding materials.

D9. Demonstrate additional abilities related to the field of the concentration within Materials Engineering as listed below.

Concentration	Graduate attributes
Metallic field	9a. to understand, analyze, model, design and test some technological processes like casting, welding and forming of metals.
Polymer field	9b. to understand, analyze and test polymer-based materials like rubbers, surfactants, petrochemical products and other polymer composites for energy saving and advanced applications
Ceramic field	9c. to understand, analyze, model, design and test some technological processes of ceramic based materials in binding, glass and ceramic materials in advance technologies of nano- and biomedical materials.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 27 List of Materials EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM115	Engineering Mathematics	3	5	125	2	2	0	4
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4
PHM141	Introduction to Organic Chemistry	2	4	100	2	0	1	3
PHM142	Reaction Kinetics and Chemical Analysis	3	5	125	3	0	1	4
PHM241	Electrochemistry	3	5	125	3	0	1	4
PHM242	Polymer Chemistry	3	5	125	3	0	1	4
MDP111	Mechanical Drawing	3	5	125	1	3	1	5
MDP112	Machine Construction	3	6	150	2	2	0	4
MDP433	Quality Control	3	5	125	2	2	0	4
MEP111	Thermal Physics	2	4	100	1	2	0	3
MEP211	Thermodynamics	4	6	150	3	1	1	5
MEP212	Heat Transfer	4	8	200	2	2	3	7
MEP222	Introduction to Fluid Mechanics	3	5	125	3	1	1	5
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6
MDP411	Introduction to Finite Elements	3	5	125	2	2	0	4
MDP256	Phase Transformations and Heat Treatment	3	6	150	2	2	2	6
MDP451	Failure Analysis	3	5	125	2	2	0	4
MDP452	Material and Process Selection	2	4	100	2	1	0	3
MDP453	Composites Technology	3	5	125	3	0	2	5
MDP454	Corrosion	3	6	150	3	1	1	5
MDP153	Crystalline Structures of Materials	3	5	125	2	2	1	5
MDP254	Thermodynamics of Materials	3	5	125	2	2	2	6
MDP255	Materials Testing and Behavior	3	6	150	2	2	2	6
MDP257	Materials for Advanced Manufacturing Technology	2	4	100	2	1	1	4
MDP353	Polymer Materials	3	5	125	3	0	2	5
MDP354	Industrial Project	3	6	150	1	0	6	7
MDP355	Modern Ferrous and Non-Ferrous Making	2	4	100	2	1	0	3
MDP356	Glass, Ceramics, and Binding Materials	3	5	125	2	2	0	4
MDP456	Petrochemicals and Polymer Products	2	4	100	2	1	0	3
MDP183	Manufacturing Technologies	4	6	150	3	2	2	7
	Materials Engineering Elective (1)	3	5	125	2	2	0	4
	Materials Engineering Elective (2)	3	5	125	2	2	0	4
	Materials Engineering Elective (3)	3	5	125	2	2	0	4
	Materials Engineering Elective (4)	3	5	125	2	2	0	4
	Materials Engineering Elective (5)	3	5	125	2	2	0	4
MDP401	Mechanical Design & Production Graduation Project (1)	3	6	150	1	0	6	7
MDP402	Mechanical Design & Production Graduation Project (2)	3	6	150	1	0	6	7
Total		170	295	7375	129	80	62	271

Pool of Metallic Concentration Elective Courses								
MDP381	Theory of Metal Forming	3	5	125	2	2	1	5
MDP457	Extractive Metallurgy	3	5	125	2	2	0	4
MDP459	Corrosion Control and Cathodic Protection	3	5	125	2	2	0	4
MDP460	Non-destructive Testing of Materials (1)	3	5	125	2	2	0	4
MDP461	Non-destructive Testing of Materials (2)	3	5	125	2	2	0	4
Pool of Polymer Concentration Elective Courses								
MDP462	Polymeric Processing Techniques	3	5	125	2	2	0	4
MDP463	Materials for Energy Solution	3	5	125	2	2	0	4
MDP464	Surfactants and lubricating Materials	3	5	125	2	2	0	4
MDP465	Rubber and Sealing Materials	3	5	125	2	2	0	4
MDP467	Polymer Testing	3	5	125	2	2	0	4
Pool of Ceramic Concentration Elective Courses								
MDP468	Materials Characterization	3	5	125	2	2	0	4
MDP469	Glasses Materials and Technology	3	5	125	2	2	0	4
MDP470	Ceramic Materials and Technology	3	5	125	2	2	0	4
MDP471	Binding Materials and Technology	3	5	125	2	2	0	4
MDP472	Biomedical Materials	3	5	125	2	2	0	4
MDP473	Introduction to Nano technology	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
MEP111	Thermal Physics	2	4	100	1	2	0	3	
PHM111	Probability and Statistics	2	4	100	2	1	0	3	
PHM115	Engineering Mathematics	3	5	125	2	2	0	4	PHM013
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6	CEP011
MDP151	Structures and properties of materials	2	4	100	2	1	1	4	PHM041
PHM141	Introduction to Organic Chemistry	2	4	100	2	0	1	3	PHM041
ASU	Elective (1)	2	2	50	2	1	0	3	
Total		16	29	725	12	10	4	26	
Semester 4									
MEP211	Thermodynamics	4	6	150	3	1	1	5	MEP111
PHM121	Modern Physics and Quantum	3	5	125	3	1	1	5	PHM022 PHM013
MEP222	Introduction to Fluid Mechanics	3	5	125	3	1	1	5	MEP111
MDP153	Crystalline Structures of Materials	3	5	125	2	2	1	5	MDP151
MDP183	Manufacturing Technologies	4	6	150	3	2	2	7	MDP081
Total		17	27	675	14	7	6	27	
Semester 5									
MEP231	Measurements and instrumentation	2	5	125	1	0	3	4	MEP211
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	PHM022
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
MDP254	Thermodynamics of Materials	3	5	125	2	2	2	6	MEP211
PHM142	Reaction Kinetics and Chemical Analysis	3	5	125	3	0	1	4	PHM141
MDP112	Machine Construction	3	5	125	2	2	0	4	PHM031 MDP111
Total		19	34	850	13	8	10	31	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MDP232	Industrial Project management	2	4	100	2	1	0	3	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
MDP255	Materials testing and behavior	3	6	150	2	2	2	6	MDP 151
MDP256	Phase Transformations and Heat Treatment	3	6	150	2	2	2	6	MDP153 MEP212
PHM241	Electrochemistry	3	5	125	3	0	1	4	PHM041
PHM242	Polymer Chemistry	3	5	125	3	0	1	4	PHM142
MDP257	Materials for advanced manufacturing technology.	2	4	100	2	1	1	4	MDP 173
Total		19	34	850	16	8	7	31	
Semester 7									
	ASU Elective (2)	2	2	50	2	1	0	3	
MDP433	Quality Control	3	5	125	2	2	0	4	PHM111
PHM122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4	PHM121
MDP353	Polymer Materials	3	5	125	3	0	2	5	MDP151 MDP242
MDP454	Corrosion	3	5	125	3	0	1	4	MDP151 PHM241
MDP411	Introduction to Finite Elements	3	5	125	2	2	0	4	PHM115 MDP112
Total		17	27	675	14	7	3	24	
Semester 8									
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
MDP453	Composites Technology	3	5	125	3	0	1	4	MDP353
MDP451	Failure Analysis	3	5	125	3	0	1	4	MDP255 MDP454
MDP354	Industrial Project	3	6	150	1	0	6	7	MDP112 MDP256
MDP355	Modern Ferrous and Non-Ferrous Making	2	4	100	2	1	0	3	MDP254 MDP256
MDP356	Glass, Ceramics, and Binding Materials	3	5	125	2	2	0	4	MDP153
Total		17	29	725	13	5	8	26	
Semester 9									
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
MDP403	Materials Engineering Graduation Project (1)	3	6	150	1	0	6	7	MDP354
	Materials Engineering Elective (1)	3	5	125	2	2	0	4	
MDP452	Material and Process Selection	2	4	100	2	1	0	3	MDP255
	Materials Engineering Elective (2)	3	5	125	2	2	0	4	
MDP456	Petrochemicals and polymer products	2	4	100	2	1	0	4	PHM141
Total		15	26	650	11	6	6	24	
Semester 10									
ASU111	Human Rights	2	2	50	2	1	0	3	
MDP475	Graduation Project 2	3	6	150	1	0	6	7	MDP474
	Materials Engineering Elective (3)	3	5	125	2	2	0	4	
	Materials Engineering Elective (4)	3	5	125	2	2	0	4	
	Materials Engineering Elective (5)	3	5	125	2	2	0	4	
MDP231	Engineering Economy	2	4	100	2	1	0	3	
Total		16	27	675	11	8	6	25	

Program #13: Manufacturing Engineering Program

Program Description

Nowadays there are rising needs to modernize manufacturing industry to cope with the global challenges of producing cost effective products, competing at international markets and adapting to rapidly changing technologies for modern industry. Manufacturing Engineering is a complex discipline that requires a great deal of diverse and specialized knowledge. Manufacturing engineers are required by companies involved in manufacturing any kind of products, ranging from machines, equipment and robotics to all consumer products. The Program provides a broad technical background for students, in addition to proficiency in engineering methods, problem-solving and decision-making skills to a variety of manufacturing engineering issues. The aim of the program is to graduate manufacturing engineers who will be responsible for the design, selection of materials, specifications and the improvement of production processes and equipment. Responsibility for design and enhance of manufacturing systems, production management and control, as well as plant maintenance are also required by manufacturing engineers.

Career Prospects

Manufacturing Engineering Program Graduates may seek jobs at companies involved in manufacturing any kind of products, ranging from machines, equipment and robotics to all consumer products. They often have their choice of challenging positions such as manufacturing engineer, production manager, design engineer, quality specialist, process analyst, maintenance engineer, operations manager, continuous improvement engineer, or technical sales engineer.

Program Concentrations

The Manufacturing Engineering Program offers two concentrations. Each concentration is offered through a pool of 6 courses, from which students should select 4 courses (12 Credit Hours), 2 from pool A and 2 from pool B, in addition to the graduation project (1) and (2) which represent additional 6 Credit Hours; i.e. the concentration will be 18 Credit Hours. Two additional elective courses, one from each pool, are offered that students choose from the other concentration. The offered concentrations are as follows:

1. Advanced Manufacturing Systems: in this concentration the modern techniques used in manufacturing process, automation and some special topics related to the manufacturing processes will be covered.

2. Manufacturing Management: All topics related to how to manage the manufacturing systems, evaluate it performance and/or propose improvement enhancing its competitiveness are covered by this concentration.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Manufacturing Engineering Program graduate must be able to (D-Level):

D1. Understand and Operate physical systems applicable to the specific discipline byapplying the concepts of: Thermodynamics, Fluid Mechanics, Instrumentation andControl Theory and Systems.

D2. Model and analyze physical systems applicable to the specific discipline byapplying the concepts of: Material Properties, solidMechanics, Material Processing, Measurements, and Mechanical Design.
D3. Design mechanical systems and machine elements using appropriatematerials both traditional means and computer-aided tools and software contemporaryto the mechanical engineering field.
D4. Understand, select and plan various materials processing technologies to produce different types of products.
D5. Design products, process and the equipment, tooling and environment necessary for their manufacture to meet desired needs within realistic constraints.
D6. Apply knowledge, problem solving techniques, and hands-on skills in assessment of design, operation and continuous improvement of manufacturing systems, including automated manufacturing processes, process controls, manufacturing operations management, and systems integration.
D7. Understanding of the creation of competitive advantage through manufacturing planning, strategy, and control.
D8. Adopt suitable national and international standards and codes to: design, build,operate, inspect and maintain industrial equipment and systems.
D9. For each concentration the following ILOs are achieved:

Concentration	**Graduate attributes**
Advanced Manufacturing systems	9a. Understand automated manufacturing processes and their impact on the manufacturing system. 10a. Outline basic ideas of industrial automation in modern manufacturing including Programmable Logic Controllers (PLC), Robotics, and CIM. 11a. Apply advanced methods to the analysis, synthesis and control of automated systems.
Manufacturing Management	9b. Understand the analysis, synthesis, and control of manufacturing operations using statistical and calculus-based methods, simulation and information technology. 10b. Create competitive advantage through manufacturing planning, strategy, quality and control. 11b. Improve cost, quality, time, and flexibility goals using world class management methodologies.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 28 List of Manufacturing EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM131	Rigid body dynamics	2	4	100	2	1	1	4
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5
MEP111	Thermal Physics	2	4	100	1	2	0	3
MEP211	Thermodynamics	4	6	150	3	2	1	6
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6
MEP231	Measurements & instrumentation	2	5	125	1	0	3	4
MDP111	Mechanical drawing	3	6	150	1	3	2	6
MDP112	Machine Construction	3	5	125	2	2	0	4
MDP211	Machine Elements Design	4	8	200	3	2	2	7
MDP212	Mechanics of Machines	4	6	150	3	3	1	7
MDP414	Product Design and Development	3	5	125	2	2	2	6
MDP331	Maintenance planning & scheduling	2	4	100	2	1	0	3
MDP433	Quality Control	3	5	125	2	2	0	4
MDP152	Metallurgy & Material Testing	3	5	125	3	1	1	5
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5
MDP252	Casting and Welding (2)	2	4	100	2	0	2	4
MDP351	Industrial Furnaces and Heat Treatment	2	4	100	2	1	0	3
MDP462	Polymer Processing Techniques	2	4	100	2	0	2	4
MDP182	Metal Forming Theory & Processes	3	6	150	2	1	3	6
MDP281	Metal Cutting Theory and Technologies	4	8	200	3	1	3	7
MDP282	Non-Conventional Processing	2	4	100	2	0	2	4
MDP385	Manufacturing Processes	2	4	100	2	1	1	4
MDP386	Computer Aided Manufacturing	3	6	150	2	0	3	5
MDP387	Metrology	3	5	125	2	0	3	5
MDP490	Dies Design	3	6	150	2	3	0	5
MDP233	Work Study & Plant layout	4	5	125	3	2	0	5
MDP334	Principles of Operation Management	3	5	125	2	2	0	4
MDP441	Industrial technologies	2	4	100	2	1	0	3
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6
ECE215	Introduction to Electronics	2	4	100	2	1	1	4
MCT211	Automatic Control	3	5	125	3	1	1	5
	Manufacturing Program Concentration Elective (1) A	3	5	125	2	2	0	4
	Manufacturing Program Concentration Elective (2) A	3	5	125	2	2	0	4
	Manufacturing Program Concentration Elective (3) A	3	5	125	2	2	0	4
	Manufacturing Program Concentration Elective (4) B	3	6	150	2	2	0	4
	Manufacturing Program Concentration Elective (5) B	3	6	150	2	2	0	4
	Manufacturing Program Concentration Elective (6) B	3	6	150	2	2	0	4
MDP401	Mechanical Design & Production Graduation Project (1)	3	6	150	1	0	6	7
MDP402	Mechanical Design & Production Graduation Project (2)	3	6	150	1	0	6	7
Total		170	298	7450	129	84	63	276

Pool of Manufacturing Management Concentration Elective Courses								
Pool A								
MDP336	Facilities Layout and Design	3	5	125	2	2	0	4
MDP439	Lean Manufacturing System	3	5	125	2	2	0	4
MDP440	Quality Assurance and Six Sigma	3	5	125	2	2	0	4
Pool B								
MDP333	Operations Research	3	6	150	2	2	0	4
MDP335	Production Planning and Scheduling	3	6	150	2	2	1	5
MDP438	Simulation of Manufacturing Systems	3	6	150	2	0	3	5
Pool of Advanced Manufacturing Concentration Elective Courses								
Pool A								
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5
MCT313	Automation	3	5	125	3	1	1	5
MCT345	Industrial Mechanisms and Robotics	3	5	125	3	1	1	5
Pool B								
MCT414	Automation & Communication Systems for Manufac.	3	6	150	2	2	1	5
MDP492	Advanced Manufacturing Systems	3	6	150	2	2	1	5
MDP493	Additive Manufacturing	3	6	150	2	2	0	4
MDP491	Design of Jigs and Fixtures	3	6	150	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
MDP151	Structures and properties of materials	2	4	100	2	1	1	4	PHM041
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	PHM022
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
PHM131	Rigid body dynamics	2	4	100	2	1	1	4	PHM032
MEP111	Thermal Physics	2	4	100	1	2	0	3	PHM041
MDP111	Mechanical drawing	3	6	150	1	3	2	6	MDP011
Total		17	30	750	12	11	5	28	
Semester 4									
MDP182	Metal Forming Theory & Processes	3	6	150	2	1	3	6	MDP081 MDP152
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6	MEP111
MEP211	Thermodynamics	4	6	150	3	2	1	6	MEP111
MDP152	Metallurgy & Material Testing	3	5	125	3	1	1	5	MDP151
MDP212	Mechanics of Machines	4	6	150	3	3	1	7	PHM131
Total		18	30	750	14	9	7	30	
Semester 5									
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	PHM022
PHM111	Probability and Statistics	2	3	75	2	1	0	3	
MDP231	Engineering Economy	2	4	100	2	1	0	3	
MDP281	Metal Cutting Theory and Technologies	4	8	200	3	1	3	7	MDP081
MDP251	Casting and Welding (1)	3	4	100	2	2	1	5	MDP081 MDP152
MDP112	Machine Construction	3	5	125	2	2	0	4	PHM031 MDP212
Total		16	28	700	13	8	5	26	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MEP231	Measurements & instrumentation	2	5	125	1	0	3	4	MEP211
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
MDP252	Casting and Welding (2)	2	4	100	2	0	2	4	MDP081 MDP152
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MCT211	Automatic Control	3	5	125	3	1	1	5	MEP231
MDP282	Non-Conventional Processing	2	4	100	2	0	2	4	MDP281 PHM041
Total		16	30	750	13	5	10	28	
Semester 7									
	ASU Elective (1)	2	3	75	2	1	0	3	
MDP232	Industrial Project management	2	4	100	2	1	0	3	
MDP351	Industrial Furnaces and Heat Treatment	2	4	100	2	1	0	3	MDP152
	Manuf. Program Concentration Elective (1) A	3	5	125	2	2	0	4	
MDP387	Metrology	3	5	125	2	0	3	5	MDP281
MDP233	Work Study & Plant layout	4	5	125	3	2	0	5	PHM111
MDP462	Polymer Processing Techniques	2	4	100	2	0	2	4	MDP182 MDP281
Total		18	30	750	15	7	5	27	
Semester 8									
	ASU Elective (2)	2	2	50	2	1	0	3	
MDP334	Principles of Operation Management	3	5	125	2	2	0	4	MDP231
MDP331	Maintenance planning & scheduling	2	4	100	2	1	0	3	
MDP386	Computer Aided Manufacturing	3	6	150	2	0	3	5	MDP281
MDP441	Industrial technologies	2	4	100	2	1	0	3	MDP233
MDP385	Manufacturing Processes	2	4	100	2	1	1	4	MDP182 MDP281
	Manuf. Program Concentration Elective (2) A	3	5	125	2	2	0	4	
Total		17	30	750	14	8	4	26	
Semester 9									
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
	Manuf. Program Concentration Elective (3) A	3	6	150	2	2	0	4	
MDP401	Mechanical Design & Production Graduation Project (1)	3	6	150	1	0	5	6	
	Manuf. Program Concentration Elective (4) B	3	5	125	2	2	0	4	
MDP490	Dies Design	3	6	150	2	3	0	5	MDP385 MDP211
MDP414	Product Design and Development	3	5	125	2	2	2	6	
Total		17	30	750	11	9	7	27	
Semester 10									
ASU111	Human Rights	2	2	50	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
MDP402	Mechanical Design & Production Graduation Project (2)	3	6	150	1	0	5	6	MDP401
	Manuf. Program Concentration Elective (5) B	3	6	150	2	2	0	4	
	Manuf. Program Concentration Elective (6) B	3	6	150	2	2	0	4	
MDP433	Quality Control	3	6	150	2	2	0	4	PHM111
Total		17	30	750	11	9	5	25	

Program #14: Mechatronics Engineering and Automation Program

Program Description

The Mechatronics and Automation program integrates multidisciplinary fields of science that includes a mechanical engineering, Electronics, computer Science and control Engineering to enhance the safety, performance, efficiency, and the ability of solving real life problems associated with mechanical systems, industrial automation, mechatronic in automotive applications, mechatronic in healthcare and biomedical devices, nano/micro mechatronic systems.

Career Prospects

The graduate of the program is expected to get a job in one of the following positions:

1. Automobiles Industry
2. Robotics Industry
3. Automation
4. Oil Industry
5. System design
6. Embedded system
7. Bionics system design
8. Sales engineer for robotics and automation

Program Concentrations

The program provides four different fields in which the students in this program can specialize. These four fields are: Autotronics, Nano-Mechatronics, Industrial Mechatronics, and Bio-Mechatronics. Each concentration includes 5 compulsory courses.

1. Autotronics: The concentration is to incorporate elements of mechanical, electrical, electronics, software and safety engineers as applied to the design, manufacture and operation of automobiles

2. Nano-Mechatronics:the concentration is to how to integrate electrical and mechanical functionality on the nanoscale

3. Industrial Mechatronics:the concentration of this area is to integrate control systems, electrical, electronic systems, computers and mechanical systems in automated manufacturing processes

4. Bio-Mechatronics:the concentration aims to integrate parts of biological organisms, mechanical elements, and electronics for improving the quality life of humans. It also encompasses the field of robotics and neurosciense

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Mechatronics Engineering and Automation Program graduate must be able to (D-Level):

- D1. Synthesize and integrate mechatronic subsystems to create custom solutions for different engineering problems while dealing with technical uncertainties.
- D2. Integrate a wide range of analytical tools, techniques, equipment, and software packages pertaining to the discipline.
- D3. Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment.

D4. Put the necessary specifications describing the different variants of mechatronic equipment such as Robotics, CNC machines, CAD/CAM systems, pneumatic and hydraulic equipment, etc. for purpose of purchasing and contracting.

D5. Write the necessary software for the equipment and the control of the mechatronic systems

D6. Competence in the safe use and operation of hand tools and machine tools that are used during the implementation phases of mechatronic systems.

D7. Distinguish the layout and the key parameters to the field of the concentration within the mechatronics and automation engineering as listed below.

Concentration	**Graduate attributes**
Autotronics	7a. Create and/or re-design mechatronic components/systems in the fields of Automobiles
Bio-Mechatronics	7b. Develop mechanical, electrical, electronic, programming and communication elements necessary for improving the quality life of humans
Nano-Mechatronics	7c. Assess the characteristics and performance of mechatronic components, systems and fabrication processes for Nano scale systems
Industrial Mechatronics	7d. Design mechatronic components that can be used in the synthesis of industrial automation

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 29 List of Mechatronics Engineering and Automation Program Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM112	Differential Equation and Numerical Analysis	4	6	150	3	2	0	5
PHM131	Rigid body dynamics	2	4	100	2	1	1	4
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6
MDP112	Machine Construction	3	5	125	2	2	0	4
MDP211	Machine Elements Design	3	8	200	3	2	2	7
MDP212	Mechanics of Machines	4	6	150	3	3	1	7
MCT211	Automatic Control	3	5	125	3	1	1	5
MCT311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6
MCT312	Industrial Automation	3	5	125	2	1	1	4
MCT131	Introduction to Mechatronics	3	5	125	2	1	2	5
MCT231	Engineering Measurements	3	5	125	2	2	1	5
MCT232	Industrial Electronics	3	5	125	2	2	1	5
MCT233	Dynamic Modeling and Simulation	3	6	150	2	2	1	5
MCT331	Design of Mechatronic Systems (1)	3	6	150	1	1	3	5
MCT332	Design of Mechatronic Systems (2)	3	7	150	1	0	3	4
MCT431	Industrial Communications and Networks Systems	3	5	125	2	2	1	5
MCT341	Introduction to Autotronics	2	4	100	2	1	1	4
MCT342	Introduction to Nano-Mechatronics	2	4	100	2	1	1	4
MCT343	Introduction to Bio-Mechatronics	2	4	100	2	1	1	4
MCT344	Industrial Robotics	3	5	125	2	2	1	5
CSE111	Logic Design	3	5	125	3	1	1	5
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	1	1	4
CSE131	Computer Programming	3	6	150	3	0	2	5
CSE473	Computational Intelligence	2	4	100	2	1	1	4
CSE483	Computer Vision	3	5	125	3	1	1	5
EPM353	Power Electronics and Motor Drives	3	5	125	2	2	1	5
ECE215	Introduction to Electronics	2	4	100	2	1	1	4
MEP214	Thermal Power Engineering	3	6	150	2	2	0	4
MEP222	Introduction to Fluid Mechanics	3	5	125	3	1	1	5
MDP183	Manufacturing Technologies	4	6	150	3	2	2	7
	Mechatronics & Automation Concentration Electives	14	24	600	10	9	4	23
MCT491	Mechatronics Graduation Project (1)	3	7	175	1	4	0	5
MCT492	Mechatronics Graduation Project (2)	3	7	175	1	4	0	5
Total		170	299	7450	130	93	57	280

Pool of Autotronics Concentration Elective Courses								
MEA313	Automotive Theory	3	5	125	2	2	1	5
MEA322	Automotive Design	2	4	100	2	1	0	3
MCT422	Automotive Embedded Networking	3	6	150	2	0	3	5
MEA441	Engine Management Systems	3	6	125	2	2	0	5
MCT446	Autotronics	3	6	125	2	0	3	5
Pool of Bio-Mechatronics Concentration Elective Courses								
MCT441	Rehabilitation Robots	3	5	125	2	2	1	5
MCT442	Biomedical Engineering	3	5	125	2	2	1	5
MCT346	System Physiology	2	4	100	2	1	0	3
MCT347	Locomotion and Gait Analysis	3	5	125	2	2	1	5
MCT348	Introduction to Biomechanics	3	5	125	2	2	1	5
Pool of Nano-Mechatronics Concentration Elective Courses								
MCT432	MEMS Devices	3	5	125	2	2	1	5
MCT447	MEMS Systems	3	5	125	2	2	1	5
MCT448	MEMS/NEMS Fabrication and Packaging	2	4	100	2	1	0	3
MCT349	Material Properties and Characterization	3	5	125	2	2	1	5
MCT350	MEMS/NEMS Characterization: Systems & Methods	3	5	125	2	2	1	5
Pool of Industrial Mechatronics Concentration Elective Courses								
MCT411	Hybrid Control Systems	3	5	125	2	2	1	5
MCT345	Industrial Mechanisms and Robotics	3	5	125	2	2	1	5
MCT443	Design of Autonomous Systems	3	5	125	2	2	1	5
MCT449	Selected topics in Industrial Mechatronics	2	4	100	2	1	0	3
MDP494	Advanced Manufacturing Technology & Prototyping	3	5	125	2	2	1	5

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
EPM116	Electrical Circuits and Machines	4	6	150	3	2	1	6	
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	
PHM111	Probability and Statistics	2	4	100	2	1	1	4	
MDP151	Structures and properties of materials	2	4	100	2	1	1	4	PHM041
MDP183	Manufacturing Technologies	4	6	150	3	2	2	7	
PHM131	Rigid Body Dynamics	2	4	100	2	1	1	4	PHM032
Total		18	30	750	15	9	6	30	
Semester 4									
MDP232	Industrial Project Management	2	4	100	2	1	0	3	
ECE215	Introduction to Electronics	2	4	100	2	1	1	4	
MEP214	Thermal Power Engineering	3	6	150	2	2	1	5	
MDP111	Mechanical Engineering Drawing	3	5	125	1	3	2	6	MDP011
CSE131	Computer Programming	3	6	150	3	0	2	5	
MDP212	Mechanics of Machines	4	6	150	2	3	1	5	PHM131
Total		17	31	775	12	10	7	28	
Semester 5									
CSE111	Logic Design	3	5	125	3	1	1	5	
MEP222	Introduction to Fluid Mechanics	3	5	125	3	1	1	5	
MCT231	Engineering Measurements	3	5	125	2	2	1	5	PHM111
MDP112	Machine Construction	3	5	125	2	2	0	4	MDP111 PHM031
MCT233	Dynamic Modeling and Simulation	3	6	150	2	2	1	5	PHM131
MCT131	Introduction to Mechatronics	3	5	125	2	1	2	5	
Total		18	31	775	15	8	6	29	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
MCT232	Industrial Electronics	3	5	125	2	2	1	5	ECE215
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
MDP231	Engineering Economy	2	4	100	2	1	0	3	
MCT211	Automatic Control	3	5	125	3	1	1	5	MCT233
EPM353	Power electronics and motor drives	3	5	125	2	2	1	5	
Total		18	31	775	15	9	5	29	
Semester 7									
MCT341	Introduction to Autotronics	2	4	100	2	1	1	4	MCT131
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	
MCT342	Introduction to Nano-Mechatronics	2	4	100	2	1	1	4	MCT131
MCT343	Introduction to Bio-Mechatronics	2	4	100	2	1	1	4	MCT131
MCT311	Hydraulic and pneumatic control	3	5	125	3	1	1	5	MEP222
ASU324	Marketing	2	2	50	2	0	0	2	
MCT331	Design of Mechatronic Systems (1)	3	6	150	1	1	3	5	MCT131 MCT233
Total		17	30	725	14	7	9	30	
Semester 8									
MCT312	Industrial Automation	3	5	125	2	1	1	4	MCT211
MCT332	Design of Mechatronic Systems (2)	3	7	150	1	0	3	4	MCT331
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	0	2	4	CSE211
	Mechatronics & Automation Elective (1)	3	5	125	3	1	1	5	
	Mechatronics & Automation Elective (2)	3	5	125	3	1	1	5	
MCT344	Industrial Robotics	3	5	125	2	2	1	5	MDP212
Total		18	32	775	13	5	9	27	
Semester 9									
MCT431	Industrial Communications and Networks Systems	3	5	125	2	2	1	5	
CSE483	Computer Vision	3	5	125	3	1	1	5	
MCT491	Mechatronics Graduation Project (1)	3	7	175	0	0	5	5	MCT332
ASU321	Innovation and Entrepreneurship	2	2	50	2	1	0	2	
	Mechatronics & Automation Elective (3)	3	3	125	3	1	1	5	
CSE473	Computational Intelligence	2	4	100	2	1	1	4	
Total		16	26	700	12	6	9	26	
Semester 10									
MCT492	Mechatronics Graduation Project (2)	3	7	175	0	0	5	5	MCT491
	Mechatronics & Automation Elective (4)	3	3	125	3	1	1	5	
	Mechatronics & Automation Elective (5)	2	4	100	2	1	1	4	
ASU331	Human Resource Management	2	2	50	2	0	0	2	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
Total		15	22	600	12	4	8	24	

Program #15: Landscape Architecture Program

Program Description

Landscape Architecture Engineering solves real-life problems. This discipline finds the best solutions through the application of knowledge, experience and skills. Engineers help to define and refine the way of life by providing innovative, high-performance, safer, cleaner or more comfortable daily-used facilities for human beings. They seek improvements through the processes of invention, design, manufacturing and construction.

The products of Landscape Architecture engineering activities are intended to be sustainable. However, the drawbacks are associated with such activities; for example, the water, air, the environment and acoustic pollutions have been aggravated by many engineering marvels created throughout the past decades.

The engineer's problem-solving complexity grows as the world's social and technological problems become more closely related. For example, the problem of air pollution cannot be solved physically without considering the social, legal, political, and ethical conflicts. Moreover, the impact of the available engineering solutions on the interests of the individuals and groups should be considered. Engineering studies provide students with the advanced, effective, technology-based education that should meet the expected needs of future science and technology. They should also promote the technical understanding and problem-solving skills required to face the engineering challenges of tomorrow.

Moreover, it motivates students, faculty and staff to learn, grow, achieve and serve the needs of society nationally, regionally and internationally. It also prepares students for a productive and rewarding career in engineering based on strong moral and ethical foundation.

Career Prospects

Landscape architecture' is a professional title. It is recognized by the International Labor Organization and it is used throughout the world Landscape architects typically work across five main areas: landscape design; landscape management; landscape planning; landscape science and urban design. alternative careers for landscape architects include: Conceptual Landscape Developer. Landscape Planner. Greenway Initiator. Landscape Assessor. Landscape-Architect. Garden Designer. Landscape Contractor. Designer-Builder. Product Design/Manufacture. Public services and Tourism Planner.

Typical employers of landscape architects include: Architecture and urban planning consultancy, the construction industry; real-estate developers, local authorities; private practices; public bodies; water networks companies, Roads companies

In the private sector, landscape architects are largely employed by architect and landscape architect companies, or by companies specializing in landscape engineering.

In the public sector, landscape architects tend to work for environmental agencies, local authorities and government agencies. There are also opportunities with voluntary organizations.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Landscape Architecture Program graduate must be able to (D-Level):

- D1. Create architectural, urban and landscape designs that satisfy both aesthetic and technical requirements, using adequate knowledge of: history and theory, related fine arts, local culture and heritage, technologies and human sciences.
- D2. Integrate relationship of structure, energy systems, landscape materials, and construction elements into design process in different scales.
- D3. Discuss, search and formulate informed opinions appropriate at specific context and circumstances affecting landscape architecture profession & practice.
- D4. Judge landscape architecture decisions considering balanced costs, benefits, safety, quality, reliability, and environmental impact.
- D5. Propose creative and innovative solution for problems facing landscape architecture projects.
- D6. Professionally merge the engineering knowledge and landscape architecture, understanding, and feedback to improve design, products and/or services.
- D7. Deal with sensitive spaces and locations using the required understanding for human needs and socio-economic dynamics.
- D8. Use and apply information technology and contemporary computer applications while dealing with landscape architecture issues
- D9. Prepare design project briefs and documents; and understand the context of the landscape architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.
- D10. Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with architectural landscape designs.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 30 List of Landscape ArchitectureProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8
ARC131	History of Arts and Architecture (1): Ancient Civilizations	3	4	100	3	0	0	3
ARC132	History of Arts and Architecture (2): History of Islamic and Western Architecture	3	5	125	2	2	0	4
ARC141	Architectural Representation	3	5	125	1	4	0	5
ARC142	Digital Presentation of the Built Environment	2	4	100	1	0	3	4
ARC241	Modeling of the Built Environment	2	5	125	1	0	3	4
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5
ARC254	building (3): Landscape Construction	2	3	75	1	3	0	4
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3
ARC262	Principles of Sustainable Architecture	3	5	125	2	2	0	4
ARC364	Outdoor Lighting and Effects	2	3	75	1	2	0	3
ARC368	Soundscape and Aural Architecture	2	4	100	1	2	0	3
UPL211	Context and Place Design Studio	4	8	200	0	8	0	8
UPL212	Principles of Urban Design and Landscape	3	4	100	2	2	0	4
UPL213	Mixed-use design studio	4	7	175	0	8	0	8
UPL311	Urban and Landscape Design Studio	4	8	200	0	8	0	8
UPL411	Mega Projects Urban Design Studio	4	8	200	0	8	0	8
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4
UPL341	Horticulture and Garden Design	2	4	100	1	2	0	3
UPL342	Arid Landscape Architecture Design Studio	4	7	175	0	8	0	8
UPL343	Landscape Working Design (1): Landscape Detailed Working Documents	3	4	100	1	4	0	5
UPL441	Landscape Working Design (2): Landscape Execution Documents Complexity	3	5	125	1	4	0	5
UPL351	Housing Studies	3	4	100	1	4	0	5
UPL462	Urban Ecology and Environmental Studies	2	3	75	1	2	0	3
UPL481	Urban Informatics	3	5	125	1	4	0	5
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4
CEP113	Surveying	2	4	100	1	1	1	3
CEI311	Infrastructure Planning and landscape Irrigation	2	3	75	1	2	0	3
MEP241	Technical Installations	2	3	75	1	2	0	3
	Landscape Architecture Elective (1) – Pool 1	2	4	100	1	2	0	3
	Landscape Architecture Elective (2) – Pool 1	2	4	100	1	2	0	3
	Landscape Architecture Elective (3) – Pool 2	3	5	125	2	2	0	4
	Landscape Architecture Elective (4) – Pool 2	3	5	125	2	2	0	4
UPL495	Landscape Architecture Graduation Project (1)	2	4	100	1	2	0	3
UPL496	Landscape Architecture Graduation Project (2)	6	18	450	0	12	0	12
Total		170	300	7500	90	168	21	279

Pool 1 of Landscape Architecture Elective Courses								
ARC323	Built Environment Accessibility	2	4	100	1	2	0	3
UPL334	Site Analysis (Spatial Analysis and Land Mapping)	2	4	100	1	2	0	3
UPL344	Landscape for Dwellings and Public Buildings	2	4	100	1	2	0	3
UPL361	Outdoor Noise Propagation in Built Environment	2	4	100	1	2	0	3
UPL371	Human Behavior and the Built Environment	2	4	100	1	2	0	3
UPL381	Introduction to Geographic Information Systems	2	4	100	1	2	0	3
CEP251	Green Building Systems and Infrastructure	2	4	100	1	2	0	3
Pool 2 of Landscape Architecture Elective Courses								
ARC441	Building Information Modeling (BIM)	3	5	125	1	4	0	5
UPL313	Eco Urban Design	3	5	125	1	4	0	5
UPL331	Planning and Urban Upgrading	3	5	125	1	4	0	5
UPL435	Urban and Architectural Heritage	3	5	125	2	2	0	4
UPL442	Ecological Landscape	3	5	125	2	2	0	4
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6	CEP011
ARC131	History of Arts and Architecture (1): Ancient Civilizations	3	4	100	3	0	0	3	
ARC141	Architectural Representation	3	5	125	1	4	0	5	CEP011
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5	CEP011
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3	PHM031
PHM111	Probability and Statistics	2	4	100	1	2	0	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		18	30	750	11	16	0	27	
Semester 4									
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8	CEP011
ARC132	History of Arts and Architecture (2): History of Islamic And Western Architecture	3	5	125	2	2	0	4	ARC131
ARC142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4	
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5	ARC151
CEP113	Surveying	2	4	100	1	1	1	3	
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	
Total		17	30	750	8	16	4	28	
Semester 5									
ARC254	Building (3): Landscape Construction	2	3	75	1	3	0	4	ARC152
UPL211	Context and Place Design Studio	4	8	200	0	8	0	8	ARC112
UPL212	Principles of Urban Design and Landscape	3	4	100	2	2	0	4	
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4	CES115
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4	
MEP241	Technical Installations	2	3	75	1	2	0	3	MDP011
	ASU Elective (1)	2	3	75	2	1	0	3	
Total		18	30	750	10	19	1	30	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
ARC241	Modeling of The Built Environment	2	5	125	1	0	3	4	ARC142
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3	
ARC262	Principles of Sustainable Architecture	3	5	125	2	2	0	4	
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5	ARC152 MEP241 CES225
UPL213	Mixed-Use Design Studio	4	7	175	0	8	0	8	UPL211
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4	
Total		17	30	750	7	18	3	28	
Semester 7									
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5	ARC351
UPL311	Urban and Landscape Design Studio	4	8	200	0	8	0	8	UPL211
UPL351	Housing Studies	3	4	100	1	4	0	5	UPL221
UPL481	Urban Informatics	3	5	125	1	4	0	5	(CSE031) ARC142
CEI311	Infrastructure Planning and Landscape Irrigation	2	3	75	1	2	0	3	PHM022 PHM032
UPL341	Horticulture and Garden Design	2	4	100	1	2	0	3	
Total		17	30	750	5	24	0	29	
Semester 8									
ARC364	Outdoor Lighting and Effects	2	3	75	1	2	0	3	PHM 022
ARC368	Soundscape and Aural Architecture	2	4	100	1	2	0	3	PHM 022
UPL343	Landscape Working Design (1): Landscape Detailed Working Documents	3	4	100	1	4	0	5	ARC352
UPL342	Arid Landscape Architecture Design Studio	4	7	175	0	8	0	8	UPL311 UPL341
	Landscape Architecture Elective (1)	2	4	100	1	2	0	3	
	Landscape Architecture Elective (2)	2	4	100	1	2	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		18	30	750	7	22	0	29	
Semester 9									
ARC371	Architecture Project Management	2	4	100	2	1	0	3	
UPL411	Mega Projects Urban Design Studio	4	8	200	0	8	0	8	UPL311
UPL441	Landscape Working Design (2): Landscape Execution Documents Complexity	3	5	125	1	4	0	5	ARC254 UPL343
UPL462	Urban Ecology and Environmental Studies	2	3	75	1	2	0	3	
UPL471	Urban Economics	2	4	100	2	1	0	3	
UPL495	Landscape ArchitectureGraduation Project (1)	2	4	100	1	2	0	3	ASU112 UPL342
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	2	
Total		17	30	750	9	18	0	27	
Semester 10									
UPL496	Landscape ArchitectureGraduation Project (2)	6	18	450	0	12	0	12	UPL411 UPL495
	Landscape Architecture Elective (3)	3	5	125	2	2	0	4	
	Landscape Architecture Elective (4)	3	5	125	2	2	0	4	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		14	30	750	6	17	0	23	

Program #16: Environmental Architecture and Urbanism Program

Program Description

Driven by the current urgency of building more environmentally friendly buildings and cities, the environmental Architecture and Urbanism Program (ENVR) aims at preparing architects and urban designers specialized in environmental design. Graduates are capable of understanding the relationship between humans and buildings and between buildings and their environment. They can integrate all the aspects dealing with the built environment and how it is planned, designed, used, furnished, landscaped, managed, and valued by the society in their creative thinking while dealing with complex architectural and urban environment problems. The program introduces students to building science and enables them to conceive the basic concepts of sustainable architecture and urbanism. They are trained to balance functional and ecological demands when developing policies or designs for new construction. Graduate will be able to deal with modern techniques and tools for learning and linking theory and practice. All efforts are directed towards achieving environmental architecture and urbanism.

Career Prospects

The acquired skills through the program qualifies the graduates to occupy a wide range of jobs, fulfilling the market's diversity of needs. They can work as architects or urban designers whether in multi-national and local companies or in architectural, urban design firms and environmental design consultancies. Moreover, graduates will be equipped to work in fields of interior design, visualization using computer graphics, 3D modeling, and model making. Specializations extend as well to dimensions of project/construction management, site supervision, and quantity surveying. The ENVR graduates can deal with environmental building assessment techniques and be aware of issues related to building energy efficiency, net zero systems and net plus systems. The current market in Egypt is thriving for such kind of interdisciplinary-skilled graduates who have strong background in environmental design that is highly needed nowadays.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is in partnership with the University of East London (UEL), United Kingdom for a Bachelor Dual Degree. Students joining this agreementwill pay an additional fee, to substitute expenses for the external Quality Audits/Moderation Boards that will take place in Egypt. The Graduates should receive two B.Sc. certificates, one from the University of East London, and one from Ain Shams University. Students are allowed to study a full year or more in London with a 10% reduction in the UK tuition fees.

Furthermore, the program under the ASU umbrella is part of the CNRD - Centres for Natural Resources and Development- project, which is one of 5 centers of Excellence in Germany under the Exceed program. The CNRD is coordinated by Cologne University of Applied Sciences (CUAS - Germany) and includes 13 universities partners from Indonesia, Chile, Mexico, Nepal, Egypt, Jordan, Kenya, Ethiopia, Sudan, Bangladesh, Vietnam, and Brazil. The CNRD is supported by the Federal Ministry for Economic Cooperation and Development, Exceed and DAAD.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Environmental Architecture and Urbanism Program graduate must be able to (D-Level):

D1. Create aesthetically pleasing and technically sound architectural and urban designs by using the architectural and urban planning principles, history and theories, technologies, economics, human sciences and local culture and heritage.
D2. Produce designs that meet building users' requirements through studying the relationship between people and buildings, and between buildings and their environment.
D3. Prepare design project briefs and documents and analyze the context of the architecture in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services, and building production.
D4. Solve problems and creatively design sustainable building schemes or urban contexts that demonstrate awareness and integration of information and processes in project work by using building environmental systems and management together with the underlying concepts and theories.
D5. Realize the process of sustainable building and urban design and their various components through the integration of structural design, construction, technology and engineering problems associated with building designs.
D6. Coordinate and monitor the production of information and data from a variety of sources, including drawings, specifications, codes of practice, related to principals of environmental architecture and urbanism.
D7. Apply appropriate mathematical and computer-based methods for modeling and analyzing environmental design problems.
D8. Judge engineering decisions considering balanced costs, benefits, risks, safety, quality, reliability, and environmental impact, while having adequate knowledge of industries, organizations, regulations and procedures involved.
D9. Produce professional technical and workshop drawings to transform the concepts into buildings using traditional drawing tools and computer-aided drawings' techniques, as well as building information modeling techniques.
D10. Exchange knowledge and skills with engineering sectors and industrial sectors working in the field of environmental control.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 31 List of Environmental Architecture and UrbanismProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6
ARC113	Vernacular Architecture Design Studio	3	6	150	0	6	0	6
ARC213	Environmental Architecture Design Studio (1)	3	6	150	0	6	0	6
ARC214	Environmental Architecture Design Studio (2)	3	6	150	0	6	0	6
ARC312	Sustainable Architecture Design Studio (1)	3	6	150	0	6	0	6
ARC313	Sustainable Architecture Design Studio (2)	3	6	150	0	6	0	6
ARC133	Introduction to History and Theory of Arts and Architecture	3	4	100	3	0	0	3
ARC141	Architectural Representation	3	5	125	1	4	0	5
ARC142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4
ARC241	Modeling of The Built Environment	2	5	125	1	0	3	4
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5
ARC253	Building (3): Sustainable Construction	3	5	125	2	3	0	5
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5
ARC451	Working Design (3): Execution Documents Complexity	3	5	125	1	4	0	5
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3
ARC262	Principles of Sustainable Architecture	3	5	125	2	2	0	4
ARC361	Lighting in Architecture	2	3	75	1	2	0	3
ARC362	Acoustics in Architecture	2	3	75	1	2	0	3
ARC363	Renewable Energy and Buildings	2	4	100	1	2	0	3
ARC365	Building Performance Simulation	3	5	125	1	4	0	5
ARC462	Sustainable Building Rating Systems	2	4	100	1	2	0	3
UPL212	Principles of Urban Design and Landscape	3	4	100	3	0	0	3
UPL313	Eco Urban Design	3	5	125	1	4	0	5
UPL412	Sustainable Contextual Architecture Design Studio	3	6	150	0	6	0	6
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4
UPL332	Sustainable Urban Development	3	4	100	2	3	0	5
UPL242	Sustainable Urban Landscape	3	5	125	1	4	0	5
UPL351	Housing Studies	3	4	100	1	4	0	5
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4
CEP113	Surveying	2	4	100	1	1	1	3
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3
CES226	Concrete Structures for Architecture Engineering	2	4	100	1	2	0	3
CES345	Steel Structures for Architecture Engineering	2	3	75	1	2	0	3
CEP251	Green Building Systems and Infrastructure	2	4	100	1	2	0	3
	Environmental Architecture Elective (1) – Pool 1	2	4	100	1	2	0	3
	Environmental Architecture Elective (2) – Pool 1	2	4	100	1	2	0	3
	Environmental Architecture Elective (3) – Pool 2	3	5	125	2	2	0	4
	Environmental Architecture Elective (4) – Pool 2	3	5	125	2	2	0	4
ARC493	Environmental Architecture Graduation Project (1)	2	4	100	1	2	0	3
ARC494	Environmental Architecture Graduation Project (2)	6	16	400	0	12	0	12
Total		170	298	7450	94	161	21	276

Pool 1 of Environmental Architecture Elective Courses								
ARC322	Architectural Criticism and Project Evaluation	2	4	100	1	2	0	3
ARC323	Built Environment Accessibility	2	4	100	1	2	0	3
ARC341	Photography and Architecture	2	4	100	1	2	0	3
ARC368	Soundscape and Aural Architecture	2	4	100	1	2	0	3
ARC425	Contemporary Vernacular Architecture	2	4	100	1	2	0	3
UPL371	Human Behavior & the Built Environment	2	4	100	1	2	0	3
UPL381	Introduction to Geographic Information Systems	2	4	100	1	2	0	3
Pool 2 of Environmental Architecture Elective Courses								
ARC472	Building Commissioning	3	5	125	2	2	0	4
ARC473	Building Life Cycle Assessment	3	5	125	2	2	0	4
UPL413	Introduction to Urban Design	3	5	125	2	2	0	4
UPL424	Selected Topics in Architecture and Urbanism	3	5	125	2	2	0	4
UPL435	Urban and Architectural Heritage	3	5	125	2	2	0	4
UPL436	Urban Renewal	3	5	125	2	2	0	4
UPL464	Environmental Planning	3	5	125	2	2	0	4
UPL472	People and Environment	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6	CEP011
ARC133	Introduction to History and Theory of Arts and Architecture	3	4	100	3	0	0	3	
ARC141	Architectural Representation	3	5	125	1	4	0	5	CEP011
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5	CEP011
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3	PHM031
CEP113	Surveying	2	4	100	1	1	1	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		18	30	750	11	15	1	27	
Semester 4									
ARC113	Vernacular Architecture Design Studio	3	6	150	0	6	0	6	ARC111
ARC142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4	
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5	ARC151
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3	
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4	
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	
PHM111	Probability and Statistics	2	4	100	1	2	0	3	
Total		17	30	750	9	16	4	29	
Semester 5									
ARC213	Environmental Architecture Design Studio (1)	3	6	150	0	6	0	6	ARC111
ARC241	Modeling of The Built Environment	2	5	125	1	0	3	4	ARC142
ARC253	Building (3): Sustainable Construction	3	5	125	2	3	0	5	ARC152
CES226	Concrete Structures for Architecture Engineering	2	4	100	1	2	0	3	CES115
UPL212	Principles of Urban Design and Landscape	3	4	100	3	0	0	3	
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4	
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	2	
Total		18	30	750	11	13	3	27	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
ARC214	Environmental Architecture Design Studio (2)	3	6	150	0	6	0	6	ARC213
ARC361	Lighting in Architecture	2	3	75	1	2	0	3	PHM022
ARC262	Principles of Sustainable Architecture	3	5	125	2	2	0	4	
UPL242	Sustainable Urban Landscape	3	5	125	1	4	0	5	UPL212
UPL351	Housing Studies	3	4	100	1	4	0	5	UPL221
CEP251	Green Building Systems and Infrastructure	2	4	100	1	2	0	3	
	ASU Elective (1)	2	3	75	2	1	0	2	
Total		18	30	750	8	21	0	28	
Semester 7									
ARC312	Sustainable Architecture Design Studio (1)	3	6	150	0	6	0	6	ARC214
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5	ARC152 CEP251 CES226
ARC363	Renewable Energy and Buildings	2	4	100	1	2	0	3	
UPL332	Sustainable Urban Development	3	4	100	2	3	0	5	
CES345	Steel Structures for Architecture Engineering	2	3	75	1	2	0	3	CES115
ARC371	Architecture Project Management	2	4	100	2	1	0	3	
ARC362	Acoustics in Architecture	2	3	75	1	2	0	3	PHM022
Total		17	30	725	8	20	0	28	
Semester 8									
ARC313	Sustainable Architecture Design Studio (2)	3	6	150	0	6	0	6	ARC312
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5	ARC351
ARC365	Building Performance Simulation	3	5	125	1	4	0	5	ARC241
UPL313	Eco Urban Design	3	5	125	1	4	0	5	UPL212
	Environmental Architecture Elective (1)	2	4	100	1	2	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		17	30	750	6	22	0	28	
Semester 9									
ARC451	Working Design (3): Execution Documents Complexity	3	5	125	1	4	0	5	ARC352
ARC462	Sustainable Building Rating Systems	2	4	100	1	2	0	3	
ARC493	Environmental Architecture Graduation Project (1)	2	4	100	1	2	0	3	ASU112
UPL412	Sustainable Contextual Architecture Design Studio	3	6	150	0	6	0	6	ARC313
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4	
	Environmental Architecture Elective (2)	2	4	100	1	2	0	3	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	8	19	0	27	
ARC463	Renewable Energy Systems and Economics	2	4	100	1	2	0	3	
ARC494	Environmental Architecture Graduation Project (2)	6	16	400	0	12	0	12	ARC493 UPL412
	Environmental Architecture Elective (3)	3	5	125	2	2	0	4	
	Environmental Architecture Elective (4)	3	5	125	2	2	0	4	
Total		14	30	750	5	18	0	23	

Program #17: Housing and Urban Development Program

Program Description

Globally, over 50% of the population lives in urban areas; and moving towards urbanization is accelerating. As urban populations grow, the housing gap will widen, exacerbating inequality and threatening the traditional view of cities as reliable drivers of economic growth. Though providing affordable, adequate and secure housing is a basic human need, housing provision persists a key urban challenge worldwide. The Housing and Urban Development (HOUD) program aims at preparing architects and urban planners specialized in housing and the built environment design for sustainable urban development. The program qualifies graduates with all necessary competences to understand the housing market and real estate development; graduates will gain knowledge in housing typology, provision, policies, finance, legislation, and management. It qualifies graduates to use digital technologies and software as design aiding tools to generate and analyze spatial data, produce integrated architecture documents, and land mapping. The HOUD emphasizes the integration of social, economic, environmental, along with physical aspects to create safe, inclusive, healthy, and sustainable cities. It introduces graduates to contemporary trends and practices in housing industry and urban development schemes such as smart housing/cities. The program will prepare graduates to take leading roles in the professional practice in the field of housing and urban development.

Career Prospects

Graduates of the HOUD program can handle with different jobs in related fields to the housing and urban development sector ranging from architecture level to the urban design and planning level with special knowledge of tender and execution documents. They can work as architects and urban planners in governmental bodies, such as, the Ministry of Housing Utilities and the Urban Development; International Agencies, such as UN-Habitat; and local companies and consultancies. The current construction booming and the future development of building new urban communities and national mega projects in Egypt is thriving for such kind of skilled graduates who have integrated vision to tackle planning and design issues in the field of housing and urban development.

Program Concentrations

There are no specified concentrations in this Program.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Housing and Urban Development Program graduate must be able to (D-Level):

- D1. Demonstrate comprehensive ability to create architectural designs for residential projects ranging across different scale (residential complex, multi- story, clustering and neighborhood) based on the most contemporary trends and smart systems and theories of architecture, urban and planning that satisfy both aesthetic and technical requirements
- D2. Using adequate knowledge of: history and theory, related fine arts, local culture and heritage, technologies and human sciences that influence on the quality of architectural design.
- D3. Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.

D4. Demonstrate comprehensive ability to Urban Upgrading (Site & Services or In-situ Development, ecologically sustainable urban and architectural conservation and rehabilitation based on the most contemporary trends with due consideration of their contexts (social, economic, political, technical, institutional, environmental and physical / infrastructure and engineering problems associated with building designs.) that exist in thematic/heritage context

D5. Recognize and demonstrate the technical design and construction aspects of houses, infrastructure, and Solve conflicts between the engineering systems that serve residential context and its urban values (Technical Installations, Urban Infrastructure, Architecture Installations).

D6. Apply digital technologies and software as design aiding tools to generate and analyze spatial data & to produce integrated architecture documents and Land Mapping.

D7. Demonstrate deep understand to public transportation modes and urban sustainable mobility that serve urban and residential communities

D8. Apply theories and concepts to identify key housing and urban development needs, problems and solutions that satisfy both aesthetic and technical requirements, with due consideration of their contexts on both regional and local levels

D9. Interpret and apply principles best practice of all aspects of property urban, development, land management and real estate valuation with due regard for the legislative framework and relevant property legislation while having adequate knowledge of industries, organizations, regulations and procedures involved.

D10. Apply theories, principles and best practice guidelines to design Affordable Housing with due regard for Social Infrastructure and Principles of Equity & Social Justice

D11. Critically evaluate Value Engineering and explain financial plans and models of Economic Models for Housing Provision within the constraints of project financing, project management, cost control and methods of project delivery.

D12. Produce design project briefs and documents; and analyses the context of the architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.

D13. Explain critical contemporary issues that face the society and built areas and apply best practices with specific reference to social, economic and environmental development towards sustainable integrated housing and urban development.

D14. Define, design, compare and evaluate models of policy and strategy formulation, programs and projects for housing through efficient resources management towards sustainable housing provision, informal upgrading and urban development

D15. Demonstrate comprehensive ability to Manage and maintain systems, processes, programs of housing and land management projects and Informal Settlements Regularization at organization and operational levels

D16. Apply principles of participatory approach with stakeholders, resolve conflict, and manage disasters in housing and human settlements.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 32 List of Housing and Urban DevelopmentProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8
ARC212	Multi Story Accommodation Building Design Studio	4	8	200	0	8	0	8
ARC413	Smart Housing Design Studio	4	8	200	0	8	0	8
ARC133	Introduction to History and Theory of Arts and Architecture	3	4	100	3	0	0	3
ARC141	Architectural Representation	3	5	125	1	4	0	5
ARC142	Digital Presentation of the Built Environment	2	4	100	1	0	3	4
ARC241	Modeling of the Built Environment	2	5	125	1	0	3	4
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5
ARC252	Building (3): Mass Housing Production Techniques and Finishing Works	3	5	125	2	3	0	5
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5
ARC452	Working Design (3): Residential Towers Execution Documents	3	6	150	1	4	0	5
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3
UPL312	In-Situ Development Design Studio	4	8	200	0	8	0	8
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4
UPL422	Smart Cities and Intelligent Residential Buildings	3	3	75	2	2	0	4
UPL331	Planning and Urban Upgrading	3	5	125	1	4	0	5
UPL333	Urban Infrastructure	3	3	75	2	2	0	4
UPL433	Land Management and Land Subdivision	3	5	125	2	2	0	4
UPL434	Sustainable Urban Mobility	2	3	75	1	2	0	3
UPL241	Principles of Residential Urban Spaces and Landscape	3	4	100	2	2	0	4
UPL251	Residential Complex Design Studio	4	8	200	0	8	0	8
UPL352	Neighborhood Planning and Design Studio	4	8	200	0	8	0	8
UPL353	Housing Policies and Programs	2	3	75	1	2	0	3
UPL451	Housing Studies and Real Estate Development	3	5	125	2	2	0	4
UPL161	Environmental Studies and passive energy systems	2	3	75	1	2	0	3
UPL481	Urban Informatics	3	5	125	1	4	0	5
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4
CEP113	Surveying	2	4	100	1	1	1	3
MEP241	Technical Installations	2	3	75	1	2	0	3
	Housing & Urban Development Elective (1) – Pool 1	2	4	100	1	2	0	3
	Housing & Urban Development Elective (2) – Pool 1	2	4	100	1	2	0	3
	Housing & Urban Development Elective (3) – Pool 2	3	5	125	2	2	0	4
	Housing & Urban Development Elective (4) – Pool 2	3	5	125	2	2	0	4
UPL497	Housing & Urban Development Graduation Proj. (1)	2	4	100	1	2	0	3
UPL498	Housing & Urban Development Graduation Proj. (2)	6	18	450	0	12	0	12
Total		170	300	7500	92	164	21	277

Pool 1 of Housing & Urban Development Elective Courses								
ARC323	Built Environment Accessibility	2	4	100	1	2	0	3
ARC366	Responsive Architecture Installations	2	4	100	1	2	0	3
ARC462	Sustainable Building Rating Systems	2	4	100	1	2	0	3
UPL321	Participatory Planning and Community	2	4	100	1	2	0	3
UPL334	Site Analysis (Spatial Analysis and Land Mapping)	2	4	100	1	2	0	3
UPL372	Equity and urban Justice	2	4	100	1	2	0	3
UPL381	Introduction to Geographic Information Systems	2	4	100	1	2	0	3
Pool 2 of Housing & Urban Development Elective Courses								
ARC424	Introduction to Modern Art Movements	3	5	125	2	2	0	4
ARC453	Housing Maintenance, Post-occupancy Evaluation, and Value Engineering	3	5	125	2	2	0	4
ARC441	Building Information Modeling (BIM)	3	5	125	1	4	0	5
UPL423	City Governance and Land Management	3	5	125	2	2	0	4
UPL463	Environmental Impact Assessment	3	5	125	2	2	0	4
UPL482	Introduction to Geo Design	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ARC111	Principles of Architecture Design Studio	3	6	150	1	5	0	6	CEP011
ARC133	Introduction to History and Theory of Arts and Architecture	3	4	100	3	0	0	3	
ARC141	Architectural Representation	3	5	125	1	4	0	5	CEP011
ARC151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5	CEP011
CES115	Structural Analysis for Architecture Engineering	2	4	100	1	2	0	3	PHM031
CES151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4	
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		18	30	750	12	15	1	28	
Semester 4									
ARC112	Creativity and Design Studio	4	8	200	0	8	0	8	CEP011
ARC142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4	
ARC152	Building (2): Finishing Works	3	5	125	2	3	0	5	ARC151
UPL161	Environmental Studies and Passive Energy Systems	2	3	75	1	2	0	3	
CEP113	Surveying	2	4	100	1	1	1	3	
PHM111	Probability and Statistics	2	4	100	1	2	0	3	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	8	17	4	29	
Semester 5									
ARC212	Multi Story Accommodation Building Design Studio	4	8	200	0	8	0	8	ARC111
UPL434	Sustainable Urban Mobility	2	3	75	1	2	0	3	
UPL241	Principles of Residential Urban Spaces and Landscape	3	4	100	2	2	0	4	
UPL271	Society and Housing Economics	2	4	100	2	1	0	3	
MEP241	Technical Installations	2	3	75	1	2	0	3	MDP011
ASU112	Report Writing and Communication skills	3	4	100	2	2	0	4	
	Housing & Urban Development Elective (1)	2	4	100	1	2	0	3	
Total		18	30	750	9	19	0	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
ARC241	Modeling of The Built Environment	2	5	125	1	0	3	4	ARC142
ARC252	Building (3): Mass Housing Production Techniques and Finishing Works	3	5	125	2	2	0	4	ARC152
UPL221	History and Theory of Urbanism	3	4	100	2	2	0	4	
ARC261	Control of Thermal Environment	2	3	75	1	2	0	3	
UPL251	Residential Complex Design Studio	4	8	200	0	8	0	8	ARC112 ARC212
CES225	Concrete and Steel Structures	3	5	125	2	2	0	4	CES115
Total		17	30	750	8	16	3	27	
Semester 7									
UPL312	In-Situ Development Design Studio	4	8	200	0	8	0	8	ARC212
UPL331	Planning and Urban Upgrading	3	5	125	1	4	0	5	UPL221
UPL333	Urban Infrastructure	3	3	75	2	2	0	4	PHM022 (PHM032)
ARC351	Working Design (1): Execution Drawings Coordination, Annotation and Coding	3	6	150	1	4	0	5	ARC152 MEP241 CES225
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
ARC371	Architecture Project Management	2	4	100	2	1	0	3	
Total		18	30	750	8	21	0	29	
Semester 8									
ARC352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5	ARC351
UPL433	Land Management and Land Subdivision	3	5	125	2	2	0	4	UPL331
UPL352	Neighborhood Planning and Design Studio	4	8	200	0	8	0	8	UPL312
UPL353	Housing Policies and Programs	2	3	75	1	2	0	3	
UPL481	Urban Informatics	3	5	125	1	4	0	5	(CSE031) ARC142
	ASU Elective (1)	2	3	75	2	1	0	2	
Total		17	30	750	7	21	0	27	
Semester 9									
ARC413	Smart Housing Design Studio	4	8	200	0	8	0	8	UPL352
ARC452	Working Design (3): Residential Towers Execution Documents	3	6	150	1	4	0	5	ARC352
UPL422	Smart Cities and Intelligent Residential Buildings	3	3	75	2	2	0	4	
UPL451	Housing Studies and Real Estate Development	3	5	125	2	2	0	4	
UPL497	Housing & Urban Development Graduation Project (1)	2	4	100	1	2	0	3	ASU112 UPL352
	Housing & Urban Development Elective (2)	2	4	100	1	2	0	3	
Total		17	30	750	7	20	0	27	
Semester 10									
UPL498	Housing & Urban Development Graduation Project (2)	6	18	450	0	12	0	12	ARC413 UPL497
	Housing & Urban Development Elective (3)	3	5	125	2	2	0	4	
	Housing & Urban Development Elective (4)	3	5	125	2	2	0	4	
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
Total		14	30	750	6	16	0	22	

Program #18: Communication Systems Engineering Program

Program Description

The Communication Systems Engineering program seeks to introduce the new in the science and technology of communication systems at the educational, practical, and scientific research levels through the application of quality systems and cooperation with specialized bodies locally and internationally. This program graduates' engineers with the ability to deal with the latest development in the fields of communication, optical, and electronic systems to meet the requirements of the market at the moral and professional levels by creating the appropriate conditions for the development of different skills of students and cooperate with specialized industrial and research bodies locally and internationally.

Career Prospects

The program aims at generating a graduate who is well trained in modern telecommunication industry as well as having a background in communication systems that enables him to fit easily within a modern telecommunication work environment and be able to identify market needs in this fast-moving segment of business. The graduate is exposed to a wide variety of courses to build an open scope to telecommunication engineering which is interdisciplinary in nature. The graduate acquires his degree by taking a balanced curriculum that is pre- dominantly concerned with communication systems on different levels and does not neglect required basic sciences needed for this field.

Program Concentrations

The program qualifies graduates to work as Electronics and telecommunication engineers. The graduate can be specialized in one of the following three concentrations (fields):

1. Circuits and Systems.
2. Physical and Wave Electronics.
3. Signals and Communication Systems.

The student has to select Eight elective courses for a total of (24) Credit Hours with at least five of these courses from one of the mentioned fields.

1. Circuits and Systems: This is the concentration for the graduate engineer to work in national and international companies concern with electronic design.

2. Physical and Wave Electronics: This is the concentration for the graduate engineer to work in telecommunication companies for transmission field, or in research field related to microwave and optical communications.

3. Signals and Communication Systems: This is the concentration for the graduate engineer to work in telecommunication companies in core network or in research field related to signal processing.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Communication Systems EngineeringProgram graduate must be able to (D-Level):

D1. Estimate and measure the performance of communication and electronic systems under specific input excitation and evaluate its suitability for a specific application.

D2. Identify needs, plan and manage resources, and gather information for solving a specific communication problem and efficiently document this solution.
D3. Have the technological abilities to design and implement elements, modules, sub-systems or systems.
D4. Be familiar with and utilize professional tools for communication system engineering.
D5. Design, model and analyze electronic, microwave, optical, and communication systems or components for a specific application and identify the tools required to optimize this design.
D6. Classify and evaluate the applications and market segments to create a specific product including the estimation of the required resources.
D7. Demonstrate additional abilities related to the field of the concentration within Communication Systems Engineering as listed below.

Concentration	**Graduate attributes**
Circuits and Systems	D7a. Demonstrate additional abilities to design analog and/or digital circuits of any electronic system.
Physical and Wave Electronics	D7b. Demonstrate additional abilities to analyze, design any microwave or optical communication system.
Signals and Communication Systems	D7c. Demonstrate additional abilities to work on state of the art research problems in signal processing, image and multimedia processing. D8c. Demonstrate additional abilities to manage and design any communication system.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 33 List of Communication Systems EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5
PHM114	Numerical Analysis	3	5	125	2	2	0	4
PHM213	Complex and Special Functions and Fourier Analysis	3	4	100	2	2	0	4
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5
PHM123	Thermal and Statistical Physics	3	5	125	2	2	0	4
ECE111	Electronic Materials	3	5	125	3	1	0	4
ECE213	Solid State Electronic Devices	3	7	175	2	2	0	4
ECE214	Electronic Circuits (1)	4	7	175	3	2	2	7
ECE315	Electronic Circuits (2)	3	5	125	2	2	0	4
ECE316	Digital Circuit Design	3	7	175	2	2	0	4
ECE131	Electrostatics and Magnetostatics	3	5	125	2	2	0	4
ECE331	Electromagnetic waves	3	6	150	2	2	1	5
ECE333	Microwave Engineering	4	6	150	3	2	2	7
ECE334	Optical Fiber Communications	4	5	125	3	2	0	5
ECE432	Antenna Engineering and Propagation	2	4	100	2	1	0	3
ECE253	Signals and Systems	4	8	200	3	2	2	7
ECE254	Analog Communications	3	5	125	2	2	1	5
ECE255	Digital Signal Processing	3	6	150	2	2	2	6
ECE354	Digital Communications	3	6	150	2	2	1	5
ECE355	Communication Networks (1)	3	6	150	2	2	0	4
ECE452	Information Theory and Coding	3	5	125	2	2	0	4
ECE458	Communication Networks (2)	3	7	175	2	2	0	4
CSE111	Logic Design	3	5	125	3	1	1	5
CSE212	Computer Organization	3	6	150	2	2	0	4
CSE131	Computer Programming	3	6	150	3	0	2	5
CSE371	Control Engineering	3	5	125	2	1	1	4
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5
	Communication Systems Elective (1) from Pool A	3	5	125	2	2	2	6
	Communication Systems Elective (2) from Pool B	3	5	125	2	2	0	4
	Communication Systems Elective (3) from Pool A	3	5	125	2	2	2	6
	Communication Systems Elective (4) from Pool B	3	5	125	2	2	0	4
	Communication Systems Elective (5) from Pool B	3	5	125	2	2	0	4
	Communication Systems Elective (6) from Pool B	3	5	125	2	2	0	4
	Communication Systems Elective (7) from Pool B	3	5	125	2	2	0	4
	Communication Systems Elective (8) from Pool B	3	5	125	2	2	0	4
ECE491	GraduationProject(1)	3	7	175	1	0	6	7
ECE492	Graduation Project (2)	3	8	200	1	0	6	7
Total		170	300	7500	127	92	47	266

Pool of Circuits and Systems Concentration Elective Courses								
Pool A								
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
ECE318	Electronic Measurements and Instrumentation	3	5	125	2	2	2	6
Pool B								
ECE317	Modern VLSI Devices	3	5	125	2	2	0	4
ECE411	Integrated Circuits Technology	3	5	125	2	2	0	4
ECE412	Analog Integrated Circuit Design	3	5	125	2	2	0	4
ECE413	ASIC Design and Automation	3	5	125	2	2	0	4
ECE414	RF Circuit Design	3	5	125	2	2	0	4
ECE419	Selected Topics in Circuits and Systems	3	5	125	2	2	0	4
Pool of Physical and Wave Electronics Concentration Elective Courses								
Pool A								
ECE335	Microwave Measurements	3	5	125	2	2	2	6
ECE338	Optical Sensing and Instrumentation	3	5	125	2	2	2	6
Pool B								
ECE336	Integrated Optics and Optical MEMS	3	5	125	2	2	0	4
ECE337	Microwave Circuits	3	5	125	2	2	0	4
ECE438	Microwave Devices	3	5	125	2	2	0	4
ECE439	Optoelectronics Devices	3	5	125	2	2	0	4
ECE440	RF and Microwave Systems	3	5	125	2	2	0	4
ECE441	Selected Topics in Physical and Wave Electronics	3	5	125	2	2	0	4
Pool of Signals and Communication Systems Concentration Elective Courses								
Pool A								
ECE357	Statistical Signal Processing	3	5	125	2	2	2	6
ECE359	Signal Processing for Multimedia	3	5	125	2	2	2	6
Pool B								
ECE356	Electro-Acoustical Engineering	3	5	125	2	2	0	4
ECE358	Wireless Communications	3	5	125	2	2	0	4
ECE454	Satellite Communication Systems	3	5	125	2	2	0	4
ECE459	Mobile Communications	3	5	125	2	2	0	4
ECE460	Machine Learning for Multimedia	3	5	125	2	2	0	4
ECE461	Selected Topics in Signals & Communication Systems	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ASU111	Human Rights	2	2	50	2	1	0	3	
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5	PHM022
EPM211	Properties of Electrical Material	2	4	100	2	1	1	4	PHM022
MDP231	Engineering Economy	2	4	100	2	1	0	3	
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
PHM121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5	PHM013 PHM022
Total		17	30	750	16	10	3	29	
Semester 4									
CSE131	Computer Programming	3	6	150	3	0	2	5	
ECE111	Electronic Materials	3	5	125	3	1	0	4	PHM022
ECE131	Electrostatics and Magnetostatics	3	5	125	2	2	0	4	PHM013 PHM022
PHM114	Numerical Analysis	3	5	125	2	2	0	4	PHM113
PHM213	Complex and Special Functions & Fourier Analysis	3	4	100	2	2	0	4	PHM113
PHM123	Thermal and Statistical Physics	3	5	125	2	2	0	4	PHM111
Total		18	30	750	14	9	2	25	
Semester 5									
ASU112	Report Writing and Communication Skills	3	4	100	2	2	0	4	
CSE111	Logic Design	3	5	125	3	1	1	5	
ECE213	Solid State Electronic Devices	3	7	175	2	2	0	4	PHM123 ECE111
ECE253	Signals and Systems	4	8	200	3	2	2	7	PHM111 PHM213
ECE331	Electromagnetic Waves	3	6	150	2	2	1	5	PHM213 ECE131
Total		16	30	750	14	7	4	25	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CSE212	Computer Organization	3	6	150	2	2	0	4	CSE111 CSE131
ECE214	Electronic Circuits (1)	4	7	175	3	2	2	7	ECE213 EPM114
ECE254	Analog Communications	3	5	125	2	2	1	5	ECE253
ECE255	Digital Signal Processing	3	6	150	2	2	2	6	ECE253
ECE333	Microwave Engineering	4	6	150	3	2	2	7	ECE331
Total		17	30	750	12	10	7	29	
Semester 7									
ECE315	Electronic Circuits (2)	3	5	125	2	2	0	4	ECE214
ECE334	Optical Fiber Communications	4	5	125	3	2	0	5	ECE254 ECE333
ECE354	Digital Communications	3	6	150	2	2	1	5	ECE254
ECE432	Antenna Engineering and Propagation	2	4	100	2	1	0	3	ECE333
	Communication Systems Elective (1)	3	5	125	2	2	2	6	
	Communication Systems Elective (2)	3	5	125	2	2	0	4	
Total		18	30	750	13	11	3	27	
Semester 8									
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
CSE371	Control Engineering	3	5	125	2	1	1	4	ECE253
ECE316	Digital Circuit Design	3	7	175	2	2	0	4	CSE111 ECE214
ECE355	Communication Networks (1)	3	6	150	2	2	0	4	ECE254
	Communication Systems Elective (3)	3	5	125	2	2	2	6	
	Communication Systems Elective (4)	3	5	125	2	2	0	4	
Total		17	30	750	12	9	3	24	
Semester 9									
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
ECE452	Information Theory and Coding	3	5	125	2	2	0	4	ECE354
ECE491	Graduation Project (1)	3	7	175	1	0	6	7	
	Communication Systems Elective (5)	3	5	125	2	2	0	4	
	Communication Systems Elective (6)	3	5	125	2	2	0	4	
Total		17	30	750	11	9	6	26	
Semester 10									
	ASU Elective (1)	2	3	75	2	1	0	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
ECE458	Communication Networks (2)	3	7	175	2	2	0	4	ECE355
ECE492	Graduation Project (2)	3	8	200	1	0	6	7	ECE491
	Communication Systems Elective (7)	3	5	125	3	1	0	4	
	Communication Systems Elective (8)	3	5	125	3	1	0	4	
Total		16	30	750	13	5	6	24	

Program #19: Energy and Renewable Energy Engineering Program

Program Description

The program is an interdisciplinary program that covers the energy studies from electrical and mechanical points of view. It aims to study both conventional energy and renewable sources energy. Energy's flows, constraints, generation, transmission, distribution, consumption, and management knowledge are acquired through the period of study. Students are provided with a deep knowledge of conventional and renewable energy technologies generation and applications. Thermal power plants, machine construction, design, and stability are topics covered. Hydro, tidal, wave, wind, solar photovoltaic, solar thermal, concentrated solar power, biomass, geothermal and others are studied. Renewable energy applications are illustrated and evaluated both theoretically and economically. Power system networks (transmission and distribution) control and modeling are explained. Energy management is discussed in detail using demand side management, energy efficiency, and energy consumption and audit are explained in details. Finally, the program encourages problem identification and solving as well as critical thinking skills. All topics under study prepare the program graduates for the national, regional and international energy job market.

Career Prospects

This program qualifies its graduates to work in electrical power engineering, mechanical power engineering, energy and renewable energy engineering fields. Graduates can join electrical sector entities such as generation (conventional and renewable), transmission, and distribution companies either public or private. Power plants, control centers, petroleum industry, factories, maintenance applications, and energy management sectors can be a target for the program's graduates. Distribution installations, refrigeration and air-conditioning, water desalination and distillation applications, and solar pumping fields are candidate jobs for the energy graduates.

Program Concentrations

There are two concentrations in this program:

1. Energy Generation: This concentration focuses on the energy generation field taking into consideration conventional (thermal) and renewable energy (hydro, tidal, wave, wind, solar photovoltaic, concentrated solar power, biomass, geothermal …etc.), and waste conversion generating power stations. Power system analysis, stability, reliability, modeling, and advanced control are a core direction in this concentration. Graduates from these concentrations are qualified to join electricity utilities such as generation (public and private) and transmission entities. The graduation project could focus on the design and the evaluation of possible uses of renewable energies, power delivery systems analysis and control …etc.

2. Energy management: This concentration tackles the energy management field that includes: energy auditing, energy efficiency, clean energy technologies, and demand side management, taking into consideration power quality standards and economical aspects. This management as it is carried out is subject to international and national quality control, and quality systems and assurance methodologies. Renewable energies applications are studied such as: water desalination and distillation for industrial and residential activities, local production of energy in remote areas, energy storage …etc. Graduates from this concentration are qualified to work in electrical distribution systems' installations, design and operation of refrigeration and air conditioning systems, management departments of large projects/industries, distribution companies (public and private) …etc.The graduation project could focus on energy efficiency standard applications, wiring in distribution level, solar pumping, energy generation for domestic purposes and their impacts on power quality, compressor work requirements for cooling loads in air conditioning projects…etc.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Energy and Renewable Energy EngineeringProgram graduate must be able to (D-Level):

D1. Model and analyze electrical power systems and electrical machines by applying energy systems concepts of: generation, transmission, distribution and protection of electrical power systems;
D2. Select, analyze and control appropriate driving systems for different energy applications;
D3. Model, analyze and design energy systems by applying energy concepts of: Thermal-fluid Mechanics, solid Mechanics, Material Properties and processing, Measurements, Control Systems, Dynamics and Vibrations;
D4. Design of mechanical energy systems using appropriate materials via both traditional and computer-aided tools;
D5. Select proper mechanical equipment according to the required specification;
D6. Adopt suitable standards and codes to: design, build, operate, inspect and maintain mechanical energy systems;
D7. Identify, analysis and evaluate the energy's conversion processes and management techniques;
D8. Indicate and relate smart applications for energy systems; and
D9. Test and evaluate the performance and suitability of energy systems.
D10. Distinguish the layout and the key parameters to the field of the concentration as listed below

Concentration	**Graduate attributes**
Energy Generation	10a. Distinguish the layout for energy generation stations and their related distribution networks.
Energy Management	10b. Distinguish and manage the energy demand for different applications to enhance their efficiency.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 34 List of Energy and Renewable Energy EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5
MDP111	Mechanical Engineering Drawing	3	4	100	2	2	0	4
MDP112	Machine Construction	3	4	100	2	2	0	4
MDP211	Machine Elements Design	4	8	200	3	2	2	7
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5
MEP111	Thermal Physics	2	4	100	1	2	0	3
MEP211	Thermodynamics	4	6	150	3	2	1	6
MEP212	Heat Transfer	4	8	200	2	2	3	7
MEP311	Combustion	3	6	150	2	2	1	5
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5
MEP426	Solar Energy	3	5	125	2	2	0	4
MEP427	Wind Energy	3	5	125	2	2	0	4
MEP231	Measurement and instrumentation	2	5	125	1	0	3	4
EPM113	Electrical Measurements	3	5	125	2	2	1	5
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5
EPM115	Fundamentals of Electromagnetic Fields	3	6	150	2	2	0	4
EPM117	Energy Resources and Renewable Energy	3	5	125	2	2	0	4
EPM151	Industrial Electronics	3	5	125	2	2	0	4
EPM221	Electrical Machines (1)	3	5	125	3	1	1	5
EPM222	Electrical Machines (2)	3	6	150	3	1	1	5
EPM231	Electrical Power Engineering	3	5	125	3	1	1	5
EPM232	Automatic Control Systems	3	6	150	2	2	0	4
EPM251	Power Electronics for Energy Applications (1)	3	5	125	2	2	1	5
EPM311	Fundamentals of Photovoltaic	3	6	150	2	2	0	4
EPM334	Economics of Generation, Transmission & Operation	3	5	125	2	2	0	4
EPM354	Power Electronics for Energy Applications (2)	3	5	125	2	2	1	5
EPM454	Renewable Energy Resources Interfacing	3	6	150	3	1	0	4
EPM463	Power System Protection	4	7	175	3	2	0	4
	Energy Elective (1) – Pool A	3	6	150	2	2	0	4
	Energy Elective (2) – Pool A	3	6	150	2	2	0	4
	Energy Elective (3) – Pool A	3	6	150	2	2	0	4
	Energy Elective (4) – Pool B	3	5	125	2	2	0	4
	Energy Elective (5) – Pool B	3	5	125	2	2	0	4
EPM493	Energy Graduation Project (1)	3	6	150	1	4	0	5
EPM494	Energy Graduation Project (2)	3	6	150	1	4	0	5
Total		170	300	7500	126	99	36	260

Pool of Energy Generation Concentration Elective Courses								
Pool A								
EPM335	Fundamentals of Power System Analysis	3	6	150	2	2	0	4
EPM436	Computer Application in Electrical Power Systems	3	6	150	2	2	0	4
MEP312	Fundamentals of Internal Combustion Engines	3	6	150	2	2	1	5
MEP313	Thermal Power Plants	3	6	150	2	2	1	5
Pool B								
EPM435	Advanced Control on Power Systems	3	5	125	2	2	0	4
MEP414	Biomass and waste Conversion Technology	3	5	125	2	2	0	4
MEP423	Hydro-Tidal and Wave Energy	3	5	125	2	2	0	4
Pool of Energy Management Concentration Elective Courses								
Pool A								
EPM336	Electrical Distribution Systems Installations	3	6	150	2	2	0	4
EPM413	Energy Management Essentials	3	6	150	2	2	0	4
EPM417	Microprocessor-Based Automated Systems	3	6	150	2	2	1	5
EPM456	Power Quality for Energy Applications	3	6	150	2	2	0	4
EPM457	Electric Drives	3	6	150	2	2	0	4
Pool B								
MDP433	Quality Control	3	5	125	2	2	0	4
MDP434	Quality Systems and Assurance	3	5	125	2	2	0	4
MEP341	Refrigeration and Air Conditioning	3	5	125	2	2	0	4
MEP434	Water Desalination and Distillation	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5	PHM022
EPM115	Fundamentals of Electromagnetic Fields	3	6	150	2	2	0	4	PHM013 PHM022
EPM117	Energy Resources and Renewable Energy	3	5	125	2	2	0	4	
MEP111	Thermal Physics	2	4	100	1	2	0	3	PHM041
Total		17	30	750	12	12	1	25	
Semester 4									
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
EPM113	Electrical Measurements	3	5	125	2	2	1	5	EPM114
EPM151	Industrial Electronics	3	5	125	2	2	0	4	
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6	MDP011
MEP211	Thermodynamics	4	6	150	3	2	1	4	MEP111
Total		18	30	750	12	13	4	27	
Semester 5									
EPM221	Electrical Machines (1)	3	5	125	3	1	1	5	EPM114 EPM115
EPM251	Power Electronics for Energy Applications (1)	3	5	125	2	2	1	5	EPM151
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP081
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
MEP221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6	MEP111
Total		17	30	750	13	7	8	28	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
	Engineering Economy Elective	2	4	100	2	1	0	3	
EPM222	Electrical Machines (2)	3	6	150	3	1	1	5	EPM221
EPM231	Electrical Power Engineering	3	5	125	3	1	1	5	EPM115
EPM232	Automatic Control Systems	3	6	150	2	2	0	4	PHM113
MDP151	Structures and Properties of Materials	3	4	100	2	1	1	4	PHM 041
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	MEP211
Total		16	30	750	13	6	6	25	
Semester 7									
	ASU Elective (1)	2	3	75	2	1	0	3	
EPM311	Fundamentals of Photovoltaic	3	6	150	2	2	0	4	EPM151
MDP112	Machine Construction	3	4	100	2	2	0	4	MDP111
MEP311	Combustion	3	6	150	2	2	1	5	MEP212
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5	MEP211 MEP221
	Energy Elective (1)	3	5	125	2	2	0	4	
Total		17	30	750	12	11	2	25	
Semester 8									
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3	
EPM334	Economics of Generation, Transmission, and Operation	3	5	125	2	2	0	4	EPM117 EPM231
EPM354	PowerElectronics for Energy Applications (2)	3	5	125	2	2	1	5	EPM251
MEP426	Solar Energy	3	5	125	2	2	0	4	MEP 212
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5	MEP 211 MEP 221
	Energy Elective (2)	3	5	125	2	2	0	4	
Total		17	30	750	12	11	2	25	
Semester 9									
	ASU Elective (2)	2	2	50	2	0	0	2	
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
EPM463	Power System Protection	4	7	175	3	2	0	4	EPM231
EPM493	Energy Graduation Project (1)	3	6	150	1	4	0	5	
MDP211	Machine Elements Design	3	8	200	3	2	2	7	MDP112
MEP427	Wind Energy	3	5	125	2	2	0	4	MEP322
Total		17	30	750	13	10	2	24	
Semester 10									
ASU111	Human Rights	2	2	50	2	1	0	3	
EPM454	Renewable Energy Resources Interfacing	3	6	150	3	1	0	4	EPM232 EPM354
EPM494	Energy Graduation Project (2)	3	6	150	1	4	0	5	EPM493
	Energy Elective (3)	3	5	125	2	2	0	4	
	Energy Elective (4)	3	5	125	2	2	0	4	
	Energy Elective (5)	3	5	125	2	2	0	4	
Total		17	29	725	12	12	0	24	

Program #20: Computer Engineering and Software Systems Program

Program Description

The systematic development of high quality software systems that are concerned with quality, cost, time, and a number of other requirements requires well-qualified engineers in this field. Targeted at software engineering apply engineering principles in each phase of software development life-cycle; requirements analysis, design, validation, implementation, testing, documentation, and management. Software engineering is one of the most promising fields in engineering and is considered an important milestone in the ever-growing information technology sector. Therefore, the main objective of this program is to graduate highly qualified engineers in the field of computer engineering and software industry that have the qualification requirements in the field of computer engineering and software engineering. This program focuses on modern methodologies in software industry that represents, without a doubt, an important sector of the national economy. Students study in this program a variety of courses that complement each other to produce a world-class qualified engineer

Career Prospects

The graduate of this program will establish technical leadership in the area of computer engineering and software systems. In addition to his contributions as a professional engineer who is able to participate and cooperate productively in his respective fields. The skills of the graduates of this program that include computer engineering, software engineering, distributed and mobile computing, embedded systems, computer security, multimedia systems, data science, and others will lead to high-level positions in leading the engineering projects in these areas. Therefore, this program will meet the increasing demand for this specialization to meet the market needs at the national, regional, and international levels.

Program Concentrations

Elective course are distributed in fourconcentrations:

1. Multimedia and Computer Graphics
2. Distributed and Mobile Computing
3. Software Product Lines
4. Data Science

The student has to select seven technical elective courses for a total of (18) credit hours with at least five of these courses from one of the mentioned fields.

1. Multimedia and Computer Graphics: This concentration prepares the graduate to work in the field of graphics software development including image processing, vision, computer animation, and games development.

2. Distributed and Mobile Computing: This concentration prepares the graduate to work in the field of distributed systems and networking including cloud computing, wireless and mobile networks, digital forensics, IOT, and parallel computing.

3. Software Product Lines: This concentration prepares the graduate to work as a full-fledged software engineer who deeply understands all software development processes and aspects including financial, managerial, and design, security, and performance aspects.

4. Data Science: This concentration prepares the graduate to work as a data scientist by covering a wide range of topics including big-data, machine learning, deep learning, and various application such as bioinformatics and business intelligence.

Agreements with another University

The program is in partnership with the University of East London (UEL), United Kingdom for a Bachelor Dual Degree. Students joining this agreement will pay an additional fee, to substitute expenses for the external Quality Audits/Moderation Boards that will take place in Egypt. The Graduates should receive two B.Sc. certificates, one from the University of East London, and one from Ain Shams University. Students are allowed to study a full year or more in London with a 10% reduction in the UK tuition fees.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Computer Engineering and Software SystemsProgram graduate must be able to (D-Level):

D1. Design and implement elements, modules, sub-systems or systems using technological and professional tools.
D2. Select and analyze appropriate design techniques for computer engineering and software systems.
D3. Estimate and measure the performance of a digital system and circuit under specific input excitation and evaluate its suitability for a specific application.
D4. Identify needs, plan and manage resources, and gather information for solving a specific digital problem and document and communicate this solution efficiently.
D5. Carry out design, development, testing, debugging, operation and maintenance of digital systems/services such as computer systems, circuit boards, software systems, and mixed (embedded) systems.
D6. Establish an environment to build, test and release digital systems in a more rapid, frequent and reliable manner by emphasizing the collaboration and communication of developers and operations team members.
D7. Select the most suitable technologies to deploy solutions to various kinds of problems and develop solutions using them
D8. Abide to software engineering standards and best practices
D9. Demonstrate additional abilities related to the field of the concentration within the Computer Engineering and Software Systems as listed below:

Concentration	**Graduate attributes**
Multimedia and Computer Graphics	D9a. Demonstrate additional abilities to model, analyze, and design multimedia and computer graphics systems potentially including pattern recognition, computer vision, computer animation, gaming, visualization, and/or human-computer interaction
Distributed and Mobile Computing	D9b. Demonstrate additional abilities to model, analyze, manage, and design securedistributed and mobile computing systems potentially including cloud computing systems, distributed embedded systems, and/or various forms of parallelism
Software Product Lines	D9c. Demonstrate additional abilities to analyze, evaluate, design, and integrate secure, reliable, and high-quality software solutions including managing the necessary software engineering processesand the corresponding business model
Data Science	D9d. Demonstrate additional abilities to model, design, and implementintelligent data science applications potentially requiring data mining, machine learning, deep learning,

	analytics, and text understanding

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 35 List of Computer Engineering and Software SystemsProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5
PHM114	Numerical Analysis	3	5	125	2	2	0	4
PHM211	Discrete Mathematics	2	5	125	2	2	0	4
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5
EPM118	Electrical and Electronic Circuits	3	6	150	2	2	1	5
CSE111	Logic Design	3	5	125	3	1	1	5
CSE112	Computer Organization and Architecture	4	8	200	3	2	2	7
CSE131	Computer Programming	3	6	150	3	0	2	5
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6
CSE231	Advanced Computer Programming	3	5	125	2	0	2	4
CSE232	Advanced Software Engineering	3	5	125	2	2	0	4
CSE233	Agile Software Engineering	2	5	125	1	0	4	5
CSE312	Electronic Design Automation	2	4	100	2	1	1	4
CSE331	Data Structures and Algorithms	3	5	125	2	2	1	5
CSE332	Design and Analysis of Algorithms	3	5	125	2	2	1	5
CSE333	Database Systems	3	5	125	2	1	1	4
CSE334	Software Engineering	3	5	125	2	2	0	4
CSE335	Operating Systems	3	5	125	2	2	0	4
CSE336	Software Design Patterns	2	4	100	2	1	1	4
CSE338	Software Testing, Validation, and Verification	3	7	175	2	2	1	5
CSE341	Internet Programming	3	5	125	2	1	2	5
CSE351	Computer Networks	3	5	125	2	2	0	4
CSE354	Distributed Computing	3	4	100	2	2	1	5
CSE371	Control Engineering	3	5	125	2	1	1	4
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	0	2	4
CSE431	Mobile Programming	3	5	125	2	1	2	5
CSE432	Automata and Computability	3	5	125	2	2	0	4
CSE439	Design of Compilers	3	5	125	2	1	1	4
CSE451	Computer and Network Security	3	5	125	2	1	1	4
CSE455	High-Performance Computing	2	5	125	2	1	1	4
CSE472	Artificial Intelligence	3	5	125	2	2	0	4
	Computer Engineering Level 3 Electives	6	15	375	6	3	3	12
	Computer Engineering Level 4 Electives	12	20	500	12	4	4	20
CSE491	Computer Engineering Graduation Project (1)	3	6	150	0	0	5	5
CSE492	Computer Engineering Graduation Project (2)	3	6	150	0	0	5	5
Total		170	300	7500	130	80	62	272

Pool of Multimedia and Computer Graphics Concentration Elective Courses								
CSE374	Digital Image Processing	2	5	125	2	1	1	4
CSE377	Pattern Recognition	2	5	125	2	1	1	4
CSE378	Computer Graphics	2	5	125	2	1	1	4
CSE379	Human-Computer Interaction	2	5	125	2	1	1	4
CSE474	Visualization	3	5	125	3	1	1	5
CSE479	Multimedia Engineering	3	5	125	3	1	1	5
CSE481	Computer Animation	3	5	125	3	1	1	5
CSE482	Game Design and Development	3	5	125	3	1	1	5
CSE483	Computer Vision	3	5	125	3	1	1	5
CSE487	Selected Topics in Multimedia & Computer Graphics	3	5	125	3	1	1	5
Pool of Distributed and Mobile Computing Concentration Elective Courses								
CSE314	Parallel and Cluster Computing	2	5	125	2	1	1	4
CSE355	Parallel and Distributed Algorithms	2	5	125	2	1	1	4
CSE356	Internet of Things	2	5	125	2	1	1	4
CSE357	Network Operation and Management	2	5	125	2	1	1	4
CSE412	Embedded Operating Systems	3	5	125	3	1	1	5
CSE456	Cloud Computing	3	5	125	3	1	1	5
CSE457	Mobile and Wireless Networks	3	5	125	3	1	1	5
CSE458	Computer and Network Forensics	3	5	125	3	1	1	5
CSE461	Selected Topics in Distributed & Mobile Computing	3	5	125	3	1	1	5
Pool of Software Product Lines Concentration Elective Courses								
CSE339	Software Formal Specifications	2	5	125	2	1	1	4
CSE342	Program Analysis	2	5	125	2	1	1	4
CSE343	Software Engineering Process Management	2	5	125	2	1	1	4
CSE344	Dependability and Reliability of Software Systems	2	5	125	2	1	1	4
CSE345	Business Process Modeling	2	5	125	2	1	1	4
CSE433	Software Performance Evaluation	3	5	125	3	1	1	5
CSE434	Aspect- and Service-Oriented Software Systems	3	5	125	3	1	1	5
CSE435	Secure Code Development	3	5	125	3	1	1	5
CSE436	Software Quality Assurance	3	5	125	3	1	1	5
CSE438	Selected Topics in Software Product Lines	3	5	125	3	1	1	5
Pool of Data Science Concentration Elective Courses								
CSE346	Advanced Database Systems	2	5	125	2	1	1	4
CSE381	Introduction to Machine Learning	2	5	125	2	1	1	4
CSE382	Data Mining and Business Intelligence	2	5	125	2	1	1	4
CSE484	Big-Data Analytics	3	5	125	3	1	1	5
CSE485	Deep Learning	3	5	125	3	1	1	5
CSE486	Bioinformatics	3	5	125	3	1	1	5
CSE488	Ontologies and the Semantic Web	3	5	125	3	1	1	5
CSE489	Selected Topics in Data Science	3	5	125	3	1	1	5

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
CSE111	Logic Design	3	5	125	3	1	1	5	
CSE131	Computer Programming	3	6	150	3	0	2	5	
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
EPM118	Electrical and Electronic Circuits	3	6	150	2	2	1	5	PHM022
EPM211	Properties of Electrical Materials	2	4	100	2	1	1	4	
ASU112	Report Writing & Communication skills	3	4	100	2	2	0	4	
Total		17	30	750	16	7	5	28	
Semester 4									
CSE112	Computer Organization and Architecture	4	8	200	3	2	2	7	CSE111 CSE131
CSE231	Advanced Computer Programming	3	5	125	2	0	2	4	CSE131
CSE334	Software Engineering	3	5	125	2	2	0	4	CSE131
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
PHM114	Numerical Analysis	3	5	125	2	2	0	4	PHM113
	ASU Elective (1)	2	3	75	2	1	0	3	
Total		17	30	750	13	9	4	26	
Semester 5									
CSE211	Introduction to Embedded Systems	3	5	125	2	2	2	6	CSE111 CSE131
CSE232	Advanced Software Engineering	3	5	125	2	2	0	4	CSE334
CSE331	Data Structures and Algorithms	3	5	125	3	1	1	5	CSE231
PHM211	Discrete Mathematics	2	5	125	2	2	0	4	
ECE251	Signals and Systems Fundamentals	4	6	150	3	2	0	5	PHM111
MDP231	Engineering Economy	2	4	100	2	1	0	3	
Total		17	30	750	14	10	3	27	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CSE233	Agile Software Engineering	2	5	125	1	0	4	5	CSE232
CSE332	Design and Analysis of Algorithms	3	5	125	2	2	1	5	CSE331
CSE333	Database Systems	3	5	125	2	1	1	4	CSE331
CSE335	Operating Systems	3	5	125	2	2	0	4	CSE112
CSE371	Control Engineering	3	5	125	2	1	1	4	ECE251
CSE439	Design of Compilers	3	5	125	2	1	1	4	CSE131
Total		17	30	750	11	7	8	26	
Semester 7									
CSE312	Electronic Design Automation	2	4	100	2	1	1	4	CSE112
CSE338	Software Testing, Validation, and Verification	3	7	175	2	2	1	5	CSE232
CSE351	Computer Networks	3	5	125	2	2	0	4	
CSE411	Real-Time and Embedded Systems Design	3	5	125	2	0	2	4	CSE211
	Computer EngineeringLevel 3 Elective (1)	2	5	125	2	1	1	4	
ASU114	Selected Topics in Contemporary issues	2	2	50	2	0	0	2	
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		17	30	750	14	6	5	25	
Semester 8									
CSE336	Software Design Patterns	2	4	100	2	1	1	4	CSE232
CSE341	Internet Programming	3	5	125	2	1	2	5	CSE231
CSE354	Distributed Computing	3	4	100	2	2	1	5	CSE231 CSE351
CSE472	Artificial Intelligence	3	5	125	2	2	0	4	CSE131 PHM111
	Computer EngineeringLevel 3 Elective (2)	2	5	125	2	1	1	4	
	Computer EngineeringLevel 3 Elective (3)	2	5	125	2	1	1	4	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	14	9	6	29	
Semester 9									
CSE431	Mobile Programming	3	5	125	2	1	2	5	CSE341
CSE432	Automata and Computability	3	5	125	2	2	0	4	CSE332
CSE441	Software Project Management	2	4	100	2	1	0	3	CSE334
	Computer EngineeringLevel 4 Elective (1)	3	5	125	3	1	1	5	
	Computer EngineeringLevel 4 Elective (2)	3	5	125	3	1	1	5	
CSE491	Computer Engineering Graduation Project (1)	3	6	150	0	0	5	5	
Total		17	30	750	12	6	9	27	
Semester 10									
CSE451	Computer and Network Security	3	5	125	2	1	1	4	CSE351
CSE455	High-Performance Computing	2	5	125	2	1	1	4	CSE112
	Computer EngineeringLevel 4 Elective (3)	3	5	125	3	1	1	5	
	Computer EngineeringLevel 4 Elective (4)	3	5	125	3	1	1	5	
CSE492	Computer Engineering Graduation Project (2)	3	6	150	0	0	5	5	CSE491
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		17	30	750	12	6	9	27	

Program #21: Building Engineering Program

Program Description

The work of the architect and civil engineer are closely linked. The Building Engineering program keeps this in mind.The aim of the Building Engineering Program is to graduate civil engineers who are capable of generating effective solutions by using engineering approaches in the field of Building Engineering. The graduates of the program will be well versed in technology, social, and environmental issues.The program aims to supply the students with the advanced concepts of structure design. Student will have basics of steel, concrete structure design and water tanks design, according to recent design codes versions. Also, Student will have basics of dynamic, earthquake, using recent design codes versions. Management of project recourses, risk, safety are essential knowledge for structure engineer.

Career Prospects

Graduates of this department has a variety of opportunities to work, of the building engineering program, you will be qualified for positions at companies specializing in the design, analysis, operation, construction, and management of a wide range of residential, commercial, and industrial building projects. Our graduates can be found at numerous companies and organizations, for example:

- Government authorities,
- Consulting firms in civil engineering and construction,
- Civil engineering contractors and project managers,
- Environmental engineering organizations,

Program Concentrations

The program provides the undergraduate student with a thorough foundation and technologies in the basic tenets of Structural, Construction Project Managements and Environmental Engineering. The program provides three different fields in which the students in this program can specialize. These three fields are:

1. Structural Engineering
2. Construction Engineering Management
3. Environmental and Sustainable Building Engineering

1. Structural Engineering is concerned with the structural design and structural analysis of buildings, bridges, towers and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads. The loads can be self-weight of the structures, other dead load, live loads, moving (wheel) load, wind load, earthquake load, load from temperature change etc. The structural engineer must design structures to be safe for their users and to successfully fulfill the function they are designed for (to be serviceable). Due to the nature of some loading conditions, sub-disciplines within structural engineering have emerged, including wind engineering and earthquake engineering.

2. Construction Engineering Management gives students a specialized focus on planning, scheduling, Resources Management, quantity take off, computer applications, cost estimating, Risk and Safety Management, contracts, problem solving, people and networking, management and leadership skills.

3. Environmental and Sustainable Building Engineeringgives students a specialized focus on how to: Reducing the demand for energy and the energetic consumption of buildings, Taking advantage of climate and natural resources to develop passive design strategies and sustainable architecture, Reusing and recycling building components and materials, Extending the lifetime of products and buildings, Adopting a sustainable environmental use, participatory planning and design, Reducing urban sprawl, promoting urban renewal, and protecting natural areas, Planning, designing and building in respect of natural constraints.

Agreements with another University

The program is in partnership with the University of East London (UEL), United Kingdom for a Bachelor Dual Degree. Students joining this agreement will pay an additional fee, to substitute expenses for the external Quality Audits/Moderation Boards that will take place in Egypt. The Graduates should receive two B.Sc. certificates, one from the University of East London, and one from Ain Shams University. Students are allowed to study a full year or more in London with a 10% reduction in the UK tuition fees.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Civil and Infrastructure Engineering Program graduate must be able to (D-Level):

D1. Select appropriate and sustainable technologies for construction of buildings; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics and Fluid Mechanics.

D2. Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures; and Transportation and Traffic.

D3. Plan and manage construction processes; address construction defects, instability and quality issues; and maintain safety measures in construction and materials.

D4. Deal with biddings, contracts and financial issues including project insurance and guarantees; and assess environmental impacts of civil engineering projects.

D5. Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.

D6. Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.

D7. Demonstrate additional abilities related to the field of the concentration within Design and Production Engineering as listed below.

Concentration	Graduate attributes
Structural Engineering	D7a. Demonstrate additional abilities to select appropriate system, analyze, and design of Buildings using the most up-to-date tools of software programs.
Construction Engineering Management	D7b. Demonstrate additional abilities to identify, formulate and solve a range of construction engineering problems such production and inventory, facility location, logistics, capital investment evaluation and resource allocation.
Environmental and Sustainable Building Engineering	D7c.Demonstrate additional capabilities to enhance life cycle sustainability of the buildings, building energy systems, taking advantage of climate and natural resources to develop passive

	design strategies and sustainable architecture.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 36 List of Building EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5
CES113	Structural Mechanics	3	6	150	2	2	0	4
CES114	Strength of Materials	3	5	125	2	2	0	4
CES213	Structural Analysis	3	5	125	2	2	0	4
CES315	Introduction to Structural Dynamics	3	6	150	3	1	0	4
CES224	Concrete Structures Design (1)	3	6	150	2	3	0	5
CES324	Concrete Structures Design (2)	3	6	150	2	3	0	5
CES427	Concrete Structures Design (3)	3	5	125	2	3	0	5
CES325	Construction Engineering	3	7	175	2	2	0	4
CES241	Steel Structures Design (1)	3	6	150	2	3	0	5
CES344	Steel Structures Design (2)	3	6	150	2	3	0	5
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4
CES251	Concrete Technology (1)	3	4	100	2	2	2	6
CES252	Concrete Technology (2)	3	4	100	3	1	1	5
CES454	Modern Building Materials	3	5	125	3	1	0	4
CES161	Geology	2	3	75	2	1	0	3
CES263	Soil Mechanics (1)	4	6	150	2	3	2	7
CES364	Soil Mechanics (2)	3	6	150	2	2	0	4
CES365	Foundation Design (1)	3	5	125	2	2	0	4
CES467	Foundation Design (2)	3	5	125	2	2	0	4
CES372	Construction Planning and Scheduling	3	5	125	2	2	0	4
CEP213	Surveying (1)	4	6	150	3	2	2	7
CEP214	Surveying (2)	4	6	150	2	3	2	7
CEP221	Introduction to Transportation & Traffic Engineering	3	5	125	2	2	0	4
CEI113	Fluid Mechanics for Civil Engineers	3	6	150	2	2	2	6
ARC143	Building Engineering Drawing	3	6	150	2	2	2	6
ARC466	Building Envelope Design	2	4	100	2	1	0	3
ARC161	Introduction to Lighting Systems	2	4	100	2	1	0	3
ARC263	Fundamentals of Building Acoustics	2	4	100	2	1	0	3
MEP213	Thermal Analysis of Buildings	3	5	125	2	2	0	4
MEP342	HVAC System Design	2	5	125	2	1	0	3
-	Building Engineering Concentration Elective (1)	3	5	125	2	2	0	4
-	Building Engineering Concentration Elective (2)	3	5	125	2	2	0	4
-	Building Engineering Concentration Elective (3)	3	5	125	2	2	0	4
-	Building Engineering Concentration Elective (4)	3	5	125	2	2	0	4
-	Building Engineering Concentration Elective (5)	3	5	125	2	2	0	4
CES493	Building Engineering Design Graduation Project (1)	3	8	200	1	4	0	5
CES494	Senior Seminar	2	3	75	0	4	0	4
CES495	Building Engineering Design Graduation Project (2)	3	9	225	1	4	0	5
Total		170	300	7500	125	111	28	264

Pool of Structural Engineering Concentration Elective Courses								
CES314	Computer Applications in Structural Design	3	5	125	3	0	2	5
CES421	Design of Prestressed Concrete and Bridges	3	5	125	2	2	0	4
CES428	Masonry	3	5	125	2	2	0	4
CES429	Advanced Design of Reinforced Concrete Structures	3	5	125	2	2	0	4
CES446	Steel Structures Design (3)	3	5	125	2	2	0	4
CES447	Advanced Design of Steel Structures	3	5	125	2	2	0	4
Pool of Construction Engineering Management Concentration Elective Courses								
CES373	Construction Cost Management	3	5	125	2	2	0	4
CES474	Resources Management	3	5	125	2	2	0	4
CES475	Risk and Safety Management	3	5	125	2	2	0	4
CES476	Legal Issues in Construction	3	5	125	2	2	0	4
CES477	Computer Applications in Construction Management	3	5	125	3	0	2	5
CES478	Quantity Surveying and Estimating	3	5	125	2	2	0	4
Pool of Environmental and Sustainable Building Engineering Concentration Elective Courses								
ARC367	Indoor Air Quality	3	5	125	2	2	0	4
ARC443	Computer Applications in Environmental Engineering	3	5	125	2	2	2	6
ARC468	Building Illumination and Day Lighting	3	5	125	2	2	0	4
ARC469	Building Acoustics	3	5	125	2	2	0	4
ARC467	Building Energy Conservation Technologies	3	5	125	2	2	0	4
CES455	Materials and Technologies for Sustainable Construction	3	5	125	2	2	0	4
CES480	Environmental Risk Management	3	5	125	2	2	0	4

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
CES151	Structures & Properties of Construction Matrls.	2	4	100	2	1	1	4	PHM032
CES172	Engineering Economics and Finance	2	4	100	2	1	0	3	
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
CES113	Structural Mechanics	3	6	150	2	2	0	4	PHM012 PHM031
ARC161	Introduction to Lighting Systems	2	4	100	2	1	0	3	PHM022
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
Total		15	28	700	13	9	1	23	
Semester 4									
ARC143	Building Engineering Drawing	3	6	150	2	2	2	6	CEP011
CES152	Properties and Testing of Materials	2	4	100	2	1	1	4	CES151
CES114	Strength of Materials	3	5	125	2	2	0	4	CES113
CEI113	Fluid Mechanics for Civil Engineers	3	6	150	2	2	2	6	PHM112
CES161	Geology	2	3	75	2	1	0	3	PHM041
ASU111	Human Rights	2	2	50	2	1	0	3	
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		18	30	750	14	11	5	30	
Semester 5									
MEP213	Thermal Analysis of Buildings	3	5	125	2	2	0	4	PHM012
CES251	Concrete Technology (1)	3	4	100	2	2	2	6	CES151
CES224	Concrete Structures Design (1)	3	6	150	2	3	0	5	CES151 CES114
CES213	Structural Analysis	3	5	125	2	2	0	4	CES114
CEP213	Surveying (1)	4	6	150	3	2	2	7	PHM013
CEP221	Introduction to Transportation and Traffic Engineering	3	5	125	2	2	0	4	PHM111
Total		19	31	775	13	13	4	30	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
ARC263	Fundamentals of Building Acoustics	2	4	100	2	1	0	3	PHM022, PHM032
CES241	Steel Structures Design (1)	3	6	150	2	3	0	5	CES151 CES114
CES263	Soil Mechanics (1)	4	6	150	2	3	2	7	CES151 CES161
CES271	Project Management Essentials	2	4	100	2	1	0	3	CES172
CEP214	Surveying (2)	4	6	150	2	3	2	7	CEP213
CES252	Concrete Technology (2)	3	4	100	3	1	1	5	CES251
Total		18	30	750	13	12	5	30	
Semester 7									
CES344	Steel Structures Design (2)	3	6	150	2	3	0	5	CES213 CES241
CES364	Soil Mechanics (2)	3	6	150	2	2	0	4	CES263
CES324	Concrete Structures Design (2)	3	6	150	2	3	0	5	CES213 CES224
CES372	Construction Planning and Scheduling	3	5	125	2	2	0	4	CES271
ASU112	Report Writing & Communication Skills	3	4	100	2	2	0	4	
	ASU Elective (1)	2	3	75	2	1	0	3	
Total		17	30	750	12	13	0	25	
Semester 8									
MEP342	HVAC System Design	2	5	125	2	1	0	3	MEP213
CES365	Foundation Design (1)	3	5	125	2	2	0	4	CES324, CES364
CES325	Construction Engineering	3	7	175	2	2	0	4	CES371
-	Building Engineering Elective (1)	3	5	125	2	2	0	4	
CES315	Introduction to Structural Dynamics	3	6	150	3	1	0	4	PHM032C ES213
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		16	30	750	13	8	0	21	
Semester 9									
CES467	Foundation Design (2)	3	5	125	2	2	0	4	CES365
CES427	Concrete Structures Design (3)	3	5	125	2	3	0	5	CES324, CES365
CES493	Building Engineering Graduation Project (1)	3	8	200	1	4	0	5	Elect. (1)
	Building Engineering Elective (2)	3	5	125	2	2	0	4	
	Building Engineering Elective (3)	3	5	125	2	2	0	4	
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
Total		17	30	750	11	13	0	24	
Semester 10									
CES454	Modern Building Materials	3	5	125	3	1	0	4	CES224CE S252
CES494	Senior Seminar	2	3	75	0	4	0	4	CES493
CES495	Building Engineering Graduation Project (2)	3	9	225	1	4	0	5	CES493
ARC466	Building Envelope Design	2	4	100	2	1	0	3	MEP342
	Building Engineering Elective (4)	3	5	125	2	2	0	4	
	Building Engineering Elective (5)	3	5	125	2	2	0	4	
Total		16	31	775	10	14	0	24	

Program #22: Civil and Infrastructure Engineering Program

Program Description

Civil engineering today is concerned with the deterioration of the nation's roads, bridges, water and power distribution systems, storm and sanitary sewers and other public infrastructure. The aim of the Civil and Infrastructure Engineering Program is to graduate civil engineers responsible for the life-cycle of the system he creates and must be capable of optimizing the total system performance of large-scale public works projects, including their social and environmental impacts, in a way that addresses critical issues of infrastructure behavior, deterioration science, and structural rehabilitation. On top of these fields comes surveying engineering, sanitary environment, transportation engineering, water-related engineering projects who can enrich the water resources and public works field.

Career Prospects

Graduates of this department has a variety of opportunities to work, for example:

- Government authorities.
- Consulting firms in civil engineering and construction.
- Civil engineering contractors and project managers.
- Water and sanitation utility companies.
- Environmental engineering organizations.
- Coastal engineers developing coastal environment systems.
- Water resources management authority.

Program Concentrations

The program provides the undergraduate student with a thorough foundation and technologies in the basic tenets of civil engineering and technologies. The program provides three different fields in which the students in this program can specialize. These three fields are:

1. Transportation Engineering
2. Geomatics and Environmental Engineering
3. Water Engineering

1. Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. It includes areas such as transportation design, transportation planning, traffic engineering, some aspects of urban engineering, queueing theory, pavement engineering, Intelligent Transportation System (ITS), and infrastructure management.

2. Geomatics and Environmental Engineering is the process by which a surveyor measures certain dimensions that occur on or near the surface of the Earth. Surveying equipment, such as levels and theodolites, are used for accurate measurement of angular deviation, horizontal, vertical and slope distances. With computerization, electronic distance measurement (EDM), total stations, GPS surveying and laser scanning have to a large extent supplanted traditional instrument. Data collected by survey measurement is converted into a graphical representation of the Earth's surface in the form of a map. This information is then used by civil engineers, contractors and realtors to design from, build on, and trade, respectively. Elements of a structure must be sized and positioned in relation to each other and to site boundaries and adjacent structures. Although surveying is a distinct profession with separate qualifications and licensing arrangements, civil engineers are trained in the basics of surveying and mapping, as well as geographic information systems. Surveyors also lay out the routes of railways, tramway tracks, highways, roads, pipelines and streets as well as position other infrastructure, such as harbors, before construction. Environmental engineering, emphasis is based both on the design of systems for water supply, water treatment, soil treatment, wastewater treatment, and waste management, as well as on the design of physical, chemical and biological unit operations and processes encountered in these systems.

3. Water Engineering is concerned with the collection and management of water (as a natural resource). As a discipline it therefore combines elements of hydrology, environmental science, meteorology, conservation, and resource management. This area of civil engineering relates to the prediction and management of both the quality and the quantity of water in both underground (aquifers) and above ground (lakes, rivers, and streams) resources. Water resource engineers analyze and model very small to very large areas of the earth to predict the amount and content of water as it flows into, through, or out of a facility. Although the actual design of the facility may be left to other engineers. Also concerned with design of pipelines, water supply network, drainage facilities (including bridges, dams, channels, culverts, levees, storm sewers), and canals. Hydraulic engineers design these facilities using the concepts of fluid pressure, fluid statics, fluid dynamics, and hydraulics, among others.

Agreements with another University

The program is not yet partnered with another university.

Program ILOs

In addition to the competences for all Engineering Programs (A-Level), the Civil and Infrastructure Engineering Program graduate must be able to (D-Level):

- D1. Select appropriate and sustainable technologies for construction of buildings, infrastructures and water structures; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics and Fluid Mechanics.
- D2. Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures, Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbors; or any other emerging field relevant to the discipline.
- D3. Plan and manage construction processes; address construction defects, instability and quality issues; and maintain safety measures in construction and materials.
- D4. Deal with biddings, contracts and financial issues including project insurance and guarantees; and assess environmental impacts of civil engineering projects.
- D5. Use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. They work to improve recycling, waste disposal, public health, and water and air pollution control. They also address global issues, such as unsafe drinking water, climate change, and environmental sustainability.
- D6. Demonstrate additional abilities related to the field of the concentration within Design and Production Engineering as listed below.

Concentration	Graduate attributes
Transportation Engineering	D6a. Demonstrate additional abilities to design, construct, maintain different types of roads and airports, manage and plan transportation modes.
Geomatics and Environmental Engineering	D6b. Demonstrate additional abilities to Use wide-range of analytical tools, techniques, equipment, and software packages in the field of surveying, remote sensing, water and waste water

	networks and treatment facilities, and of environment pollution and solid waste management.
Water Engineering	D6c. Demonstrate additional abilities to Plan and design irrigation and drainage systems, hydraulic networks, sustainable drainage systems and pump stations, and Consider environmental issues in hydraulics, coastal engineering.

Required Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program ILOs, the following set of courses need to be completed.

Table 37 List of Civil and Infrastructure EngineeringProgram Requirements courses.

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5
CES113	Structural Mechanics	3	6	150	2	2	0	4
CES114	Strength of Materials	3	5	125	2	2	0	4
CES213	Structural Analysis	3	5	125	2	2	0	4
CES224	Concrete Structures Design (1)	3	6	150	2	3	0	5
CES324	Concrete Structures Design (2)	3	6	150	2	3	0	5
CES427	Concrete Structures Design (3)	3	5	125	2	3	0	5
CES430	Construction Methods and Techniques	2	4	100	2	1	0	3
CES241	Steel Structures Design (1)	3	6	150	2	3	0	5
CES344	Steel Structures Design (2)	3	6	150	2	3	0	5
CES251	Concrete Technology (1)	3	4	100	2	2	2	6
CES252	Concrete Technology (2)	3	4	100	3	1	1	5
CES161	Geology	2	3	75	2	1	0	3
CES263	Soil Mechanics (1)	4	6	150	2	3	2	7
CES364	Soil Mechanics (2)	3	6	150	2	2	0	4
CES365	Foundation Design (1)	3	5	125	2	2	0	4
CES479	Planning and Scheduling of Repetitive Projects	2	4	100	2	1	0	3
CEP213	Surveying (1)	4	6	150	3	2	2	7
CEP214	Surveying (2)	4	6	150	2	3	2	7
CEP312	Surveying (3)	2	4	100	2	1	0	3
CEP314	Infrastructure Network Planning	2	5	125	2	1	1	4
CEP221	Introduction to Transportation & Traffic Engineering	3	5	125	2	2	0	4
CEP332	Highway Geometric and Structural Design	3	4	100	2	2	0	4
CEP342	Railway Engineering Principles	2	5	125	2	1	0	3
CEP151	Introduction to Environmental Engineering	2	3	75	2	1	0	3
CEP353	Principles of Water and Wastewater Treatment	3	6	150	2	2	0	4
CEI113	Fluid Mechanics for Civil Engineers	3	6	150	2	2	2	6
CEI212	Hydraulics	3	6	150	2	2	2	6
CEI222	Irrigation and Drainage	3	5	125	2	2	0	4
CEI262	Principles of Water Resources Engineering	2	4	100	2	1	0	3
CEI132	Civil Engineering Drawing	2	4	100	1	3	1	5
CEI333	Design of Irrigation Structures	2	4	100	2	1	0	3
CEI435	Hydraulic Structures	2	4	100	2	1	0	3
CEI341	Coastal Engineering	2	4	100	2	1	0	3
CEI441	Port Engineering and Navigation	2	4	100	2	1	0	3
CEI352	Applied Hydrology	2	4	100	2	1	0	3
	Civil and Infrastructure Engineering Elective (1)	2	4	100	2	1	0	3
	Civil and Infrastructure Engineering Elective (2)	2	4	100	2	1	0	3
	Civil and Infrastructure Engineering Elective (3)	2	4	100	2	1	0	3
	Civil and Infrastructure Engineering Elective (4)	2	4	100	2	1	0	3
	Civil Engineering Design Graduation Project (1) Elect.	3	6	150	1	4	0	5
	Civil Engineering Senior SeminarElective	2	3	75	0	4	0	4
	Civil Engineering Design Graduation Project (2)Elect.	3	6	150	1	4	0	5
Total		170	300	7500	130	111	29	270

Pool of Transportation Engineering Elective Courses								
Pool of Civil and Infrastructure Engineering Elective (1)								
CEP323	Principles of Traffic Engineering	2	4	100	2	1	0	3
CEP333	Road Construction Material	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (2)								
CEP424	Transportation Economics	2	4	100	2	1	0	3
CEP434	Road Maintenance	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (3)								
CEP425	Urban Transportation Planning	2	4	100	2	1	0	3
CEP435	Road Construction	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (4)								
CEP426	Intelligent Transportation Systems	2	4	100	2	1	0	3
CEP436	Airport Engineering	2	4	100	2	1	0	3
Pool of Geomatics and Environmental Engineering Elective Courses								
Pool of Civil and Infrastructure Engineering Elective (1)								
CEP313	Photogrammetric Surveying	2	4	100	2	1	0	3
CEP354	Computer Applications in Sanitary Engineering	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (2)								
CEP415	Geodetic and GPS Surveying	2	4	100	2	1	0	3
CEP455	Design of Water and Wastewater Networks	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (3)								
CEP416	Hydrographic Surveying and Harbor Engineering	2	4	100	2	1	0	3
CEP456	Water and Wastewater Supply	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (4)								
CEP417	GIS Applications in Civil Infrastructure Projects	2	4	100	2	1	0	3
CEP457	Reuse of Treated Wastewater	2	4	100	2	1	0	3
Pool of Water Engineering Elective Courses								
Pool of Civil and Infrastructure Engineering Elective (1)								
CEI321	Modern Irrigation Systems	2	4	100	2	1	0	3
CEI433	Dams Engineering	2	4	100	2	1	0	3
CEI451	Ground water Hydrology	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (2)								
CEI413	Environmental Hydraulics	2	4	100	2	1	0	3
CEI442	Coastal Environment Engineering	2	4	100	2	1	0	3
CEI463	Environmental Impact Assessment for Water Engineering Projects	2	4	100	2	1	0	3
Pool of Civil and Infrastructure Engineering Elective (3)								
CEI412	Pump Stations Engineering	2	4	100	2	1	0	3
CEI416	Hydraulic Modeling	2	4	100	2	1	0	3
CEI443	Inland Navigation	2	4	100	2	1	0	3
CEI461	Geographical Information Systems in Water Engineering	2	4	100	2	0	2	4
Pool of Civil and Infrastructure Engineering Elective (4)								
CEI414	River Engineering	2	4	100	2	1	0	3
CEI417	Sustainable Urban Water Systems	2	4	100	2	1	0	3
CEI436	Topics in Hydraulic Structures	2	4	100	2	1	0	3
CEI466	Water Security and Governance	2	4	100	2	1	0	3
Pool of Civil Engineering Design Graduation Project (1) Elective								
CEP492	Civil Engineering Design Graduation Project (1)	3	6	150	1	4	0	5
CEI492	Civil Engineering Design Graduation Project (1)	3	6	150	1	4	0	5
Pool of Civil Engineering Senior Seminar Elective								
CEP493	Civil Engineering Senior Seminar	2	3	75	0	4	0	4
CEI493	Civil Engineering Senior Seminar	2	3	75	0	4	0	4
Pool of Civil Engineering Design Graduation Project (2) Elective								
CEP494	Civil Engineering Design Graduation Project (2)	3	6	150	1	4	0	5
CEI494	Civil Engineering Design Graduation Project (2)	3	6	150	1	4	0	5

Proposed Study Plan

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 1									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
Semester 2									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
Semester 3									
CES151	Structures & Properties of Construction Matrls.	2	4	100	2	1	1	4	PHM032
CEI132	Civil Engineering Drawing	2	4	100	1	3	1	5	CEP011
PHM111	Probability and Statistics	2	4	100	2	2	0	4	
CES113	Structural Mechanics	3	6	150	2	2	0	4	PHM012 PHM031
PHM112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5	PHM013
CES172	Engineering Economics and Finance	2	4	100	2	1	0	3	
ASU111	Human Rights	2	2	50	2	1	0	3	
Total		17	30	750	15	11	2	28	
Semester 4									
CEP151	Introduction to Environmental Engineering	2	3	75	2	1	0	3	PHM031
CES251	Concrete Technology (1)	3	4	100	2	2	2	6	CES151
CES114	Strength of Materials	3	5	125	2	2	0	4	CES113
CES161	Geology	2	3	75	2	1	0	3	PHM041
CES271	Project Management essentials	2	4	100	2	1	0	3	CES172
CEI113	Fluid Mechanics for Civil Engineers	3	6	150	2	2	2	6	PHM112
ASU112	Report Writing & Communication Skills	3	4	100	2	2	0	4	
Total		18	29	725	14	11	4	29	
Semester 5									
CES252	Concrete Technology (2)	3	4	100	3	1	1	5	CES251
CES213	Structural Analysis	3	5	125	2	2	0	4	CES114
CEI262	Principles of Water Resources Engineering	2	4	100	2	1	0	3	CEI113
CEP213	Surveying (1)	4	6	150	3	2	2	7	PHM013
CEI212	Hydraulics	3	6	150	2	2	2	6	CEI113
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
Total		18	29	725	14	10	5	29	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 6									
CES263	Soil Mechanics (1)	4	6	150	2	3	2	7	CES151 CES161
CES224	Concrete Structures Design (1)	3	6	150	2	3	0	5	CES151 CES114
CEP221	Introduction to Transportation and Traffic Engineering	3	5	125	2	2	0	4	PHM111
CEP214	Surveying (2)	4	6	150	2	3	2	7	CEP213
CEI222	Irrigation and Drainage	3	5	125	2	2	0	4	CEI212 CEI262
ASU114	Selected Topics in contemporary issues	2	2	50	2	0	0	2	
Total		19	30	750	12	13	4	29	
Semester 7									
CES364	Soil Mechanics (2)	3	6	150	2	2	0	4	CES263
CES324	Concrete Structures Design (2)	3	6	150	2	3	0	5	CES213 CES224
CEP353	Principles of Water and Wastewater Treatment	3	6	150	2	2	0	4	CEI113
CEP312	Surveying (3)	2	4	100	2	1	0	3	CEP214
CEP332	Highway Geometric and Structural Design	3	4	100	2	2	0	4	CEP221
CEI333	Design of Irrigation Structures	2	4	100	2	1	0	3	CEI222 CES224
Total		16	30	750	12	11	0	23	
Semester 8									
CES365	Foundation Design (1)	3	5	125	2	2	0	4	CES324 CES364
CES241	Steel Structures Design (1)	3	6	150	2	3	0	5	CES151 CES114
CEP342	Railway Engineering Principles	2	5	125	2	1	0	3	CEP221
CEI341	Coastal Engineering	2	4	100	2	1	0	3	CEI212 CES364
CEI352	Applied Hydrology	2	4	100	2	1	0	3	CEI333
	Civil and Infrastructure Engineering Elective (1)	2	4	100	2	1	0	3	
CEP314	Infrastructure Network Planning	2	5	125	2	1	1	4	CEP312
Total		16	33	825	14	10	1	25	
Semester 9									
CEI441	Port Engineering and Navigation	2	4	100	2	1	0	3	CEI341
CES427	Concrete Structures Design (3)	3	5	125	2	3	0	5	CES324 CES365
	Civil Engineering Design Graduation Project (1) Elective	3	6	150	1	4	0	5	
	Civil and Infrastructure Engineering Elective (2)	2	4	100	2	1	0	3	
	Civil and Infrastructure Engineering Elective (3)	2	4	100	2	1	0	3	
CEI435	Hydraulic Structures	2	4	100	2	1	0	3	CEI333 CES364
	ASU Elective (1)	2	3	75	2	1	0	3	
Total		16	30	750	13	12	0	25	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
Semester 10									
CES430	Construction Methods and Techniques	2	4	100	2	1	0	3	CES271
CES344	Steel Structures Design (2)	3	6	150	2	3	0	5	CES213, CES241
	Civil Engineering Senior SeminarElective	2	3	75	0	4	0	4	
	Civil Engineering Design Graduation Project (2)Elective	3	6	150	1	4	0	5	
CES479	Planning and Scheduling of Repetitive Projects	2	4	100	2	1	0	3	CES271
	Civil and Infrastructure Engineering Elective (4)	2	4	100	2	1	0	3	
	ASU Elective (2)	2	2	50	2	0	0	2	
Total		16	29	725	11	14	0	25	

Part E: Course Pool

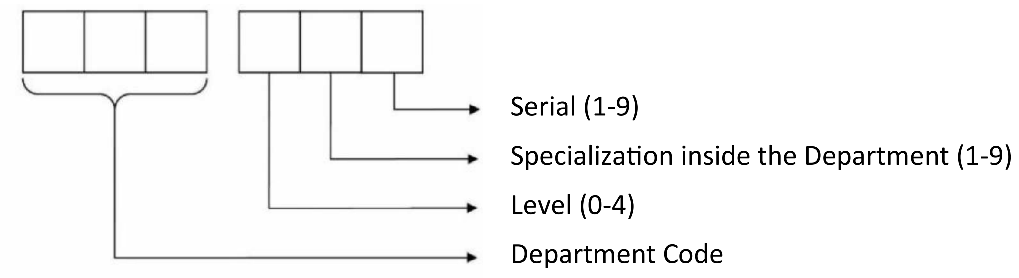
All the programs use course from the Faculty Departments. There are 13 departments at the Faculty of Engineering, Ain Shams University. They are listed in the following table.

Table 38 List of Departments at the Faculty of Engineering, Ain Shams University.

Field	#	Department	Acronym	Courses
General	0	Teacher Support and Training Center	TSDC	16
Basic Science	1	Engineering Physics and Mathematics	PHM	24
Mechanical Engineering	2	Design and Production Engineering	MDP	98
	3	Mechanical Power Engineering	MEP	49
	4	Automotive Engineering	MEA	26
	5	Mechatronics Engineering	MCT	44
Architectural Engineering	6	Architecture Engineering	ARC	72
	7	Urban Planning and Design	UPL	61
Electrical Engineering	8	Electrical Power and Machines Engineering	EPM	58
	9	Electronics and Communication Engineering	ECE	70
	10	Computer and Systems Engineering	CSE	94
Civil Engineering	11	Structural Engineering	CES	97
	12	Irrigation and HydraulicsEngineering	CEI	51
	13	Public Works Engineering	CEP	59
Total number of courses				819

Any given course can be used in different Programs based on the Program requirement. The course code follows the Department offering this course. The course coding is divided into two parts and follows the following convention:

5. Three Letters which are the Department code listed in Table 38.
6. Three Numbers indicating the Level, the Specialization inside the department, and a counter inside the specialization.



Some of the courses offered by the department are offered in two versions (with the same code and contents), to account for the large number of students with respect to the number of teaching staff. The courses are amended with the letter “s”. These courses will only be offered in a transition phase of 3 years until the Faculty balances the student to teacher ratio in these courses. These courses are different in the following way:

1. Different assessment criteria.
2. Relaxed pre-requisites so that the result of the previous semester does not have to appear in 1 week before the registration of the semester starts.

E0. Courses not offered by any of the Faculty Departments

The general courses which are not offered by any of the faculty departments are the responsibility of the Teacher Development and Support Center (TSDC).These courses are all University Requirements (UR) and one course as a Faculty requirement.

Table 39 List of categories of the General Courses.

#	Specialization
1	UR Compulsory courses
2	UR Elective courses with tutorial
3	UR Elective courses without tutorial
4	Engineering

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 40 List of ASU courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. University Requirement Compulsory Courses																				
1	0	011	Technical English Language	0	4	100	2	2	0	4	x				20	20	0	60		
2	1	111	Human Rights	2	2	50	2	1	0	3	x				20	0	0	80		
3		112	Report Writing & Communication skills	3	4	100	2	2	0	4	x				20	20	0	60		
4		113	Professional Ethics and Legislations	3	4	100	2	2	0	4	x				20	20	0	60		
5		114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	x				20	0	0	80		
2. University Requirement Elective courses with tutorial																				
6	3	321	Innovation and Entrepreneurship	2	3	75	2	1	0	3	x				20	0	0	80		
7		322	Language Course	2	3	75	2	1	0	3	x				20	20	0	60		
8		323	Introduction to Accounting	2	3	75	2	1	0	3	x				20	20	0	60		
9		324	History of Engineering & Technology	2	3	75	2	1	0	3	x				20	20	0	60		
3. University Requirement Elective courses without tutorial																				
10	3	331	Human Resource Management	2	2	50	2	0	0	2	x				20	0	0	80		
11		332	History of Architecture	2	2	50	2	0	0	2	x				20	0	0	80		
12		333	Introduction to Marketing	2	2	50	2	0	0	2	x				20	0	0	80		
13		334	Building Safety and Fire Protection	2	2	50	2	0	0	2	x				20	0	0	80		
14		335	Literature and Arts	2	2	50	2	0	0	2	x				20	0	0	80		
15		336	Business Administration	2	2	50	2	0	0	2	x				20	0	0	80		

Table 41 List of ENG courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
4. Engineering																				
16	0	011	Fundamentals of Engineering	2	4	100	2	1	0	3		x			35	25	0	40		
17	1	111	Field Training	0								x			100	0	0	0		

E0.1 University Requirements Compulsory Courses

ASU011	Technical English Language			0 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Origin of English language, vocabulary from other language including Arabic, main grammar rules, characteristics of technical English, sources of noise in writing, examples from different engineering specialization, punctuation for engineers, how engineering numbers are reported in text, submitting a report on current subject of engineering interest.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ASU111	Human Rights			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	50		Equivalent ECTS	2
Course Content				
A general introduction to international human rights, as well as an overview of some specific topics in this field.The first half of the course consists in: An introduction to basic notions of public ethics, the history of Human Rights, international instruments, categories of rights, Human Rights violations, protection and responsibility thereof.The second part of the course deals with current issues in the human rights agenda such as: Rights of women, rights of the child, rights of indigenous peoples, armed conflicts and terrorism, the environment, transitional justice, sexual minorities.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement			1-4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	0%	0%	80%	

ASU112	Report Writing and Communication Skills		3 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	100	Equivalent ECTS	4
Course Content			
Typography and writing, Formal report components, types of engineering reports, content and appearance, communication types, nonverbal communication, memo, letter, email and social media, infographics in reports and presentations, types of graphs, how to evaluation written material and oral presentations.			
Used in Program / Level			
Program Name or requirement		Study Level	
University Requirement		1-4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

ASU113	Professional Ethics and Legislation		3 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	100	Equivalent ECTS	4
Course Content			
Introduce undergraduate engineering students to the concepts, theory and practice of engineering ethics. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers, broaden student mind to be open to society's ever changing character, how to share ideas and concepts regardless of the fact that you may not always agree, working in teams on majority of the assignments in this course, exposure to national legislation related to education and engineering ethics.			
Used in Program / Level			
Program Name or requirement		Study Level	
University Requirement		1-4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

ASU114	Selected Topics on Contemporary Issues		2 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	0	
Required SWL	50	Equivalent ECTS	2
Course Content			
Exposure to national mega projects in different disciplines related to water, energy and food security, importance of multidisciplinary thinking, project management basics related to national projects, pressing engineering issues depending on the timing of the course such as effect of seal level rise and the GERD dam in Ethiopia on Egypt.			
Used in Program / Level			
Program Name or requirement	Study Level		
University Requirement	1-4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	0%	0%	80%

E0.2 University Requirements Elective Courses with Tutorial

ASU321	Innovation and Entrepreneurship				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	75		Equivalent ECTS	3	
Course Content					
Focus on the interconnection between entrepreneurial thinking and innovation, look at models used in Silicon Valley to grow both start-up companies as well as innovation inside large organizations, bring together top Haas School of Business, UC Berkeley faculty, address critical areas for successful growth, including design thinking, open innovation, business models, product-market fit, and financing, how to think like an entrepreneur and provides the models, tools and frameworks to further develop your business or idea, emphasis on the IT space.					
Used in Program / Level					
Program Name or requirement			Study Level		
University Requirement Elective			1-4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	0%		0%	80%	

ASU322	Language Course				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	75		Equivalent ECTS	3	
Course Content					
Study of the basics of a language different from English, such as German or French, grammar rules, selected text related to engineering, translation into Arabic, writing an essay in the chosen language along with its translation.					
Used in Program / Level					
Program Name or requirement			Study Level		
University requirement Elective			1-4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

ASU323	Introduction to Accounting			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Financial reporting process and uses of accounting data, linkages between accounting information and management planning, decision making and control. Cost accounting concepts such as product costing, cost terminology, budgeting, cost volume-profit analysis, and standard costs, as well as non-traditional management accounting topics such as variable costing and activity-based costing.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement Elective			1-4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ASU324	History of Engineering and Technology			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Provide students with an understanding of the historical development of Engineering with relation to societal expectations of the period, Interaction between human society and Engineers to develop and guide the advancement of engineering technology; with society posing problems for Engineers to solve and Engineers developing new technology that changed the course of human history, and helped shape the world we live in, General philosophy behind Engineering work to fulfill the needs of society (water, electricity, technological improvements etc.), The role of engineers in society from a humanistic perspective, Other relevant philosophical analyses of Engineering as a skill and profession such as, aesthetics, creativity, the epistemology of Engineering and more. Examples from the contributions of Arab Scientists in different fields.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement Elective			1-4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

E0.3 University Requirements Elective Courses without Tutorial

ASU331	Human Resources Management				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		0		0	
Required SWL	50		Equivalent ECTS	2	
Course Content					
Introduction to Human Resources Management (HRM) in a changing Environment. The HRM Frameworks, Functions and Strategy. Effective job analysis, job description, and job specifications. Employee's planning, recruitment, testing, interviewing, and selection. Training and developing employees. Performance management and Appraisal. Career planning and development. Compensation, employee benefits, health and safety, and labor relations.					
Used in Program / Level					
Program Name or requirement				Study Level	
University Requirement Elective				1-4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	0%		0%	80%	

ASU332	History of Architecture				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		0		0	
Required SWL	50		Equivalent ECTS	2	
Course Content					
This course is a global-oriented survey of the history of architecture, from the prehistoric to the sixteenth century. It treats buildings and environments, including cities, in the context of the cultural and civilizational history. It offers an introduction to design principles and analysis. Being global, it aims to give the student perspective on the larger pushes and pulls that influence architecture and its meanings, whether these be economic, political, religious or climatic. Applications and examples drawn from Architecture in Egypt.					
Used in Program / Level					
Program Name or requirement				Study Level	
University Requirement Elective				1-4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	0%		0%	80%	

ASU333	Introduction to Marketing			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		0
Required SWL	50		Equivalent ECTS	2
Course Content				
The concept of marketing: definition of marketing and its role in achieving organizational objectives, the importance of marketing, the marketing system, and organizing the marketing functions. The concept and aspects of the consumer behavior, studying the markets. Market mix, segmentation, targeting, and positioning. The product strategy: branding, packaging, product mix, product life cycle, new products development. The pricing strategy: The importance of pricing, Methods of pricing. Distribution strategy: distribution channels, distribution outlets. Promotion strategy: advertising and personal selling.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement Elective			1-4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	0%		0%	80%

ASU334	Building Safety and Fire Protection			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		0
Required SWL	50		Equivalent ECTS	2
Course Content				
The student should be able to recognize dangers and to have a reasonably good view of how these can be eliminated or in the least he/she should know where to look for solutions, and where to find them. The student should also know the real value of the solutions that are sometimes offered by the commercial world. The course concerns the following aspects of fire protection: fire risk, severity of a fire, reaction to fire, resistance of fire. Eurocodes, properties of construction products, legislation and standards, evacuation in case of fire and other emergencies. Fire alarm systems, smoke and heat evacuation systems, fire extinguishing systems, fire safety engineering and management, carbon monoxide poisoning in case of combustion, fire investigation.				
Used in Program / Level				
Program Name or requirement			Study Level	
University Requirement Elective			1-4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	0%		0%	80%

<table>
<tr><td>ASU335</td><td colspan="4">Literature and Arts</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>50</td><td colspan="2">Equivalent ECTS</td><td colspan="2">2</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Appreciate the roles of creative endeavors in enriching the human condition, Identify, interpret, and explain themes in works of literature or art, explain how artistic and literary traditions have influenced individuals, cultures or societies, demonstrate an understanding of creative processes through the production of works of art or literature, Reflect upon and explain the decisions made during the creative process, Applications and examples from the Egyptian literature and Arts.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">University Requirement Elective</td><td colspan="2">1-4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>0%</td><td colspan="2">0%</td><td colspan="2">80%</td></tr>
</table>

<table>
<tr><td>ASU336</td><td colspan="4">Business Administration</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">0</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>50</td><td colspan="2">Equivalent ECTS</td><td colspan="2">2</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">The nature of business and entrepreneurship as the vehicle for making money by creating wealth and producing goods and services. Management, Planning, Controlling & Organizing. Various functional areas in business including: accounting, entrepreneurship, economics, finance management and marketing, legal environment of business, globalization and e-business.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">University Requirement Elective</td><td colspan="2">1-4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>0%</td><td colspan="2">0%</td><td colspan="2">80%</td></tr>
</table>

E0.4 Engineering Courses

ENG011	Fundamentals of Engineering			2 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
History of Engineering, Engineering definition, Engineering fields of specialization, Engineer carrier path, Engineers initial carrier profile, Study programs at ASU Faculty of Engineering, registration, advising and examination procedures, The engineering approach to problem solving, Engineering calculations: Numbering systems, units and dimensions, The International System of Units, Units Used with SI, Units conversions, Significant Figures, Scientific Notation, Branches of mathematics and physics. Case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

ENG111	Field Training			0 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		10		15
Required SWL	300		Equivalent ECTS	12
Course Content				
The major objective of this field training is to put knowledge and skills into practice. It provides students with the necessary skills to work in his engineering specialization. For a sufficient understanding of technical and economic lectures and tutorials as well as a preparation for future work, internships in companies are essential. The field training is one of the substantial preconditions for a successful course of study and it forms an important part of the education. The students should gain insights into engineering practice, knowledge of field relevant aspects of their studies. The trainees should particularly show interest in professional structures within the company. The verification of carrying out the internship according to the guidelines takes place after the start of training.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			1-4	
Assessment Criteria				
Assignments & Projects	Mid-Term Exam	Practical Exam	Final Exam	
100%	0%	0%	0%	

E1. Courses offered by Engineering Physics and Mathematics Department (PHM)

The Engineering Physics and Mathematics Department is responsible for the teaching of Basic Science courses for all Programs.

Table 42 List of specializations at the Engineering Physics and Mathematics Department.

#	Specialization
1	Mathematics
2	Physics
3	Mechanics
4	Chemistry

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 43 List of PHM courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Mathematics																				
1	0	011	Basic Mathematics	0	4	100	2	2	0	4		x			15	15	0	70		
2		012	Mathematics (1)	3	5	125	3	2	0	5		x			35	25	0	40		
		012s													15	15	0	70		
3		013	Mathematics (2)	3	5	125	3	2	0	5		x			35	25	0	40	PHM012	
		013s													15	15	0	70	(PHM012)	
4	1	111	Probability and Statistics	2	4	100	2	2	0	4		x			35	25	0	40		
		111s													15	15	0	70		
5		112	Differential Equations and Numerical Analysis	4	6	150	3	2	0	5			x		35	25	0	40	PHM013	
		112s													15	15	0	70	(PHM013)	
6		113	Differential and Partial Differential Equations	3	5	125	3	2	0	5			x		35	25	0	40	PHM013	
		113s													15	15	0	70	(PHM013)	
7		114	Numerical Analysis	3	5	125	2	2	0	4				x	35	25	0	40	PHM113	
8		115	Engineering Mathematics	3	5	125	3	2	0	5				x	35	25	0	40	PHM013	
9	2	211	Discrete Mathematics	2	4	100	2	2	0	4				x	35	25	0	40		
		211s													15	15	0	70		
10		212	Complex, Special Functions and Numerical Analysis	3	5	125	2	2	0	4				x	35	25	0	40	PHM113	
		212s													15	15	0	70	(PHM113)	
11		213	Complex, Special Functions and Fourier Analysis	3	5	125	2	2	0	4				x	35	25	0	40	PHM113	
2. Physics																				
12	0	021	Vibration and Waves	3	5	125	3	1	1	5		x			30	20	10	40		
		021s													10	15	15	60		
13		022	Electricity and Magnetism	3	5	125	3	1	1	5		x			30	20	10	40	PHM021	
		022s													10	15	15	60	(PHM021)	
14	1	121	Modern Physics and Quantum Mechanics	3	5	125	3	1	1	5			x		30	20	10	40	PHM013	PHM022
		121s													10	15	15	60	(PHM013)	(PHM022)
15		122	Physics of Semiconductors and Dielectrics	3	5	125	2	2	0	4			x		40	20	0	40	PHM121	
		122s													15	15	0	70	(PHM121)	
16		123	Thermal and Statistical Physics	3	5	125	2	2	0	4				x	40	20	0	40	PHM111	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE	
3. Mechanics																			
17	0	031	Statics	3	5	125	2	2	1	5		x			30	25	5	40	
		031s													5	20	5	70	
18		032	Dynamics	3	5	125	2	2	1	5		x			30	25	5	40	PHM031
		032s													5	20	5	70	(PHM031)
19	1	131	Rigid Body Dynamics	2	4	100	2	1	1	4			x		30	25	5	40	PHM032
		131s													5	20	5	70	(PHM032)
4. Chemistry																			
20	0	041	Engineering Chemistry	3	5	125	2	1	2	5		x			20	25	15	40	
		041s													10	15	15	60	
21	1	141	Introduction to Organic Chemistry	2	4	100	2	0	1	3				x	25	25	10	40	PHM041
22		142	Reaction Kinetics and Chemical Analysis	3	5	125	3	0	1	4				x	25	25	10	40	PHM141
23	2	241	Electrochemistry	3	5	125	3	0	1	4				x	25	25	10	40	PHM041
24		242	Polymer Chemistry	3	5	125	3	0	1	4				x	25	25	10	40	PHM142

E1.1 Mathematics Courses

PHM011	Basic Mathematics			0 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Differential and integral calculus: Differentiation and its applications, The calculus of exponential and logarithmic functions, Behavior of functions and curve sketching, The definite integral and its application Algebra: Permutations and combinations and binomial theorem, Complex numbers, Determinants and matrices. Analytic and solid geometry: Geometry and measurements in two and three dimensions, Straight lines and planes in space.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	0%	70%	

PHM012	Mathematics (1)			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review on Calculus, Chain Rule, Hyperbolic Functions, Inverse Functions, Techniques of Integration, L'hopital Rule, Conic Sections, Series				
Used in Program / Level				
Program Name or requirement		Study Level		
Faculty Requirement		0		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

PHM012s	Mathematics (1)			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review on Calculus, Chain Rule, Hyperbolic Functions, Inverse Functions, Techniques of Integration, L'hopital Rule, Conic Sections, Series				
Used in Program / Level				
Program Name or requirement		Study Level		
Faculty Requirement		0		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	0%	70%	

PHM013	Mathematics (2)			3 CH
Prerequisites	Mathematics (1)			
Number of weekly Contact Hours				
Lecture	Tutorial	Laboratory		
3	2			
Required SWL	125	Equivalent ECTS	5	
Course Content				
Functions of Several Variables, Partial Differentiation, Applications of Partial Differentiation, Quadric Surfaces, Coordinate Systems, Multiple Integrals and applications, Line Integral, Green's Theorem, Linear System of Equations, Matrix Algebra, Eigenvalues				
Used in Program / Level				
Program Name or requirement	Study Level			
Faculty Requirement	0			
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

PHM013s	Mathematics (2)			3 CH
Prerequisites	Registered in Mathematics (1)			
Number of weekly Contact Hours				
Lecture	Tutorial	Laboratory		
3	2			
Required SWL	125	Equivalent ECTS	5	
Course Content				
Functions of Several Variables, Partial Differentiation, Applications of Partial Differentiation, Quadric Surfaces, Coordinate Systems, Multiple Integrals and applications, Line Integral, Green's Theorem, Linear System of Equations, Matrix Algebra, Eigenvalues				
Used in Program / Level				
Program Name or requirement	Study Level			
Faculty Requirement	0			
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	0%	70%	

<table>
<tr><td>PHM111</td><td colspan="4">Probability and Statistics</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Review on Probability, Bayes' Theorem, Random Variables (Continuous and Discrete), Probability Distributions, Data Description, Descriptive and Inferential Statistics, Measures of Central Tendency and Dispersion.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Faculty Requirement</td><td colspan="2">1</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
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<table>
<tr><td>PHM111s</td><td colspan="4">Probability and Statistics</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Review on Probability, Bayes' Theorem, Random Variables (Continuous and Discrete), Probability Distributions, Data Description, Descriptive and Inferential Statistics, Measures of Central Tendency and Dispersion.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Faculty Requirement</td><td colspan="2">1</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>15%</td><td>15%</td><td colspan="2">0%</td><td colspan="2">70%</td></tr>
</table>

PHM112	Differential Equations and Numerical Analysis				4 CH
Prerequisites	Mathematics (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		2		0	
Required SWL	150		Equivalent ECTS	6	
Course Content					
First Order Differential Equations, Higher Order Differential Equations, Laplace Transform, Fourier Series, Partial Differential Equations, Numerical Methods for Solving Ordinary Differential Equations, Numerical Methods for Solving Partial Differential Equations.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				1	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

PHM112s	Differential Equations and Numerical Analysis				4 CH
Prerequisites	Registered in Mathematics (2) in a previous semester.				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		2		0	
Required SWL	150		Equivalent ECTS	6	
Course Content					
First Order Differential Equations, Higher Order Differential Equations, Laplace Transform, Fourier Series, Partial Differential Equations, Numerical Methods for Solving Ordinary Differential Equations, Numerical Methods for Solving Partial Differential Equations.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				1	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
15%	15%		0%	70%	

PHM113	Differential and Partial Differential Equations			3 CH
Prerequisites	Mathematics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	125	Equivalent ECTS		5
Course Content				
First Order Differential Equations, Higher Order Differential equations, Laplace Transform, Fourier Series, Partial Differential Equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Communication Systems Engineering Program			1	
Computer Engineering and Software Systems			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

PHM113s	Differential and Partial Differential Equations			3 CH
Prerequisites	Registered in Mathematics (2) in a previous semester			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	125	Equivalent ECTS		5
Course Content				
First Order Differential Equations, Higher Order Differential equations, Laplace Transform, Fourier Series, Partial Differential Equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	0%	70%	

PHM114	Numerical Analysis			3 CH
Prerequisites	Differential and Partial Differential Equations			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Numerical solution of Non-linear Equations, Curve Fitting, Numerical Integration, Eigenvalues, Error Analysis, Numerical Methods for Solving Ordinary Differential Equations, Numerical Methods for Solving Partial Differential Equations				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			1	
Computer Engineering and Software Systems			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

PHM115	Engineering Mathematics			3 CH
Prerequisites	Mathematics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Numerical solution of linear and Non-linear Equations, Eigenvalues, Error Analysis, Interpolation, Curve Fitting, Numerical Integration, First Order Differential Equations, Higher Order Differential equations, Laplace Transform, Numerical Methods for Solving Ordinary Differential Equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Material Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

PHM211	Discrete Mathematics					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Elementary number theory and methods of proof. Direct proof and counterexample: rational numbers, divisibility, division into cases and the quotient-remainder theorem, and floor and ceiling. Indirect argument: contradiction and contraposition and two classical theorems. Sequences, mathematical induction and recursion. Graphs and trees: definitions and basic properties; trails, paths, and circuits; matrix representations of graphs; isomorphisms of graphs; trees, rooted trees; spanning trees and shortest paths.						
Used in Program / Level						
Program Name or requirement				Study Level		
Computer Engineering and Software Systems Program				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

PHM211s	Discrete Mathematics					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Elementary number theory and methods of proof. Direct proof and counterexample: rational numbers, divisibility, division into cases and the quotient-remainder theorem, and floor and ceiling. Indirect argument: contradiction and contraposition and two classical theorems. Sequences, mathematical induction and recursion. Graphs and trees: definitions and basic properties; trails, paths, and circuits; matrix representations of graphs; isomorphisms of graphs; trees, rooted trees; spanning trees and shortest paths.						
Used in Program / Level						
Program Name or requirement				Study Level		
Computer and Systems Engineering Program				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
15%	15%		0%		70%	

PHM212	Complex, Special functions and Numerical Analysis			3 CH
Prerequisites	Differential and Partial Differential Equations			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Functions of complex variables and their derivatives, Complex integrals, Cauchy integral theorems, Complex series, Taylor and Laurent series, Singularities and the residue theorem, Conformal mapping. Special functions, Gamma and Beta function, Series solution of linear differential equations, Bessel functions and Legendre polynomials, Bessel and Legendre series, Numerical solutions for ordinary differential equations, Numerical solutions for partial differential equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communications Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

PHM212s	Complex, Special functions and Numerical Analysis			3 CH
Prerequisites	Differential and Partial Differential Equations			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Functions of complex variables and their derivatives, Complex integrals, Cauchy integral theorems, Complex series, Taylor and Laurent series, Singularities and the residue theorem, Conformal mapping. Special functions, Gamma and Beta function, Series solution of linear differential equations, Bessel functions and Legendre polynomials, Bessel and Legendre series, Numerical solutions for ordinary differential equations, Numerical solutions for partial differential equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communications Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	0%	70%	

<table>
<tr><td colspan="2">PHM213</td><td colspan="4">Complex, Special functions and Fourier Analysis</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="5">Differential and Partial Differential Equations</td></tr>
<tr><td colspan="7">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="3">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td colspan="7">Functions of complex variables and their derivatives. Complex integrals. Cauchy integral theorems. Complex series, Taylor and Laurent series. Singularities and the residue theorem, Conformal mapping. Special functions, Gamma and Beta function. Series solution of linear differential equations, Bessel functions and Legendre polynomials. Bessel and Legendre series, Continuous time Fourier transform: Definition, Basic concepts and properties.</td></tr>
<tr><td colspan="7">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="4">Communication Systems Engineering Program</td><td colspan="3">2</td></tr>
<tr><td colspan="7">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td colspan="2">25%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

E1.2 Physics Courses

PHM021	Vibration and Waves			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review of basic physical mechanics: Work, Kinetic energy, Potential energy, Conservation of energy, Conservative and non-conservative forces, Potential gradient and Power. Vibrations: Uniform circular motion, Simple harmonic motion, energy of a simple harmonic oscillator, Superposition of harmonic vibrations, Damped vibration, Forced vibration and resonance. Wave motion: Wave equation, Transverse and Longitudinal waves, velocity of sound waves, Intensity of sound waves and intensity levels, Standing waves, Interference and Diffraction of light.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

PHM021s	Vibration and Waves			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review of basic physical mechanics: Work, Kinetic energy, Potential energy, Conservation of energy, Conservative and non-conservative forces, Potential gradient and Power. Vibrations: Uniform circular motion, Simple harmonic motion, energy of a simple harmonic oscillator, Superposition of harmonic vibrations, Damped vibration, Forced vibration and resonance. Wave motion: Wave equation, Transverse and Longitudinal waves, velocity of sound waves, Intensity of sound waves and intensity levels, Standing waves, Interference and Diffraction of light.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	15%	15%	60%	

<table>
<tr><td colspan="2">PHM022</td><td colspan="8">Electricity and Magnetism</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Vibration and Waves</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">3</td><td colspan="4">1</td><td colspan="4">1</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Electricity: Review of vectors, Coulomb's law, Electric field, Electric flux, Gauss Law and its applications, Electric potential, Capacitance and Dielectrics, Electric current and RC circuits.
Magnetism: Magnetic field, Magnetic Force, Sources of Magnetic Fields, Ampere’s law, Faraday's Law, Electromagnetic induction, Magnetic properties of materials and AC circuits.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Faculty Requirement</td><td colspan="4">0</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">30%</td><td colspan="3">20%</td><td colspan="3">10%</td><td colspan="3">40%</td></tr>
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<table>
<tr><td colspan="2">PHM022s</td><td colspan="8">Electricity and Magnetism</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Registered in Vibration and Waves in a previous semester</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">3</td><td colspan="4">1</td><td colspan="4">1</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Electricity: Review of vectors, Coulomb's law, Electric field, Electric flux, Gauss Law and its applications, Electric potential, Capacitance and Dielectrics, Electric current and RC circuits.
Magnetism: Magnetic field, Magnetic Force, Sources of Magnetic Fields, Ampere’s law, Faraday's Law, Electromagnetic induction, Magnetic properties of materials and AC circuits.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Faculty Requirement</td><td colspan="4">0</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">10%</td><td colspan="3">15%</td><td colspan="3">15%</td><td colspan="3">60%</td></tr>
</table>

PHM121	Modern Physics and Quantum Mechanics			3 CH
Prerequisites	Mathematics (2), Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in special relativity, Planck's theory, Photoelectric effect, Compton effect, Wave properties of matter, Uncertainty principles, Wave function, Principles of quantum mechanics and Schrodinger equation, Quantum well and potential barrier, Simple harmonic oscillator, Tunneling phenomena. Band theory of solids: Periodic structures, Bloch function, Kronig-Pennymodel, Energy band structure of metals, insulators and semiconductors, Semiconductors under thermal equilibrium.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Communication Systems Engineering Program			1	
Computer Engineering and Software Systems Program			1	
Materials Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		10%	40%

PHM121s	Modern Physics and Quantum Mechanics			3 CH
Prerequisites	Registered in Mathematics (2), Electricity and Magnetism in a previous semester			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in special relativity, Planck's theory, Photoelectric effect, Compton effect, Wave properties of matter, Uncertainty principles, Wave function, Principles of quantum mechanics and Schrodinger equation, Quantum well and potential barrier, Simple harmonic oscillator, Tunneling phenomena. Band theory of solids: Periodic structures, Bloch function, Kronig-Pennymodel, Energy band structure of metals, insulators and semiconductors, Semiconductors under thermal equilibrium.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	15%		15%	60%

<table>
<tr><td>PHM122</td><td colspan="3">Physics of Semiconductors and Dielectrics</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Modern Physics and Quantum Mechanics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Crystal structure of solid, Miller indices, Types of bonding. Semiconductor in Equilibrium: Bonding model and energy band model, Fermi-Dirac distribution, Intrinsic carrier concentration, Doped semiconductors, Charge-neutrality Equation and Mass action law. Carrier transport phenomena: mobility, drift current, diffusion current and the Einstein relation. Nonequilibrium excess carrier in semiconductors: carrier generation and recombination, carrier life time and continuity equation. Dielectrics: Electric dipoles, Capacitors without and with dielectrics, Losses in dielectrics, Polarization vector and susceptibility, Local fields, Clausius-Mosotti relation, Microscopic models for polarization, Time and frequency response of dielectric materials.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Electrical Engineering Requirement</td><td colspan="2">1</td></tr>
<tr><td colspan="3">Communication Systems Engineering Program</td><td colspan="2">1</td></tr>
<tr><td colspan="3">Materials Engineering Program</td><td colspan="2">1</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td>0%</td><td colspan="2">40%</td></tr>
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<table>
<tr><td>PHM122s</td><td colspan="3">Physics of Semiconductors and Dielectrics</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Registered in Modern Physics and Quantum Mechanics in a previous semester</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Crystal structure of solid, Miller indices, Types of bonding. Semiconductor in Equilibrium: Bonding model and energy band model, Fermi-Dirac distribution, Intrinsic carrier concentration, Doped semiconductors, Charge-neutrality Equation and Mass action law. Carrier transport phenomena: mobility, drift current, diffusion current and the Einstein relation. Nonequilibrium excess carrier in semiconductors: carrier generation and recombination, carrier life time and continuity equation. Dielectrics: Electric dipoles, Capacitors without and with dielectrics, Losses in dielectrics, Polarization vector and susceptibility, Local fields, Clausius-Mosotti relation, Microscopic models for polarization, Time and frequency response of dielectric materials.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Electrical Engineering Requirement</td><td colspan="2">1</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>15%</td><td>15%</td><td>0%</td><td colspan="2">70%</td></tr>
</table>

PHM123	Thermal and Statistical Physics			3 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Basic Thermodynamics Terminology – Chemical Concepts - Mechanisms of Heat Transfer: Conduction, Convection and Radiation - Kinetic Theory and the Maxwell Distribution - Law of Equipartition- Distribution of Molecular Speeds - Heat Capacities - First Law of Thermodynamics – Reversible and irreversible processes - Second Law of Thermodynamics - Heat Engines and Heat Pumps - Entropy and its Microscopic Interpretation - Elementary Statistical Physics - The Fermi–Dirac Distribution - The Fermi Energy - Applications of the FD Distribution - the Bose–Einstein Distribution - Black–Body Radiation - Vibrations in a Solid – Phonons and Heat Capacity - Debye's Theory.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

E1.3 Mechanics Courses

PHM031	Statics			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Fundamentals of statics, Types of supports, Free Body Diagram (FBD), Equilibrium of system of particles under plane forces, Frames, Trusses and Machines, Space statics: Resultant of systems of space forces, Moments about a point and about an axis, Reduction of system of forces to one force and couple, Wrench, Equilibrium under system of space forces, Friction and its applications, Belt friction, Center of mass, Center of weight for single and composite bodies, Shearing forces and bending moment diagrams, Virtual work.				
Used in Program / Level				
Program Name or requirement		Study Level		
Faculty Requirement		0		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	25%	5%	40%	

PHM031s	Statics			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Fundamentals of statics, Types of supports, Free Body Diagram (FBD), Equilibrium of system of particles under plane forces, Frames, Trusses and Machines, Space statics: Resultant of systems of space forces, Moments about a point and about an axis, Reduction of system of forces to one force and couple, Wrench, Equilibrium under system of space forces, Friction and its applications, Belt friction, Center of mass Center of weight for single and composite bodies, Shearing forces and bending moment diagrams, Virtual work.				
Used in Program / Level				
Program Name or requirement		Study Level		
Faculty Requirement		0		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
5%	20%	5%	70%	

PHM032	Dynamics			3 CH
Prerequisites	Statics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Kinematics of particles, linear motion, Motion in resistive media, Study of curvilinear motion using: Cartesian coordinates, Cylindrical coordinate and Intrinsic coordinate, Relative motion, Kinetics of motion with applications on projectiles and harmonic motion, Work and energy, Applications on conservative and non conservative fields of forces, Impulse and impact, Newton's empirical formula, Impact of particle with fixed plane, Impact of two small balls, Introduction to vibration mechanics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	25%	5%	40%	

PHM032s	Dynamics			3 CH
Prerequisites	Registered in Statics in a previous semester			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Kinematics of particles, linear motion, Motion in resistive media, Study of curvilinear motion using: Cartesian coordinates, Cylindrical coordinate and Intrinsic coordinate, Relative motion, Kinetics of motion with applications on projectiles and harmonic motion, Work and energy, Applications on conservative and non conservative fields of forces, Impulse and impact, Newton's empirical formula, Impact of particle with fixed plane, Impact of two small balls, Introduction to vibration mechanics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
5%	20%	5%	70%	

PHM131	Rigid Body Dynamics				2 CH
Prerequisites	Dynamics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Geometrical properties: Moment of area, mass moments of inertia for single and composite bodies, product of inertia and principal moments of inertia. **Kinematics of single rigid body:**Types of motions, Instantaneous center of rotation, rolling without slipping and with slipping, **Kinetics of single rigid body:** Newton's and Euler equations, D'Alembert's principle and applications. Work and energy with application on conservative and non conservative fields of forces, Impact and impulsive motion, Linear and angular Impulses and momentums, Impact of rigid bodies and introduction to Analytical mechanics.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				1	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
30%	25%		5%	40%	

PHM031s	Rigid Body Dynamics				2 CH
Prerequisites	Registered in Dynamics in a previous semester				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Geometrical properties: Moment of area, mass moments of inertia for single and composite bodies, product of inertia and principal moments of inertia. **Kinematics of single rigid body:**Types of motions, Instantaneous center of rotation, rolling without slipping and with slipping, **Kinetics of single rigid body:** Newton's and Euler equations, D'Alembert's principle and applications. Work and energy with application on conservative and non conservative fields of forces, Impact and impulsive motion, Linear and angular Impulses and momentums, Impact of rigid bodies and introduction to Analytical mechanics.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				1	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
5%	20%		5%	70%	

E1.4 Chemistry Courses

PHM041	Engineering Chemistry			3 CH
Prerequisites	English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
Physical chemistry: Gases, Liquids, Solids. Thermochemistry, Thermodynamics, Solutions, Ionic equilibrium, Electrochemistry. Applied chemistry: Corrosion of metals, Alloys, Water chemistry and treatment, Chemistry of cements, Chemistry of polymers, Fuels and Combustion, Environmental pollution and its control				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

PHM041s	Engineering Chemistry			3 CH
Prerequisites	Egyptian High School Diploma (Thanaweya Amma) or an International General Certificate of Secondary Education (IGCSE) or Passing Math Placement Test or Basic Mathematics, English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125	Equivalent ECTS	5	
Course Content				
Physical chemistry: Gases, Liquids, Solids. Thermochemistry, Thermodynamics, Solutions, Ionic equilibrium, Electrochemistry. Applied chemistry: Corrosion of metals, Alloys, Water chemistry and treatment, Chemistry of cements, Chemistry of polymers, Fuels and Combustion, Environmental pollution and its control				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	15%	15%	60%	

PHM141	Introduction to Organic Chemistry			2 CH
Prerequisites	Engineering Chemistry			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Basic and fundamental principles of organic chemistry, overview of the properties and characteristics of organic molecules, key reactions, reaction mechanisms: structure, nomenclature, occurrence and uses of main classes of organic compounds; functional groups and their interconversion; character of chemical bonding; stereochemistry; structure and reactivity; acid/base reactions, resonance, inductive and steric effects; reaction mechanisms, nucleophilic and electrophilic reaction mechanisms; molecular rearrangements; radical reactions; organic synthesis. Petroleum and Petrochemicals: origin and classification of petroleum; types of crude oil; refining of petroleum; cracking; knocking, Octane number and factors affecting it. Gasoline, Diesel and biodiesel. Synthetic petrochemical.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Programs			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

PHM142	Reaction Kinetics and Chemical Analysis			3CH
Prerequisites	Introduction to Organic Chemistry			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	0		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
General concepts of equilibrium based on methods of detection, determination, and separation; equilibrium in aqueous and non-aqueous media; graphical presentation of equilibrium data; conditional equilibrium constants and alpha coefficients: analytical implications; generalities of kinetic methods of analysis. Reaction rates in chemical analysis. Introduction to instrumental methods of analysis, with emphasis upon electrometric and spectroscopic techniques and instruments. Includes sampling procedures, requirements of reagents and standards, and evaluation of errors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

PHM241	Electrochemistry			3 CH
Prerequisites	Engineering Chemistry			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Electrochemistry basics and concepts, conductivity and interaction in ionic systems, potential and structure at phase boundaries, potentials and currents, electrode reaction mechanisms, electrolyte systems, galvanic elements, analytical applications, spectrometry, photochemistry, applications of electrochemistry batteries, corrosion, electroplating, electrochemistry of polymers, etc.).				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

PHM242	Polymer Chemistry			3 CH
Prerequisites	Reaction Kinetics and Chemical Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to polymers, nomenclature and classification of polymers, raw materials for production of synthetic polymers, natural polymers, polymer structure, molecular weight and molecular weight distribution, chemical formation of polymers: polymerization, poly-condensation, polyaddition, commercial polymerization. Degradable polymers, stereo-regular polymers, copolymers, Aramids, the latest in polyamides, polyurethanes and commercial polymers				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

E2. Courses offered by Design and Production Engineering Department (MDP)

The Design and Production Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Engineering courses as a Faculty Requirement.
2. Several Basic Mechanical Engineering courses as a Mechanical Discipline Requirement.
3. Design and Production Engineering Program.
4. Materials Engineering Program.
5. Manufacturing Engineering Program.
6. Energy and Renewable Energy Engineering Program.

Table 44 List of specializations at the Design and Production Engineering Department.

#	Specialization
0	Graduation Projects
1	Design and Dynamics
3	Industrial Engineering
5	Material Engineering
8	Manufacturing

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 45 List of MDP courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
0. Graduation Projects																				
1	4	401	Mechanical Design & Production Graduation Pr. (1)	3	6	150	1	0	6	7				x	50	0	0	50	Elect.(1)	
2		402	Mechanical Design & Production Graduation Pr. (2)	3	6	150	1	0	6	7				x	50	0	0	50	MDP401	
3		403	Materials Engineering Graduation Project (1)	3	6	150	1	0	6	7				x	60	0	0	40	MDP354	
4		404	Materials Engineering Graduation Project (2)	3	6	150	1	0	6	7				x	60	0	0	40	MDP403	
1. Design and Dynamics																				
5	0	011	Engineering Drawing	3	6	150	1	3	2	6		x			40	20	0	40		
6	1	111	Mechanical Engineering Drawing	3	6	150	1	3	2	6			x		20	20	10	50	MDP011	
7		112	Machine Construction	3	5	125	2	2	0	4			x		25	25	0	50	PHM031	MDP111
8	2	211	Machine Elements Design	4	8	200	3	2	2	7			x		40	20	0	40	MDP112	
9		212	Mechanics of Machines	4	6	150	3	3	1	7			x		25	15	0	60	PHM131	
10	3	311	Mechanical Vibrations	4	7	175	3	2	1	6			x		25	15	0	60	PHM032	
11		312	Mechanical System Design	3	5	125	2	2	2	6				x	60	0	0	40	MDP211	
12	4	411	Introduction to Finite Elements	3	5	125	2	2	0	4				x	50	20	0	30	PHM112	MDP112
13		412	Noise & Vibration Control	3	5	125	2	2	1	5				x	20	20	0	60	MDP312	
14		413	Design Optimization	3	5	125	3	1	1	5				x	20	20	20	40	PHM112	MDP211
15		414	Product Design & Development	3	5	125	2	2	2	6				x	40	20	0	40		
16		415	Selected Topics in Mechanical Design	3	5	125	2	2	1	5				x	40	20	0	40	MDP312	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
3. Industrial Engineering																				
17		231	Engineering Economy	2	4	100	2	1	0	3		x			35	25	0	40		
18	2	232	Industrial Project Management	2	4	100	2	1	0	3		x			35	25	0	40		
19		233	Work Study and Plant Layout	4	5	125	3	2	0	5				x	35	25	0	40	PHM111	
20		331	Maintenance Planning and Scheduling	2	4	100	2	1	0	3			x		35	25	0	40		
21		332	Work Study	3	6	150	2	2	0	4			x		35	25	0	40	PHM111	
22	3	333	Operations Research	3	6	150	2	2	0	4			x		35	25	0	40	PHM013	PHM111
23		334	Principles of Operations Management	3	5	125	2	2	0	4				x	35	25	0	40	MDP331	
24		335	Production Planning and Scheduling	3	6	150	2	2	1	5				x	35	25	0	40	MDP334	
25		336	Facilities Layout and Design	3	5	125	2	2	0	4				x	35	25	0	40	MDP233	
26		431	Operations Management	3	6	150	2	2	0	4				x	35	25	0	40	MDP331	
27		432	Facilities Planning	3	7	175	2	2	0	4				x	35	25	0	40	MDP332	MDP333
28		433	Quality Control	3	5	125	2	2	0	4				x	35	25	0	40	PHM111	
29		434	Quality Systems & Assurance	3	5	125	2	2	0	4				x	35	25	0	40	PHM111	
30		435	Industrial Systems Modeling& Simulation	3	5	125	2	0	3	5				x	50	0	50	0	MDP431	MDP432
31	4	436	Production Planning & Control	3	5	125	2	2	0	4				x	35	25	0	40	MDP431	
32		437	Ergonomics	3	5	125	2	2	0	4				x	35	25	0	40	MDP332	
33		438	Simulation of Manufacturing Systems	3	6	150	2	0	3	5				x	35	25	0	40	MDP332	/MDP233
34		439	Lean Manufacturing Systems	3	5	125	2	2	0	4				x	35	25	0	40	MPD334	
35		440	Quality Assurance and Six Sigma	3	5	125	2	2	0	4				x	35	25	0	40	PHM111	
36		441	Industrial Technologies	2	4	100	2	1	0	3				x	50	10	0	40	MDP233	
5. Material Engineering																				
37		151	Structures & Properties of Materials	2	4	100	2	1	1	4		x			25	25	10	40	PHM041	
38	1	152	Metallurgy & Material Testing	3	5	125	3	1	1	5			x		10	10	20	60	MDP151	
39		153	Crystalline Structures of Materials	3	5	125	2	2	0	4				x	25	25	10	40	MDP151	
40		251	Casting & Welding (1)	3	4	100	2	2	1	5			x		20	10	10	60	MDP152	
41		252	Casting & Welding (2)	2	4	100	2	0	2	4				x	35	25	0	40	MDP081	MDP152
42		254	Thermodynamics of Materials	3	5	125	2	2	2	6				x	25	25	10	40	MEP111	
43	2	255	Materials Testing and Behavior	3	6	150	2	2	2	6				x	25	25	10	40	MDP151	
44		256	Phase Transformation and Heat Treatment	3	5	125	2	2	2	6				x	25	25	10	40	MDP152 /MDP153/	MEP212
45		257	Materials for Advanced Manufacturing Technology	2	4	100	2	1	1	4				x	25	25	10	40	MDP183	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
46	3	351	Industrial Furnaces and Heat Treatment	2	4	100	2	1	0	3				x	35	25	0	40	MDP152	
47		353	Polymer Materials	3	5	125	3	0	2	5				x	25	25	10	40	MDP151	PHM242
48		354	Industrial Project	3	6	150	1	0	6	7				x	60	0	0	40	MDP255	MDP256
49		355	Modern Ferrous and Non-Ferrous Making	2	4	100	2	1	0	3				x	35	25	0	40	MDP254	MDP256
50		356	Glass, Ceramics, and Binding Materials	3	5	125	2	2	0	4				x	35	25	0	40	MDP153	
51	4	451	Failure Analysis	3	5	125	3	0	1	4				x	10	10	20	60	MDP151	
52		452	Material and Process Selection	3	5	125	3	0	1	4				x	10	10	20	60	MDP151	
53		453	Composites Technology	3	5	125	3	0	1	4				x	10	10	20	60	MDP151	
54		454	Corrosion	3	5	125	3	0	1	4				x	10	10	20	60	MDP151	
55		455	Renewable Materials	3	5	125	2	2	2	6				x	50	10	0	40		
56		456	Petrochemicals and Polymer Products	2	4	100	2	1	0	3				x	35	25	0	40	PHM141	
57		457	Extractive Metallurgy	3	5	125	2	2	0	4				x	35	25	0	40	MDP183	MDP256
58		459	Corrosion Control and Cathodic Protection	3	5	125	2	2	0	4				x	35	25	0	40	MDP451	MDP454
59		460	Non-destructive Testing of Materials (1)	3	5	125	2	2	0	4				x	35	25	0	40	MDP255	
60		461	Non-destructive Testing of Materials (2)	3	5	125	2	2	0	4				x	35	25	0	40	MDP460	
61		462	Polymeric Processing Techniques	3	5	125	2	2	0	4				x	35	25	0	40	MDP353	
62		463	Materials for Energy Solution	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MDP353
63		464	Surfactants and lubricating Materials	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MDP353
64		465	Rubber and Sealing Materials	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MDP353
65		467	Polymer Testing	3	5	125	2	2	0	4				x	35	25	0	40	MDP353	
66		468	Materials Characterization	3	5	125	2	2	0	4				x	35	25	0	40	MDP255	
67		469	Glasses Materials and Technology	3	5	125	2	2	0	4				x	35	25	0	40	MDP356	
68		470	Ceramic Materials and Technology	3	5	125	2	2	0	4				x	35	25	0	40	MDP356	
69		471	Binding Materials and Technology	3	5	125	2	2	0	4				x	35	25	0	40	MDP356	
70		472	Biomedical Materials	3	5	125	2	2	0	4				x	35	25	0	40	MDP356	
71		473	Introduction to Nano technology	3	5	125	2	2	0	4				x	35	25	0	40	PHM121	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
8. Manufacturing																				
72	0	081	Production Engineering	3	5	125	2	0	3	5		x			25	15	10	50		
73		181	Manufacturing Technology (1)	3	5	125	3	0	2	5			x		20	25	15	40	MDP081	
74	1	182	Metal Forming Theory and Processes	3	6	150	2	1	3	6				x	35	25	0	40	MDP081	MDP151
75		183	Manufacturing Technologies	4	6	150	3	2	2	7				x	25	25	10	40	MDP081	
76	2	281	Metal Cutting Theory and Technologies	4	8	200	3	1	3	7				x	35	25	0	40	MDP081	
77		282	Non-Conventional Processing	2	4	100	2	0	2	4				x	35	25	0	40	MDP182	PHM041
78		381	Theory of Metal Forming	3	5	125	2	2	1	5				x	35	25	0	40	MDP181	
79		382	Theory of Metal Cutting	3	5	125	2	2	1	5				x	35	25	0	40	MDP181	
80		383	Metal Forming Technology, Machines and Dies	3	5	125	2	2	1	5				x	35	25	0	40	MDP181	
81	3	384	Metal Cutting Machines and Technology	3	6	150	2	2	2	6				x	35	25	0	40	MDP181	MDP211
82		385	Manufacturing Processes	2	4	100	2	1	1	4				x	35	25	0	40	MDP182	MDP281
83		386	Computer Aided Manufacturing	3	6	150	2	0	3	5				x	35	25	0	40	MDP281	
84		387	Metrology	3	5	125	2	0	3	5				x	20	25	15	40	MDP281	
85		481	Design of Tools & Production Facilities	3	4	100	2	2	0	4				x	35	25	0	40	MDP382	
86		482	Metrology & Measuring Instruments	4	8	200	3	0	5	8				x	20	25	15	40		
87		483	Computerized Numerical Controlled Machines	2	4	100	2	1	1	4				x	35	25	0	40	MDP382	
88		484	Product Life Cycle Management	3	5	125	2	1	2	5				x	35	25	0	40		
89		485	Advanced Topics in CNC Machine Tools	3	5	125	2	2	1	5				x	60	0	0	40	MDP483	
90		486	Selected Topics in Manufacturing	3	5	125	2	1	2	5				x	60	0	0	40		
91		487	Computer Integrated Manufacturing	3	5	125	2	2	1	5				x	35	25	0	40	MDP483	
92	4	488	Advanced Manufacturing Technology	3	5	125	2	2	0	4				x	35	25	0	40		
93		489	Selected Topics in Forming	3	5	125	2	1	2	5				x	60	0	0	40		
94		490	Die Design	3	6	150	2	3	0	5				x	35	25	0	40	MDP281	MDP211
95		491	Design of Jigs and Fixtures	2	6	150	2	2	0	4				x	35	25	0	40	MDP211	MDP385
96		492	Advanced Manufacturing Systems	3	6	150	2	2	1	5				x	35	25	0	40	MDP387	
97		493	Additive Manufacturing	3	5	125	2	2	0	4				x	35	25	0	40	MDP462	
98		494	Advanced Manufacturing Technology & Prototyping	3	5	125	3	1	1	5				x	25	25	10	40	MDP181	/MDP183/

E2.0Graduation Projects

MDP401	Design and Production Engineering Graduation Projects (1)			3 CH
Prerequisites	Concentration Elective (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	150		Equivalent ECTS	6
Course Content				
Identification of a real life problem related to the program in general and the concentration in specific, Setting the overall objectives of the project and specific objectives of Project(1), Collecting data from the field, market and/or literature, Proposing engineering solutions, Developing conceptual ideas/designs, Conducting preliminary analyses, Comparing different ideas based on technical aspects, Selection of the solution approach.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

MDP402	Design and Production Engineering Graduation Projects (2)			3 CH
Prerequisites	Design and Production Engineering Graduation Projects (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	150		Equivalent ECTS	6
Course Content				
Setting the specific objectives of Project(2), Implementation of the solution(s) proposed in Project (1), Conducting necessary analyses, Developing necessary drawings, calculations, and models, Selecting appropriate materials, Using contemporary software tools, manufacturing of physical prototypes or physical models if necessary, testing and validation of the developed systems, Estimation of costs and necessary resources, Technical reporting of the project, Presenting the project activities and outcomes.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

MDP403	Materials Engineering Graduation Project (1)			3 CH
Prerequisites	Industrial project			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	150		Equivalent ECTS	6
Course Content				
Under supervision, the student should approach his graduation project within his Senior year. The purpose of this graduation project is to provide students with an opportunity to engage in an activity that will allow them to demonstrate their ability to apply the knowledge and skills they have gained throughout their years in the educational system. The project is designed to ensure that students are able to apply, analyze, synthesize, and evaluate information and to communicate significant knowledge and understanding. Problems/ topics to be considered should be materials engineering oriented, in any of the related disciplines offered by the faculty.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

MDP404	Materials Engineering Graduation Project (2)			3 CH
Prerequisites	Materials Engineering Graduation Project(1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	150		Equivalent ECTS	6
Course Content				
This graduation project may be seen as a continuation of the first part (MDP 491: Graduation Project (1)) of a major topic, or it might be a new subject that the student is considering proving his competence in materials engineering practice.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

E2.1 Design and Dynamics Courses

MDP011	Engineering Drawing			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		3		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Engineering drawing techniques and skills. Conventional lettering and dimensioning. Geometric constructions. Theories of view derivation. Orthographic projection of engineering bodies. Derivation of views from isometric drawings and vice versa. Derivation of views and sections from given views. Sectioning views: (half, removed, rotates, offset and partial sectioning). Introduction of assembly drawing. Computer aided drafting (CAD).				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

MDP111	Mechanical Engineering Drawing			3 CH
Prerequisites	Engineering Drawing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		3		2
Required SWL	150		Equivalent ECTS	6
Course Content				
In the tutorial these contents will be covered: Introduction to Machine parts and assembly drawing, Types of threaded fasteners and washers, Internal and external Thread Standards, definitions and drawings, Bearing drawings, types of fittings, Fits and Tolerances, Geometrical Tolerances, Surface Finish. Exercises on assembly drawings such as: crane hook, stuffing box, valves, grinding wheel drive, worm and worm gear, machine vice, hand press, transmission shaft, …,etc. In the Lab. These contents will be covered: Introduction to solid modeling on a CAD software such as Solidworks, Inventor, or any other CAD, Sketcher workbench, Solid workfeatures: applied features, pattern features, fillets, design tables. 3D Modeling techniques;3D Part design, Parametric part design. 3D Assembly. 3D animation. Drafting and 2D drawings: basics, cross sections, dimensions, fits and tolerance. Sheet metal design; Weldmentfeatures.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			1	
Energy and Renewable Energy Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	10%	50%	

MDP112	Machine Construction			3 CH
Prerequisites	Mechanical Engineering Drawing, Statics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Loading Diagrams, General concepts of Stress and Strain, Types of Stresses (Normal Stresses and Shear Stresses), Combined Stresses, Theories of Elastic Failure, Safety Factor. Constructional details as affected by manufacturing, assembly, and strength considerations, Connections (Centering, Flanged, Riveted, Keyed, Splined, Screwed), Power Screw and its joints, Seals, Springs, Stress Concentrations, Reverse Engineering.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Energy and Renewable Energy Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

MDP211	Machine Elements Design			4 CH
Prerequisites	Machine Construction			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	200		Equivalent ECTS	8
Course Content				
Introduction to Design Concepts, General Concepts of (Deflection, Buckling and Thermal Stresses), Design for Fatigue, Design of Machine Elements (Bolts, Power Screws, Rivets, Keys, Welded Joints, Springs), Design of Power Transmission Elements (Shafts, Couplings, Gears, Belt Drives, Chain Drives), Selection of Bearings, Design of Pressure Cylinders. Use of interactive Finite Element computer programs for problem solving is illustrated and used.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Energy and Renewable Energy Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exams	Final Exam	
40%	20%	0%	40%	

MDP212	Mechanics of Machines				4 CH
Prerequisites	Rigid Body Dynamics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		3		1	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Mechanisms: Definitions,open-chain systems, closed-chain systems constraints, degrees of freedom, reference frames, inversions of four linkage (lower pair) mechanisms, slotted lever mechanism, steering mechanisms, inversions of mechanisms,Hook's joint, and synthesis of mechanisms. **Kinematics**:Kinematics of rigid bodies, position analysis, velocity analysis, acceleration analysis, rotation representations, Euler angles,rotation matrix, homogeneous transformation matrix, direct and inverse kinematics. **Dynamics:**Equilibrium of machines, D'Alembert's principle, force analysis, power analysis, Friction and inertia-effects, center of percussion, flywheel design. **Kinetics of single degree of freedom mechanisms:** Free body diagrams, Static equilibrium, Equation of motion. **Cams:**Types of cams, types of followers, kinematics and kinetics of cam. **Gears:** Concept of gear motion transmission, gear geometry and gear trains.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	15%		0%	60%	

MDP311	Mechanical Vibrations				4 CH
Prerequisites	Dynamics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		2		1	
Required SWL	175		Equivalent ECTS	7	
Course Content					
Introduction, Vibration of single degree of freedom systems (free, damped, forced), Vibration isolation, Vibration of two degree of freedom systems (free, forced), Vibration absorber, Torsional vibrations (free, forced), Equivalent torsional systems: Geared system, Crank system, Multi-degree-of-freedom systems, Continuous systems: bending of shafts, analytical solution, balancing of rotary mass,Whirling of shafts, Vibration measurements.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	15%		0%	60%	

MDP312	Mechanical System Design			3 CH
Prerequisites	Machine Elements Design, Hydraulics and Pneumatics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	2	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Project work (mainly an industrial problem with focus on detail design in a system context).Innovation, creativity and patent. Information sources and search, benchmarking. The product development process, project planning. Requirement specification, QFD. Concept development, functions-means tree, concept selection. Detail design, considering environmental effects, material selection, ergonomics. Solid mechanics for modeling and dimensioning (both using FEM and analytical). Manufacturing documents (detail drawings including manufacturing tolerances).Assembling, testing, evaluation, redesign. Presentation and communication, both orally and in different form of written documentation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

MDP411	Introduction to Finite Elements			3 CH
Prerequisites	Differential Equations and Numerical Analysis, Machine Construction			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Overview and Introduction to Variational Methods, Bar Problem, Truss problem, Two dimensional plate problem: Plane stress, Plane strain, Numerical integration, Beam bending problem, Buckling of beams, MATLAB programming of all problems, FE Applications Using Software Packages, Eigenvalue Problems (Structural Dynamics/Buckling of Beams)				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration				
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	20%	0%	30%	

<table>
<tr><td colspan="3">MDP412</td><td colspan="6">Noise and Vibration Control</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="7">Mechanical Vibrations</td></tr>
<tr><td colspan="10">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="3">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="3">2</td><td colspan="3">1</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="10">Course Content</td></tr>
<tr><td colspan="10">Introduction, fields of application, effect of sound and vibration on man and equipment. Fundamental Concepts, Signal Analysis and Measurement Techniques, Vibrations of simple mechanical systems, Continuous systems in 1D, and mode shapes, Introduction to 2-dimensional systems, Building Acoustics and sound propagation outdoors, Sound in Ducts and Flow induced vibrations, Principles of noise and vibration control, Study of the sound and vibration of selected machines, Standards and Regulations.</td></tr>
<tr><td colspan="10">Used in Program / Level</td></tr>
<tr><td colspan="7">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="7">Design and Production Engineering Program concentration</td><td colspan="3"></td></tr>
<tr><td colspan="10">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="2">20%</td><td colspan="3">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td colspan="3">MDP413</td><td colspan="6">Design Optimization</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="7">Differential Equations and Numerical Analysis, Machine Elements Design</td></tr>
<tr><td colspan="10">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="3">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="4">3</td><td colspan="3">1</td><td colspan="3">1</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="10">Course Content</td></tr>
<tr><td colspan="10">Principles of optimization in design process, design variables, objective functions, constraints, optimization problem formulation, optimality criteria and conditions, single-variable optimization, graphical optimization, multivariable optimization without constraints and with constraints, Linear, quadratic, nonlinear and dynamic programming optimization problems. Evolutionary design algorithms for global optimization such as genetic algorithm. Structural Optimization: size optimization, Shape optimization, Topology optimization. Automated design optimization and design exploration. All design optimization examples in this course will be on mechanical structures and machine elements such as cantilevers, beams, coil springs, shafts, pressure vessels, bars, trusses, cross section shapes ...etc.</td></tr>
<tr><td colspan="10">Used in Program / Level</td></tr>
<tr><td colspan="7">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="7">Design and Production Engineering Program concentration</td><td colspan="3">4</td></tr>
<tr><td colspan="10">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="2">20%</td><td colspan="3">20%</td><td colspan="2">40%</td></tr>
</table>

MDP414	Product Design and Development			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Design Methodologies, Product Development Process, Task Clarification, Generic Design Process (Conceptual, Embodiment, Detail, Robust, Modular, System), Design for X, DFM, DFA, DFMA, Product Design and Development – Case Studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

MDP415	Selected topics in Mechanical Design			3 CH
Prerequisites	Mechanical System Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Contemporary topics in mechanical design, Multi-objective design, Design for X, Design optimization, Innovation in mechanical design, software and hardware tools for mechanical design, Design standardization, etc.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E2.3Industrial Engineering Courses

MDP231	Engineering Economy						2 CH
Prerequisites							
Number of weekly Contact Hours							
Lecture			Tutorial			Laboratory	
2			1			0	
Required SWL		100		Equivalent ECTS		4	
Course Content							
Origins of engineering economy, Principles of engineering economy, Design and manufacturing processes and EE, Cost estimation and cost terminology, Accounting, Balance sheet, Profit loss statement, Concept of equivalence, Money time relationships, Simple and compound interest rates, Single amounts and uniform series, Increasing and decreasing gradient, Application of money, Time relationships, Present value, Internal rate of return, External rate of return, Payback period, Evaluation of alternatives for different useful life and study period, Depreciation methods, Replacement analysis, Determination of the economic life of challenger and defender, Engineering economy techniques for evaluation of public projects.							
Used in Program / Level							
Program Name or requirement					Study Level		
Faculty Requirement Elective							
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
35%		25%		0%		40%	

MDP232	Industrial Project Management						2 CH
Prerequisites							
Number of weekly Contact Hours							
Lecture			Tutorial			Laboratory	
2			1			0	
Required SWL		100		Equivalent ECTS		4	
Course Content							
Definitions used in project management, The project life cycle, Project stages, Relationships and responsibilities of the different project parties, Work Breakdown Structure (WBS) and Linear Responsibility Chart (LRC), Project Scheduling, Network planning: Activity on arrow, Activity on node, CPM, PERT, Progress monitoring, Project crashing, Progress curves, Resource allocation and levelling. Project productivity, Quality management.							
Used in Program / Level							
Program Name or requirement					Study Level		
Faculty Requirement Elective							
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
35%		25%		0%		40%	

MDP233	Work Study & Plant layout			4 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Productivity: Factors affecting productivity and role of management, Introduction to work study: Objectives, Techniques applied, Method study techniques: Charts and diagrams, Critical examination and analysis, Developing new methods, Measures and controls, Work measurements: Direct and indirect methods, Relaxation allowances and calculation of standard time, Learning curves: Concept, Application in work study and determination of standard time, workers incentives. Plant layout objectives and requirement, Work station layout, SLP, Setting the Layout.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP331	Maintenance Planning and Scheduling			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction and concepts in maintenance management, Maintenance organization, Types of maintenances: preventive, predictive, programed, emergency, repair, etc. Maintenance planning and scheduling, spare parts management and control. Total Productive Maintenance (TPM), maintenance information system, maintenance cost, maintenance safety. Different approaches to evaluate Overall Equipment Effectiveness (OEE) and understanding Six Major Equipment Losses.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP332	Work Study			3 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Productivity: Factors affecting productivity and role of management, Introduction to work study: Objectives, Techniques applied, Method study techniques: Charts and diagrams, Critical examination and analysis, Developing new methods, Measures and controls, Work measurements: Direct and indirect methods, Relaxation allowances and calculation of standard time, Learning curves: Concept, Application in work study and determination of standard time, workers incentives				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP333	Operations Research			3 CH
Prerequisites	Mathematics (2), Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Linear programming: Formulation, Graphical solution, Simplex method, and Duality and sensitivity analysis, Transportation models: Transportation algorithm, Assignment problem and transshipment problem, Network models: Minimal spanning tree algorithm, Shortest route problem and Maximum flow problem, Branch and bound algorithm,				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP334	Principles Operations Management			3 CH
Prerequisites	Engineering Economy			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	175		Equivalent ECTS	7
Course Content				
Competitiveness, Strategy and Productivity, Forecasting and time series analysis (qualitative techniques: Sales force polling, Customers' opinion, Delphi technique, Quantitative techniques: Smoothing methods, Averaging Methods, Linear regression), Product and service design, Capacity planning (defining capacity, rough-cut capacity planning, detailed capacity planning), Aggregate production planning,				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP335	Production Planning and Scheduling			3 CH
Prerequisites	Principles of Operations Management			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Inventory management and control (determining optimal order quantity, optimal production quantity, safety stock), Materials requirement planning, Enterprise resources planning, Production scheduling and sequencing, Assembly line balancing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP336	Facilities Layout and design		3 CH
Prerequisites	Work Study and Plant Layout		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction to production systems, Types and characteristics of production systems, Product and Process design, Quantitative and qualitative data, Number of machines and manpower, Quantitative and qualitative techniques for construction of initial layout, improvement layout techniques, Computerized layout techniques, Single facility location problem, Assembly line balancing,Warehouse design, Introduction to materials handling equipment and systems, Setting the facility plan, Lighting and environmental considerations, factories utilities, office layout and labor services.			
Used in Program / Level			
Program Name or requirement	Study Level		
Manufacturing Engineering Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

MDP431	Operations Management		3 CH
Prerequisites	Engineering Economy		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	150	Equivalent ECTS	6
Course Content			
Forecasting and time series analysis (qualitative techniques: Sales force polling,, Customers' opinion, Delphi technique, Quantitative techniques: Smoothing methods, Averaging Methods, Linear regression), Capacity planning(defining capacity, rough-cut capacity planning, detailed capacity planning), Aggregate production planning, Inventory management and control (determining optimal order quantity, optimal production quantity, safety stock), Materials requirement planning, Work loading and scheduling.			
Used in Program / Level			
Program Name or requirement	Study Level		
Design and Production Engineering Program	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

MDP432	Facilities Planning			3 CH
Prerequisites	Work Study, Operations Research			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	175		Equivalent ECTS	7
Course Content				
Introduction to production systems, Types and characteristics of production systems, Types of layouts, Advantages and disadvantages of each, Layout objectives, Types of layout data, Quantitative and qualitative data, Construction of flow matrix, Construction of activity relationship chart, Space determination, Number of machines and manpower, Quantitative and qualitative techniques for construction of initial layout, improvement layout techniques, Computerized layout techniques, Evaluation of solutions and selection of the optimum, Single facility location problem, Introduction to materials handling equipment and systems				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP433	Quality Control			3 CH
Prerequisites	Probability and statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
History of quality control Quality definitions and concepts, Process capability analysis, Theory of control charts, Statistical control charts for attributes, Statistical control charts for variables, Acceptance sampling: Principles and concepts, Acceptance sampling by attributes, Acceptance sampling by variables.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP434	Quality Systems and Assurance			3 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Basic concepts, Definitions, Terminology, Development of quality control systemsQuality systems for: design, development, purchasing, and Planning, Quality organization, Cost of quality, Economics of quality, Training, Quality Management Systems, Quality assurance, Employee participation programs.				
Used in Program / Level				
Program Name or requirement		Study Level		
Design and Production Engineering Program Concentration		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP435	Industrial Systems Modelling and Simulation			3 CH
Prerequisites	Facilities planning, Operations Management			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		3	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Introduction to industrial systems modelling, Basic simulation models, Modelling complex systems, Discrete event simulation, hand simulation, Simulation software, Building simulation models, Output data analysis for a single system, Comparing alternative system configurations, Variance reduction techniques, Sensitivity analysis, Simulation of manufacturing systems.				
Used in Program / Level				
Program Name or requirement		Study Level		
Design and Production Engineering Program Concentration		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	50%	0%	

MDP436	Production Planning and Control				3 CH
Prerequisites	Operations Management				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Operations strategy in global economy; strategic management inputs; strategic actions (strategy formulation and implementation); product process and service design; operations technologies; strategic allocation of resources; supply chain management; decision making and planning with uncertainty; cost management; enterprise resource planning; lean synchronization; operations improvement; risk management.					
Used in Program / Level					
Program Name or requirement			Study Level		
Design and Production Engineering Program Concentration			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP437	Ergonomics				3 CH
Prerequisites	Work Study				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
A Systematic approach to the optimization of the human task environment system: Workspace design, Manual materials handling, Cumulative trauma disorders and environmental factors, Emphasis on industrial applications, Ergonomics process, Anatomy, Anthropometry, Workplace design, Hand use design, Office ergonomics, Handling loads, Work physiology, Design for special populations, Information processing, Noise, Vibration, illumination, Control and display design.					
Used in Program / Level					
Program Name or requirement			Study Level		
Design and Production Engineering Program Concentration			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP438	Simulation of Manufacturing Systems			3 CH
Prerequisites	Work Study or Work Study and Plant Layout			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	150		Equivalent ECTS	6
Course Content				
Introduction to industrial systems modelling, Basic simulation models, Modelling complex systems, hand simulation, Discrete event simulation, Simulation software, Building simulation models, Output data analysis for a single system, Comparing alternative system configurations, Simulation of manufacturing systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP439	Lean Manufacturing System			3 CH
Prerequisites	Principles of Operations Management			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Fundamentals of lean manufacturing principles. Toyota house, seven wastes, Push verse Pull systems and JIT, Kanban system, Kanban size and number, CONWIP. Value stream mapping: How to construct the current state map, improvement tools Kaizen, Poka-a-Yoke, 5S. Takt time calculations and production leveling.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35 %	25 %	0 %	40 %	

<table>
<tr><td>MDP440</td><td colspan="3">Quality Assurance and Six Sigma</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Probability and Statistics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Quality control systems, Quality systems for: design, development, purchasing, and Planning, Quality organization, Cost of quality, Training, Quality Management Systems, Quality assurance, ISO 9000 principles, other certification (CE mark, OSHA, … etc.), Employee participation programs. Six Sigma principles, Six Sigma as tool for development.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Manufacturing Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35 %</td><td>25 %</td><td>0 %</td><td colspan="2">40 %</td></tr>
</table>

<table>
<tr><td>MDP441</td><td colspan="3">Industrial technologies</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Work Study and Plant Layout</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td>0</td></tr>
<tr><td>Required SWL</td><td>100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Primary, secondary tertiary and Quaternary economies and their relation to manufacturing activities. Different types of industries and technologies used in various industries such as food industries, apparel industries, building materials industries, petrochemical industries. A focus will be made on the different equipment, characteristics and considerations related to each industry.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Manufacturing Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>50%</td><td>10%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

E2.5Materials Engineering Courses

MDP151	Structures and Properties of Materials			2 CH
Prerequisites	Engineering Chemistry			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Engineering materials: metals, polymers, ceramics, and composites. The internal structure of material: atomic structure, atomic arrangement, microstructure, andmacrostructure. Good exploitation of the material requirements for a set of properties suitable for this use. Material properties: physical, chemical, mechanical, electrical, thermal, and optical properties. Relationship between material properties and its internal structure, method of synthesizing, manufacturing, processing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

MDP152	Metallurgy and Material Testing			3 CH
Prerequisites	Structures and Properties of Materials			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
This course provides a general treatment of the principles and problems of engineering materials and testing with specific reference to the mechanical properties. It also covers the common methods of static and dynamic testing: tension, compression, bending, shear, hardness, impact, creep and fatigue. Other topics are also included namely the types of fracture and the non-destructive testing of materials.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	10%	20%	60%	

MDP153	Crystalline Structures of Materials				3 CH
Prerequisites	Structure and properties of materials				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Solidification processes, nucleation, crystal growth, crystal geometry, physical properties of crystals, Miller indices, x-ray diffraction methods for the determination of crystalline structures and chemical compositions, electron and neutron diffraction methods, crystalline defects, dislocations, crystal and phase boundaries, precipitation and segregation, revision of Gibbs free energy rules, cooling curves, phase diagrams, phase transitions, tertiary phase diagrams.					
Used in Program / Level					
Program Name or requirement				Study Level	
Materials Engineering Program				1	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	25%		10%	40%	

MDP251	Casting and Welding(1)				3 CH
Prerequisites	Metallurgy and Material Testing				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Metal casting technology: Introduction, Solidification processing, Liquid metals, Principles of solidification, Primary (wrought) and casting, Metals and alloys, Production of primary metals, Production of shaped casting, Patterns, Molding techniques: Molding techniques and dynamics, Melting procedures and equipment, Design considerations, Structure, Properties and defects of casting, Casting process selection, Computer applications in metal casting, Quality control in casting, advanced casting processes. Metal Welding Definition, Welding Joints, Welding Standards, Welding Symbols, Fusion Welding Processes, Solid State Welding Processes, High Energy Welding Processes, Heat Flow in Metal Welding, Chemical Reactions & Fluid Flow in Arc Welding, Solidification of Fusion Zone, Weldability & Cracking Susceptibility, Welding Defects, and Inspection of Welded Joints.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Engineering Requirement				2	
Manufacturing Engineering Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	10%		10%	60%	

MDP252	Casting & Welding (2)			2 CH
Prerequisites	Production Engineering, Metallurgy & Material testing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		2
Required SWL	100		Equivalent ECTS	4
Course Content				
Casting techniques: die casting, continuous casting, centrifugal casting, ribbon casting, rheocasting, investment casting, casting defects and remedy, Codes of cast inspection., Design considerations, Computer applications in metal casting and flow patterns. Advanced welding operations: Laser welding, Electron beam welding, Friction stir welding of different alloys and post weld heat treatment and dissimilar materials, Ultrasonic welding (USW)				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP254	Thermodynamics of materials			3 CH
Prerequisites	Thermal physics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Thermodynamic activity in solid and liquid systems, Gibbs free energy of solutions, entropy and enthalpy, binary phase diagrams, equilibrium constant, reaction equilibrium in gases, heats of reactions, stoichometric phases with complex gas phases, mixed gas thermodynamics, Ellingham diagrams.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	25%		10%	40%

<table>
<tr><td colspan="3">MDP255</td><td colspan="7">Materials Testing and Behavior</td><td colspan="2">3CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Structures and Properties of Materials</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">2</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Mechanical testing methods to produce data that will be used for design purposes or as part of a material joining procedure or operator acceptance scheme. Different mechanical testing (tensile, compression, bending, impact, hardness, fatigue, creep, etc.), factors affecting mechanical properties, introductory to some nondestructive testing. Material response to different external forces, factors affecting the mechanical behavior of materials, true stress-true strain relation and idealized models of deformation of materials, elastic and plastic deformation, yielding criteria, treatment of multiaxial stresses and strains, physical models (rheological) for elastic, plastic and creep deformation.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Materials Engineering Program</td><td colspan="4">2</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">25%</td><td colspan="3">25%</td><td colspan="3">10%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="3">MDP256</td><td colspan="7">Phase Transformations and heat treatment</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Heat transfer, Crystalline Structures of Materials</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">2</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">The use of heat treatment to produce required metallurgical properties, Cooling curves and equilibrium diagrams, Heat treatment of steels, phase transformations (e.g., martensitic transformations), Hardenability, Strength, and Toughness, Case hardening, Carburizing, and Nitriding, De-carburizing, Re-heat treatment, Re tempering, Annealing, and Normalizing, Heat treatment of Aluminum alloys, Annealing, Solution treatment, Natural ageing, Artificial ageing, Over ageing, Explanation of the heat treatment of Aluminum alloys, Control testing.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Materials Engineering Program</td><td colspan="4">2</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">25%</td><td colspan="3">25%</td><td colspan="3">10%</td><td colspan="3">40%</td></tr>
</table>

MDP257	Materials for Advanced Manufacturing Technology				2 CH
Prerequisites	Manufacturing Technologies				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL		100	Equivalent ECTS		4
Course Content					
Advanced materials, advanced manufacturing techniques, mechanical, physical and electrical properties of materials used in advanced manufacturing technology, materials requirements in advanced manufacturing techniques. Electrical discharge machining (EDM), electrochemical machining (ECM), photochemical machining (PCM), ultrasonic machining, lasers cutting, plasma Cutting, rapid prototyping, hybrid machining, etc.					
Used in Program / Level					
Program Name or requirement			Study Level		
Materials Engineering Program			2		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	25%		10%	40%	

MDP351	Industrial Furnaces and Heat Treatment				2 CH
Prerequisites	Metallurgy and Materials testing				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		100	Equivalent ECTS		4
Course Content					
Classification of furnaces, Thermal furnaces (melting, drying, roasting, sintering and heat treatment), heat exchange and insulation materials, heat transfer and furnace design, fuel fired furnace, electric furnace, batch versus continuous furnaces, Elements of heat treating process, heat treatment types (stress relief, solution treatment, annealing, normalizing, quenching, tempering, ageing), heat treatment of steels, cast iron and nonferrous alloys. case hardening, nitriding and carbonizing, surface hardening.					
Used in Program / Level					
Program Name or requirement			Study Level		
Design and Production Engineering Program Elective			4		
Manufacturing Engineering Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP353	Polymer Materials			3 CH
Prerequisites	Structures and Properties of Materials, Polymer Chemistry			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	0		2	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Structure of amorphous and crystalline polymeric materials, mechanical, electrical and optical properties and their modification through processing, Newtonian and non-Newtonian behavior, viscoelastic behavior, viscosity, review on destructive and non-destructive testing, mechanical analysis (DMA, TMA), quick overview on polymer processing technologies.				
Used in Program / Level				
Program Name or requirement		Study Level		
Materials Engineering Program		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	10%	40%	

MDP354	Industrial Project			3 CH
Prerequisites	Materials Testing and Behavior, Phase Transformations and Heat Treatment			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	0		6	
Required SWL	150	Equivalent ECTS	6	
Course Content				
The project is to be completed within the student's junior year. The student is requested to consider a simple engineering problem that is materials engineering related. The student should analyze the problem and find a systematic approach towards solving the problem. Practical work to achieve the goals are accomplished, the stages and results are analyzed. By the end the student is requested to submit a technical report and make an oral presentation to persuade the audience of his approach.				
Used in Program / Level				
Program Name or requirement		Study Level		
Materials Engineering Program		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

MDP355	Modern Ferrous and Non-Ferrous Making			2CH
Prerequisites	Phase Transformations and Heat treatment, Thermodynamics of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Types of Metals, History of metals making, Status of steel and nonferrous metal making in Egypt and world, Steel, Aluminum, copper, Magnesium and Titanium production and consumption, metals making fundamentals: Solution thermodynamics, Role of slag in steelmaking, properties of slag. Steel making fundamentals: Steelmaking reactions such as oxidation of carbon, silicon, manganese, iron, phosphorous and chromium, Numerical problems, Role of refractory. Steel making practice: Bessemer and open-hearth steel making, Blast furnace iron making, Basic oxygen steel making, Electric furnace steel making and vacuum treatment, ladle metallurgy, deoxidation and teeming practice, ingot production, ingot defects and remedies, testing of steel products, inspection of steel products. Clean steel, ingot and continuous casting, final finishing operations like heat treatment and deformation processing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	10%	40%	

MDP356	Glass, Ceramics, and Binding Materials			3CH
Prerequisites	Crystalline Structures of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the non-metal and non-polymer class of materials, including glass, Ceramics and binding materials. Principles of glasses: glassy status, structure, thermodynamics, examples of glass formation (silicate, borate glasses), viscosity and brittleness, density and thermal strain, heat capacity and heat transfer, failure, dispersion and optic glasses, absorption, Ligandenfeld theory, coloration, ionic construction, electric conduction, dielectric loss, chemical resistance, corrosion, aging, dissolution, permeability, diffusion. Principles of ceramics: review on atomic structure (silica ceramics, oxide ceramics, non-oxide ceramics), characteristics. Principles of adhesive agents and construction materials: physical and chemical principles of multi material systems, Portland cements, other cements, calk, Testing and standardization, development of mineral adhesive agents.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP451	Failure Analysis			3 CH
Prerequisites	Structures and Properties of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		1
Required SWL	125		Equivalent ECTS	5
Course Content				
General approaches of Failure Analysis: data and sample collection, preliminary examination, non-destructive inspection, macroscopic and microscopic examination of metallographic sections and fractured surfaces, modes of failure (ductile, brittle) causes of failure (overloads, fatigue, creep, corrosion, wear, elevated temperature failures, etc.), solve the problems of cracks' initiation and propagation, writing a standardized failure technical report, and failure prevention recommendations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	10%		20%	60%

MDP452	Material and Process Selection			3 CH
Prerequisites	Structures and Properties of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Review traditional methods and new developments. Learn how a new material or manufacturing process can offer new design opportunities. Novel Strategies for Materials and Process Selection: Using 'material-selection charts' as a way of putting material performance and cost into perspective. Extracting criteria for materials and process selection from design requirements. The Concept of Optimal Selection: Maximizing performance and minimizing material cost or environmental impact by incorporating the concepts of cost, price and utility into the selection process. Optimal selection of material and shape: the interaction of material and shape in mechanical design. Database design and quality assurance: Types and sources of data, the structure of engineering selection, principles for designing selection databases, data checking, demonstration of commercial software Constructor data input module. Hands-on experience: Materials and process selection software and database creation software: demonstrations, and exercises.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	10%		20%	60%

MDP453	Composite Technology			3 CH
Prerequisites	Structures and Properties of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the concepts of composite materials, matrix, reinforcement and interface, engineering matrices and reinforcements, production techniques for common reinforcing fibres, intrinsic properties of matrix materials and fibres, mechanical properties and fabrication of engineering composites including MMCs PMCs and CMCs, introduction to the mechanics of composites, rule of mixtures, methods for interfacial characterization.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	10%		20%	60%

MDP454	Corrosion			3 CH
Prerequisites	Structures and Properties of Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction, corrosion types, atmospheric corrosion, principles of cathodic protection, corrosion by soils, corrosion by water and steam, localized corrosion, fundamentals of inhibitors, stress corrosion, metallurgical factors affecting corrosion, at high temperature, alloy behavior at high temperature, coatings, corrosion testing, materials for corrosive environments, analysis of corrosion failure.				
Used in Mechanical/ Level 4				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	10%		20%	60%

MDP456	Petrochemicals and polymer products			2 CH
Prerequisites	Introduction to Organic Chemistry			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Origin and classification of petroleum; types and chemical composition of crude oil, routine laboratory tests of crude oil, Manufacturing Processes and Refinery of petroleum (Separation, Conversion and Refining and Treating); physical parameters of petroleum products (cracking; knocking, Diesel index, Octane number and factors affecting it. Gasoline), Effect of Sulphur compounds upon petroleum products, Diesel and biodiesel. Natural gas, Petrochemical process, Synthetic petrochemical, Petrochemical products based on natural gas and synthesis gas.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP457	Extractive Metallurgy			3CH
Prerequisites	Manufacturing Technologies, Phase Transformations and Heat Treatment			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Background of extraction, Thermodynamics, Oxides and sulfides. Pyrometallurgical processes for iron and steel, copper and lead-Zinc production, Hydrometallurgical processes for uranium and gold, copper and alumina. Refractory gold ore treatment. Electrometallurgical refining/ winning for copper, zinc, precious metals and aluminum. Developments in extraction and in bio metallurgy. Separation equipment, material handling devices.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP459	Corrosion Control and Cathodic Protection			3 CH
Prerequisites	Corrosion, Failure Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Corrosion resistant materials for specific environments. Controlling environmental parameters: dehumidification, temperature, velocity and pH control. Corrosion inhibitors: functions, classification, mechanisms, types, dose calculation. Painting and coating systems: surface preparation, applying coats, coating systems, painting, coating testing and inspection. Cathodic protection: theory of cathodic protection. Impressed current CP and sacrificial anode CP systems. Anode materials. Anode current capacity and anode efficiency. Calculation of protection current. Cathodic protection systems: calculation of anode weight and distribution, installation and inspection. Case study. anodic protection system. Corrosion monitoring, testing and inspection.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP460	Non-destructive Testing of Materials (1)			3 CH
Prerequisites	Materials Testing and Behavior.			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Motivation to NDT, Scope of tested products such as weld lines/ castings/ forgings/ textile reinforced plastics, NDT selection chart according to the process, material and expected flaw size, Types of NDT: Visual inspection/ Die penetrant test/ Thermography/ Radiography/ Ultrasonic/ Acoustic Emission/ Magnetic test/ Eddy current/ Computer tomography, Case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP461	Non-destructive Testing of Materials (2)				3 CH
Prerequisites	Non-destructive Testing of Materials (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Visual inspection (VT): Joining and metal forming processes and developments of discontinuities, In-service discontinuities with respect to stress and corrosion, Tools for VT.Die penetrant test (PT): Scope of application, proper use and calibration of media and equipment, and an overview of the origin and nature of discontinuities, technique demonstrations and hands-on lab exercises. Magnetic test (MT): Basic theory of magnetism, applications for the testing of ferromagnetic materials. Technique demonstrations and hands-on lab exercises. Ultrasonic test (UT): Review of basic ultrasonic theory, evaluation of weldments, innovative techniques to detect and evaluate discontinuities, equipment and advanced calibration methods, demonstrations and hands-on lab exercises.					
Used in Program / Level					
Program Name or requirement				Study Level	
Materials Engineering Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP462	Polymer Processing Techniques				3 CH
Prerequisites	Polymer Materials				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
An introduction to the basic principles of polymer processing, mixing, extrusion (single and twin-screw extruders, foils, plates, profiles, blow forming), injection molding, reactive processing, injection molding related processes, decorative molding, extrusion and injection blow molding, compression molding, thermoforming, coating … etc.					
Used in Program / Level					
Program Name or requirement				Study Level	
Materials Engineering Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP463	Materials for Energy Solution			3 CH
Prerequisites	Heat Transfer, Polymer Materials			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Operating principles and applications of emerging technological solutions to the energy demands of the world. The scale of global energy usage and requirements for possible solutions. Basic physics and chemistry of solar cells, fuel cells, and batteries. Performance issues, including economics, from the ideal device to the installed system. The promise of materials research for providing next generation solutions.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP464	Surfactants and lubricating Materials			3 CH
Prerequisites	Heat Transfer, Polymer Materials			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Lubrication properties, types of lubricants, solid, waxy and oil, Interdisciplinary materials on lubrication in machine design including mechanical, mechanics and chemistry aspects, engineering tribology, surface topography, topographical measurements and characterization and classification of regimes of lubrication types of industrial lubricants, properties of lubricating oils: compositions, viscosity and additives, synthetic lubricants and engine oils. Hydrodynamic lubrication. The last topic to be covered is the theory and application of Elasto-hydrodynamic lubrication (EHL).				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP465	Rubber and Sealing Materials			3CH
Prerequisites	Heat Transfer, Polymer Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to rubbers and sealing materials, Natural rubber, chemical arrangement of natural rubber, synthetic rubber, types of synthetic rubber, Vulcanization of rubber. Thermoplastic rubber, chain of thermoplastic rubber, sealing materials, rubber processing (silicon rubber injection, etc.)				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP467	Polymer testing			3 CH
Prerequisites	Polymer Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the significance of polymer testing and its applications, short destructive testing showing the effect of test speed (tension, compression, impact, torsion), long destructive testing (relaxation, retardation, fatigue), thermal analysis (DTA, TGA, DSC), mechanical analysis (DMA, TMA), special techniques (µTA), chemical analysis, non-destructive testing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP468	Materials Characterization			3CH
Prerequisites	Materials Testing and Behavior			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to characterization, characterization techniques, principles, analysis and applications: optical metallography, measurements and analysis, quantitative analysis, SEM, EDX, TEM, x-ray diffraction, AFM, introduction to thermal analyses methods (TGA, DSC, DMA, DTA) etc.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP 469	Glasses Materials and Technology			3 CH
Prerequisites	Glass, Ceramics, and Binding Materials			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to materials, the glassy state, definition of glass, raw materials, viscosity, brittleness, batch calculations, colorizing/decolorizing glass, glass processing techniques, annealing, glass ingredients, properties of glasses, production technology and glass reaction, glass cullet, technology of sun glasses, glass ceramics and its recent applications, nano-glass ceramic, smart glass technologies including: electrochromic glass, liquid crystal glazing, self-cleaning glass, photovoltaic glassfloat glass, alarm glass, fire-resistant glass, and body-tinted glass, types of sheet glasses: reflective glass, low-e glass, mirror, insulating glass, enameled/screen printed glass, pattern glass, antique mirror, x-ray protection glass, electrically heated glass, sand-blasted glass , acid-etched glass, tempered glass, laminated glass, wired glass, anti-reflective glass, glass defects, fiber glass and physical properties of glass, thermal expansion for various types of glasses.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP470	Ceramic Materials and Technology					3 CH
Prerequisites	Glass, Ceramics, and Binding Materials					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Introduction to Ceramics: (definition, traditional and advanced ceramics, what the future may hold for advanced ceramics). Advanced Processing Concepts for increased ceramic reliability: (processing methods, glass-ceramic methods, gelation methods, powder methods, densification concepts, grain growth and densification, heterogeneities associated with powder processing, colloidal methods for preparing and consolidating powders). Wet forming processes as a potential solution of agglomeration problems: (the green microstructure, origin and nature of agglomerates, development of the green microstructure). Processing of electronic ceramics: (powder preparation, mixing, milling, drying, dry forming, tape casting, slip casting, sintering. Processing of ceramic composites: (composite mechanisms, composite processing, sintering of composites, particulate composites, whisker composites, fiber composites)						
Used in Program / Level						
Program Name or requirement			Study Level			
Materials Engineering Program			4			
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam	Final Exam		
35%	25%		0%	40%		

MDP471	Binding Materials and Technology					3 CH
Prerequisites	Glass, Ceramics, and Binding Materials					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Principles of binding agents: (introduction, thermal behavior, general concepts of binding). Inorganic binders: cement, lime, gypsum, occurrence, methods for preparation, initial and final setting times, normal consistency, accelerators, retarders, drying, shrinkage, water absorption, durability, mechanical properties, aggregates. Organic binders: epoxy resin, acrylic emulsion, admixures). Advantages and disadvantages of concrete, geopolymers and its composites. Biocements. Cements for biomedical applications. Bone cementing						
Used in Program / Level						
Program Name or requirement			Study Level			
Materials Engineering Program			4			
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam	Final Exam		
35%	25%		0%	40%		

MDP472	Biomedical Materials			3CH
Prerequisites	Glass, Ceramics, and Binding Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Reviews of biological materials (mechanical and physical properties of bone, cartilage, vessels, skin, muscle and the variety of collagen based biological materials), use of metals clinically in joint replacement, use of ceramics in Medicine, polymer and composite material and filler selection for soft tissue replacement (e.g., heart valves), implants, percutaneous prosthetics, and active devices, introduction to the analysis of surfaces, particularly by electron spectroscopy, surface coatings and treatments used to achieve biocompatibility, introduction to the mechanical and physical properties of shape memory alloys, their current clinical use and their clinical potential.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP473	Introduction to Nano Technology			3CH
Prerequisites	Modern Physics and Quantum Mechanics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to nano technology, engineering of nano-materials with emphasis on structural, optical, photonic, magnetic and electronic materials. Synthetic methods and analytical characterization with design for applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

<table>
<tr><td>MDP455</td><td colspan="4">Renewable Materials</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">2</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Definition of renewable materials (RM) and classification, Comparison between renewable and non-renewable resources, Principles guiding the use of RM, RM as a new challenge to engineering, The agricultural residues (AGR) as a base for competitive and comparative advantages, Machines for processing of AGR, Engineered products from AGR, Examples of use of RM in development: new products and opportunities, Open discussion on the course content and evaluation. Study of the structure of RM (Examples of palm midrib and sorghum stalk), Study of machines for stripping of palm midribs, Comparison between the mechanical properties of palm midrib inner layers and spruce, red European pine and beech woods, Comparison between the tensile strength of the palm midrib and sorghum stalk external layer and mild steel according to the tensile strength/density criterion, Study of the process of manufacture of palm midrib board, Mechanical testing of fiber bundles, Tensile test of polymer composite, Bending test of polymer composite, Microstructure investigation, Thermogravemetric analysis.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Design and Production Engineering Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>50%</td><td>10%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
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<table>
<tr><td>MDP475</td><td colspan="4">Graduation Project in Material Engineering (1)</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">0</td><td colspan="2">6</td></tr>
<tr><td>Required SWL</td><td>150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Under supervision, the student should approach his graduation project within his Senior year. The purpose of this graduation project is to provide students with an opportunity to engage in an activity that will allow them to demonstrate their ability to apply the knowledge and skills they have gained throughout their years in the educational system. The project is designed to ensure that students are able to apply, analyze, synthesize, and evaluate information and to communicate significant knowledge and understanding. Problems/ topics to be considered should be materials engineering oriented, in any of the related disciplines offered by the faculty.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Materials Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>60%</td><td>0%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

MDP476	Graduation Project in Material Engineering (2)			3 CH
Prerequisites	Graduation Project in Material Engineering (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	0		8	
Required SWL	175	Equivalent ECTS	7	
Course Content				
This graduation project may be seen as a continuation of the first part (MDP 491: Graduation Project (1)) of a major topic, or it might be a new subject that the student is considering proving his competence in materials engineering practice.				
Used in Program / Level				
Program Name or requirement			Study Level	
Materials Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

E2.8Manufacturing Courses

MDP081	Production Engineering			3 CH
Prerequisites	English Placement Test or English Course.			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	125		Equivalent ECTS	5
Course Content				
This course aims to provide engineering students with a simple introduction and general knowledge about engineering parts, their materials, and primary production processes and manufacturing technologies. It includes engineering materials classification, characteristics, and materials selection for different applications. Production processes such as casting, joining and metal forming processes. Some manufacturing processes of polymers, machining processes of metals. Machining processes of wood and Measuring instrumentations. In addition, a brief view on new materials (e.g. Nano-materials, metallic glass… etc.) and advanced processing techniques (e.g., CNC, high deformation rate, water jet cutting…. etc.) is provided.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	10%	50%	

MDP181	Manufacturing Technology (1)			3 CH
Prerequisites	Production Engineering			
Number of weekly Contact Hours:				
Lecture		Tutorial		Laboratory
3		0		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Machining: Principles of machining, Turning machines and processes, Drilling machines and processes, Shaping and planning machines and processes, Milling machines and processes, Methods of tools and work piece fixation, Machining time, Introduction to Non-conventional machining processes. Forming: Introduction includes mechanical behavior of the materials, Plastic deformation, Effect of temperature on plastic behavior, Types of forming processes: Hot, Cold, Massive or sheet metal work, Metal forming processes: Forging and its types, Rolling, Extrusion, Types of drawing (rod, wire, tube, and deep), Sheet metal work (shearing, pressing, blanking, spinning, bending, coining, etc.), Brief explanation to forming machines and equipment.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Energy and Renewable Energy Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MDP182	Metal Forming Theory and Processes	3 CH
Prerequisites	Production Engineering, Metallurgy and Material testing	

Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	3	
Required SWL	175	Equivalent ECTS	7
Course Content			
Deformation and recrystallization, Cold and hot working, Strain hardening, Analysis of stress and strain, Forging and its types, calculation of loads required to metal forming, Forging and dimensional changes, Calculation of load during friction and frictionless drawing and upsetting, Rolling and Calculation of load, Torque and rolling mill power, Extrusion and metal flow, Extrusion pressure diagram,Calculation of friction and frictionless extrusion pressure and parameters affectingextrusion, Wire and tube drawing and wire drawing die, Calculation of friction and frictionless wire drawing load, Stress strain curve and maximum reduction permissible, Deep drawing and dimensional changes in flange and wall thickness, Calculation of deep drawing load, Redrawing and parameters affecting deep drawing.			
Used in Program / Level			
Program Name or requirement		Study Level	
Manufacturing Engineering		1	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

MDP183	Manufacturing Technologies		4 CH
Prerequisites	Production Engineering		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
3	2	2	
Required SWL	150	Equivalent ECTS	6
Course Content			
Introduction to manufacturing, Casting processes: Sand casting: Gating and raiser design, Die casting, Centrifugal casting, Investment casting. Metal forming processes: Rolling, Forging, Extrusion, Drawing, Sheet metal working (shear, bending…). Joining of metals, Welding processes: Oxy-Acetylene Welding, Arc welding, Submerged arc welding, Resistance welding, Spot and seam welding, Cold pressure welding, Adhesive welding. Machining Processes: Principles of machining, Materials of cutting tools, Sawing, Turning, Shaping, Planning &Slotting, Broaching, Drilling, Milling, and Grinding process and the details of the machines. Methods of tools and work piece fixation, machining time.			
Used in Program / Level			
Program Name or requirement		Study Level	
Materials Engineering Program		1	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
25%	25%	10%	40%

MDP281	Metal Cutting Theory and Technologies				4 CH
Prerequisites	Production Engineering				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		3	
Required SWL		200	Equivalent ECTS		8
Course Content					
Principles of machining, Materials of cutting tools, Turning machines, forces and processes, Drilling machines, forces and processes, Shaping and planning machines, forces and processes, Milling machines, forces and processes, Grinding machines and processes, Methods of tools and work piece fixation, Machining time, Sequence of Technological processes and operations, process sheet, operation sheet. Screws manufacturing, Gear cutting.					
Used in Program / Level					
Program Name or requirement				Study Level	
Manufacturing Engineering Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
35%	25%		0%		40%

MDP282	Non-Conventional Processing				2 CH
Prerequisites	Metal Cutting Theory and Technologies, Engineering Chemistry				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		0		2	
Required SWL		100	Equivalent ECTS		4
Course Content					
Chemical and Photochemical Machining (CHM), Electrochemical Machining (ECM), Electrochemical Deburring (ECD), Ultrasonic Machining (USM), Electro Discharge Machining (EDM sinking), EDM wire cutting, Laser Beam Machining (LBM), Electron Beam Machining (EBM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Abrasive Flow Machining (AFM). Rapid Prototype technique.					
Used in Program / Level					
Program Name or requirement				Study Level	
Manufacturing Engineering				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
35%	25%		0%		40%

MDP381	Theory of Metal Forming				3 CH
Prerequisites	Manufacturing technology (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Engineering and true stress and strain, Stress strain curves and models of mechanical behavior, Strain rate and its effect on stress strain curve, Deformation and recrystallization, Cold and hot working, Strain hardening, Plastic deformation of metals, Yield criteria, Forging and dimensional changes, Calculation of load during drawing and upsetting, Factors affecting forging load, Rolling and neutral point, Calculation of load rolling mill power, Factors affecting rolling load, Extrusion and metal flow, Extrusion pressure diagram, Calculation of extrusion pressure and parameters affecting extrusion, Wire drawing and wire drawing die, Calculation of wire drawing load, Optimum wire drawing die angle and parameters affecting wire drawing. Tube drawing and dimensional changes in diameter and wall thickness, Calculation of drawing thin walled tubes, Plug tube drawing and mandrel tube drawing. Deep drawing and dimensional changes in flange and wall thickness, Calculation of deep drawing load, parameters affecting deep drawing.					
Used in Program / Level					
Program Name or requirement				Study Level	
Design and Production Engineering Program requirement				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP382	Theory of Metal Cutting				3 CH
Prerequisites	Manufacturing Technology (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Basic concepts and definitions, Tool geometry (definitions, reference planes, geometry of single point tools, twist drills and milling cutters), Tool materials (types and applications), Chip formation (types of chips, built up edge BUE, chip compression ratio, determination of shear angle and shear strain), Mechanics of metal cutting (merchant's analysis, factors affecting cutting forces), Measurement of the cutting forces, Empirical cutting force relationships in conventional cutting (turning, drilling and milling), Heat in metal cutting (heat generation and dissipation, cutting temperature, measurement, distribution, relationships of cutting temperature), Tool failure (types and causes), Tool wear and its measurement, Tool life, Taylor's relationship, Factors affecting tool life, Chatter in machining (causes, measurements, limiting width of cut, factors, affecting the limiting width of cut), Cutting fluids (functions, requirements, types and applications), Surface roughness (sources, parameters, factors affecting surface roughness, theoretical relationship), Machining economy (machining cost equation, optimum tool life, optimum machining variables), Machinability (definitions, criteria and indices).					
Used in Program / Level					
Program Name or requirement				Study Level	
Design and Production Engineering Program requirement				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MDP383	Metal Forming Technology, Machines and Dies			3 CH
Prerequisites	Manufacturing Technology (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Metal forming technology: process, product design of forgings, rolling sections, extrusion, wire, tube and deep drawing. Powder metallurgy (powder production, compaction, sintering and sizing). Metal forming machines: types, details, parts and operation including forging hammers, presses, horizontal forging machines, rolling mills, extrusion presses, wire and tube drawing and deep drawing. Metal forming Dies design: forging, roll pass, extrusion, wire, tube and deep drawing of cylindrical cup with and without flanges. Quadratic and rectangular shapes, ironing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP384	Metal Cutting Machines and Technology			3 CH
Prerequisites	Manufacturing Technology (1), Machine Elements Design			
Number of weekly Contact Hours:				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Rigidity of machine tools and the accuracy of production, Spindles of machine tools, Frame parts of machine tools, Drives of machine tools, Machining tolerance and allowances, Process and operation sheet preparation, Capstan and turret lathes,Hobbing and gear shaping machines, Gear cutting operations, Grinding operations, Super finishing operations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP385	Manufacturing Processes			2 CH
Prerequisites	Metal Cutting Theory and Technologies, Metal Forming Theory & Processes			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Sheet metal work (shearing, pressing, blanking, spinning, bending, coining, etc.), Brief explanation to forming machines and equipment. Rolling lines: Coil-pass design, High-energy-rate terming (explosive, electro-hydraulic, electro-magnetic forming), Powder metallurgy (powder production, compaction, sintering and sizing), Super finishing and metal coating.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP386	Computer Aided Manufacturing			3 CH
Prerequisites	Metal Cutting Theory and Technologies			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		3
Required SWL	150		Equivalent ECTS	6
Course Content				
Computer technology, The foundations of CAD/CAM. Computer aided design: Fundamentals of CAD, The design process, Applications of computers for design, Computer-aided design software, Wire frame models, Solid modelling. Computer-aided manufacturing: Automation of manufacturing processes, Numerically controlled machines, Computerized numerically controlled machines (CNC), G codes, Programming languages, Applications and performance of CAD/CAM systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

<table>
<tr><td>MDP387</td><td colspan="3">Metrology</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Metal Cutting Theory and Technologies</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>0</td><td colspan="2">3</td></tr>
<tr><td>Required SWL</td><td>150</td><td>Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">International system of units, Theory of measurements, Instrument classification, Types of magnification (mechanical, electrical, optical, pneumatic), Fits, Tolerances and limit gauges, Simple measuring Instruments (Vernier, micrometers, dial gauges, angle gauges, protractors, sine bar, sensitive level), Comparators, Measuring machines, Errors and calibration of measuring equipment, Indirect measurements, Screw thread and gear measurements, Surface roughness measurements (2D and 3D measurement), Static tests for machine tools, Advanced measuring techniques (laser measurement, computer- aided measurement, machine vision).</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Manufacturing Engineering</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>25%</td><td>15%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>MDP481</td><td colspan="3">Design of Tools and Production Facilities</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Theory of Metal Cutting</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Jigs and Fixture: Advantages of jigs and fixtures, Principles of location, Types of locators, over determined location, principles of clamping, types of clamping, calculations of clamping forces, Design of drilling jigs, indexing jigs, milling fixtures, indexing table, single and multiple pieces' fixtures, turning fixtures, welding fixture, and assembly fixture, Manufacturing of jigs and fixture, Economy of jigs and fixtures. Cutting tools: Modern cutting tool materials, Design and manufacturing of turning form tools, form relieved milling cutters, drilling tools and broaching tools.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Design and Production Engineering Program requirement</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

MDP482	Metrology and Measuring Instruments			4 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		5
Required SWL	200		Equivalent ECTS	8
Course Content				
Measuring Instruments: International system of units and standards, types of instrument magnification (mechanical, optical, electric, digital and pneumatic), measuring signals; static and dynamic response; design of limit gauges, simple measuring instruments, measuring instruments components; kinematics, comparators, measuring machines, CMM, advanced measuring techniques; computer vision, laser measurement, Nano measurement. Metrology: Linear measurement, angular measurement, form measurement, screw thread and gear measurement, geometric errors; straightness, flatness, roundness, squareness, alignment, parallelism and surface roughness measurement. Static tests for machine tools. Using CMM and advanced techniques in measurements.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program requirement			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MDP483	Computerized Numerical Controlled Machines			3 CH
Prerequisites	Theory of Metal Cutting, Metrology Instruments			
Number of weekly Contact Hours:				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Components of CNC machines; mechanical parts, sensors and transducers, limit switch, speed drive and control, operating of CNC machine tools; mode selection, cycle selection, dry run, reference datum; Programming of CNC; manual programming, using fixed cycles and subroutines; Fanuc, fagor, sinumeric and heidenihien Controls, Computer aided Programming.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program requirement			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	--	40%	

MDP484	Product lifecycle Management			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Benefits, development process, Phases of product lifecycle; conceive, design, realize, service; concurrent engineering workflow, bottom up design, to down design, pyramid of production systems; Product Lifecycle Management, Sustainable development, Quality and Environmental Assurance of Product Development, Life cycle analysis, Product Data Management and CAD, Design for disassembly, Product recovery cycle, PLM integration; case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP485	Advanced Topics in CNC Machine Tools			3 CH
Prerequisites	Computerized Numerical Controlled Machines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Micro scale products; micro system platforms, scaling laws, micro manufacturing techniques, micro machining, micro forming, photochemical machining, laser machining and joining, metrology and characterization, shape variation in micro manufacturing, lamina metrology, additive manufacturing, micro mechanical assembly, handling for micro manufacturing, sustainability of micro machining technologies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

MDP486	Selected Topics in Manufacturing					3 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		2		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Selected topics in recent directions and advanced manufacturing techniques.						
Used in Program / Level						
Program Name or requirement				Study Level		
Design and Production Engineering Program concentration				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
60%	0%		0%		40%	

MDP487	Computer Integrated Manufacturing					3 CH
Prerequisites	Computerized Numerical Controlled Machines					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Introduction, Computer aided design (CAD) systems, computer aided graphical modeling, Cad database, computer aided manufacturing (Cam) systems, computer aided process planning (CAPP) systems, robotics systems, group technology and cellular manufacturing systems, automated material handling systems, automated inspection systems, flexible manufacturing systems (FMS)						
Used in Program / Level						
Program Name or requirement				Study Level		
Design and Production Engineering Program concentration				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

MDP488	Advanced Manufacturing Technology			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Non-Conventional Machining: ECM, EDM, WEDM, PCM, USM, WJM, LBM, PBM, Bio Machining, Hybrid Machining, ...etc Additive Manufacturing Processes: Stereo Lithography, Selective Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, ...etc. Micro manufacturing: Micro scale products, micro system platforms, scaling laws, micro manufacturing techniques, handling for micro machining technologies				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MDP489	Selected Topics in Metal Forming			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions and advanced forming techniques. High energy rate forming, electro- hydraulic, electromagnetic, Dynapak, Petro Forge.				
Used in Program / Level				
Program Name or requirement			Study Level	
Design and Production Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

MDP490	Die Design			3 CH
Prerequisites	Metal Forming Theory and Processes, Machine Elements Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Design of sheet metal of dies (single, compound, combination and progressive dies), Shearing (blanking and piercing), Bending (U- and V-bending), Deep drawing of cylindrical cup with and without flanges, Quadratic and rectangular shapes, Ironing. Design of forming dies. Parts of different types of dies and their materials and functions. The life and cost of different types of dies in terms of number of produced items. The capacity of different machines based on the utilized die. Manufacturing of dies. Plastic Molding: Injection molds: Tolerances in Mold and Part Design. Mold Steels, Mold Bases, Mold Layout, Ejection, Cooling, Gating, Hot Runners, Venting. Blow molding processes, Materials, Primary equipment, Mold design and Auxiliary equipment.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP491	Design of Jigs and Fixtures			3 CH
Prerequisites	Machine Design, Stress Analysis, Machining Processes			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Advantages of jigs and fixtures, principles of location, types of locators, over-determined location, principles of clamping, design procedures, drilling jigs, indexing jigs, milling fixtures, turning fixtures, welding and assembly fixtures. Design and manufacturing of cutting form tools.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP492	Advanced Manufacturing Systems			3 CH
Prerequisites	Computer Aided Manufacturing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Addressing the problems facing industry regarding the automated systems such that of automatic storing and retrieving, integrated manufacturing systems, application of conveyors in industry, integration of CNC machinery within the FMS, collective control of machinery and automated manufacturing systems. The students will be aware with major cutting-edge technologies of production automation and material handling, and how these technologies are used to construct modern manufacturing systems. Material Transport Systems; Storage Systems; Automatic Data Capture; Group Technology and Cellular Manufacturing; Flexible Manufacturing Systems; Transfer Lines and Similar Automated Manufacturing Systems; Automated Assembly Systems; Process Planning and Concurrent Engineering; Production Planning and Control Systems and Agile Manufacturing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35 %	25 %	0 %	40 %	

MDP493	Additive Manufacturing			3 CH
Prerequisites	Polymers and ceramics Processing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Additive Manufacturing (AM) is driving a paradigm shift in design and manufacturing. Provides a comprehensive overview of AM, from process physics and material chemistry to process and technology development. Explores new engineering and product design degrees of freedom enabled by AM. Topics include fundamentals of polymer, metal and composite AM processes; process capabilities such as rate and resolution; material properties and their dependence on material characteristics, process parameters and machine designs; existing and new applications of AM; and a perspective on current and future technical challenges in AM.				
Used in Program / Level				
Program Name or requirement			Study Level	
Manufacturing Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35 %	25 %	0 %	40 %	

MDP494	Advanced Manufacturing Technology and Prototyping			3 CH
Prerequisites	Manufacturing Technology (1) or Manufacturing Technologies			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to advanced manufacturing including the working principles and applications of Computer Aided Manufacturing (CAM), CAD/CAM, Computer Integrated Manufacturing (CIM), Computer Numerical Control (CNC), unconventional machining (chemical machining (ECM), electric discharge machining (EDM), wire cut machining, abrasive jet, ultrasonic machining, electron beam machining, etc.). Digital manufacturing processes, rapid prototyping techniques and tools: 3D printing, 3D scanning. Stereo Litho-graphy, laser cutting, object printing, thermo-jet wax printing. Cleanroom technology in manufacturing and production process.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			4	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	25%		10%	40%

E3. Courses offered by Mechanical Power Engineering Department (MEP)

The Mechanical Power Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Mechanical Engineering courses as a Mechanical Discipline Requirement.
2. Mechanical Power Engineering Program.
3. Energy and Renewable Energy Engineering Program.
4. Architectural Engineering Program.

Table 46 List of specializations at the Design and Production Engineering Department.

#	Specialization
1	Energy Generation
2	Energy Efficiency and Sustainability
3	Process and Equipment Design
4	Environment, Services and Systems
5	Nuclear Energy Technology
9	Graduation Projects

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 47 List of MEP courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Energy Generation																				
1	1	111	Thermal Physics	2	4	100	1	2	0	3			x		35	25	0	40	PHM041	
2	2	211	Thermodynamics	4	6	150	3	2	1	6			x		35	25	0	40	MEP111	
3		212	Heat Transfer	4	8	200	2	2	3	7			x		20	25	15	40	MEP211	
4		213	Thermal Analysis of Buildings	3	5	125	2	2	0	4				x	35	25	0	40	PHM012	
5		214	Thermal Power Engineering	3	5	125	2	2	0	4			x		25	25	0	50	PHM041	PHM022
6	3	311	Combustion	3	6	150	2	2	1	5				x	20	25	15	40	MEP211	MEP212
7		312	Fundamentals of Internal Combustion Engines	3	6	150	2	2	1	5				x	20	25	15	40	MEP212	MEP221
8		313	Thermal Power Plants	3	6	150	2	2	1	5				x	20	25	15	40	MEP212	MEP221
9		314	Power Plant Technology	4	6	150	3	2	0	5				x	35	25	0	40	MEP313	
10	4	411	Control Systems of Internal Combustion Engines	3	6	150	2	2	1	5				x	20	25	15	40	MEP312	
11		412	Heat Engines	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
12		413	Gas Fueled Engines	3	5	125	2	2	0	4				x	35	25	0	40	MEP312	
13		414	Biomass and Waste Conversion Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP311
2. Energy Efficiency and Sustainability																				
14	2	221	Fluid Mechanics and Turbo-Machinery	4	7	175	3	2	1	6			x		20	25	15	40	MEP111	
15		222	Introduction to Fluid Mechanics	3	5	125	3	1	1	5				x	20	25	15	40	MEP111	
16	3	321	Incompressible Flow Machines	3	6	150	2	2	1	5				x	20	25	15	40	MEP211	MEP221
17		322	Compressible Flow Machines	3	6	150	2	2	1	5				x	20	25	15	40	MEP211	MEP221
18	4	421	Sustainable Energy	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
19		422	Energy Storage Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEP313	
20		423	Hydro-Tidal and Wave Energies	3	5	125	2	2	0	4				x	35	25	0	40	MEP321	
21		424	Water Distribution Networks	3	5	125	2	2	0	4				x	35	25	0	40	MEP321	
22		425	Aircraft Propulsion	3	5	125	2	2	0	4				x	35	25	0	40	MEP311	MEP322
23		426	Solar Energy	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
24		427	Wind Energy	3	5	125	2	2	0	4				x	35	25	0	40	MEP322	
25		428	Hydraulic Transmission	3	5	125	2	2	0	4				x	35	25	0	40	MEP221	MEP321
3. Process and Equipment Design																				
26	2	231	Measurement and Instrumentation	2	5	125	1	0	3	4			x		20	25	15	40	MEP211	
27	3	331	Digital Control	2	4	100	2	0	1	3				x	20	25	15	40	MCT211	
28		332	Process Control	3	6	150	2	2	1	5				x	20	25	15	40	MEP331	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
29		431	Fire Fighting	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
30		432	Computational Fluid Dynamics	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
31	4	433	Management of Mechanical Power Projects	3	5	125	2	2	0	4				x	35	25	0	40	MEP314	
32		434	Water Desalination and Distillation	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
33		435	Design of Mechanical Power Units	3	5	125	2	2	0	4				x	35	25	0	40	MDP211	MDP212
4. Environment, Services and Systems																				
34	2	241	Technical Installations	3	5	125	2	2	0	4			x		20	25	15	40	MDP011	
35	3	341	Refrigeration and Air Conditioning	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
36		342	HVAC System Design	2	5	125	2	1	0	3				x	35	25	0	40	MEP213	
37		441	Applied Building Services Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
38		442	Thermodynamics of Materials	3	5	125	2	2	0	4				x	35	25	0	40	PHM041	
39		443	Petroleum Pipelines	3	5	125	2	2	0	4				x	35	25	0	40	MEP221	MEP321
40	4	444	Economics of Energy Conversion	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
41		445	Environmental Impact of Mechanical Power Projects	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
42		446	Refrigerators and AC Systems and Equipment	3	5	125	2	2	0	4				x	35	25	0	40	MEP342	
5. Nuclear Energy Technology																				
43		451	Nuclear Energy	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	MEP221
44		452	Thermal Aspects of Nuclear Reactors	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
45	4	453	Nuclear Reactions and Interaction with Matter	3	5	125	2	2	0	4				x	35	25	0	40	MEP211	
46		454	Radioactive Waste Management	3	5	125	2	2	0	4				x	35	25	0	40	MEP212	
47		455	Methods of Nuclear Risk Analysis	3	5	125	2	2	0	4				x	35	25	0	40	MEP314	
9. Graduation Project																				
48	4	491	Mechanical Power Graduation Project (1)	3	6	150	1	2	4	7				x	35	25	0	40		
49		492	Mechanical Power Graduation Project (2)	3	6	150	1	2	4	7				x	35	25	0	40	MEP492	

E3.1 Energy Generation Courses

MEP111	Thermal Physics			2 CH
Prerequisites	Engineering Chemistry			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Thermal System, Control Volume, States of the Working Medium, Processes and Cycles, Calculation of Work, Heat Exchange with the Surroundings, Ideal Gases, Specific Heat at Constant Volume, Specific Heat at Constant Pressure, Equation of State, Pure Substances, Phase Equilibrium, Tables of Thermodynamic Properties, Internal Energy, Enthalpy, First Law of Thermodynamics on Closed Systems, First Law of Thermodynamics on Steady State Steady Flow Open Systems, The Case of Uniform State Uniform Flow, Application on Reciprocating Compressors, Ideal Gas Mixtures.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			1	
Energy and Renewable Energy Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP211	Thermodynamics			4 CH
Prerequisites	Thermal Physics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Heat Engines, Refrigerator and Heat Pump, Second Law of Thermodynamics, Kelvin Plank Statement, Clausius Statement, Clausius Inequality, Entropy, Irreversibility, Reversible Process, Entropy Change of a Reversible Process, Entropy Change of Solids and Liquids, Entropy Change of Ideal Gases, Gibbs Relations, Isentropic Process, Entropy Increase Principle, Exergy and Availability, Reversible Work, Exergy Destruction Principle, The Second Law Efficiency, Air Standard Cycles, Vapor Cycles, Property Diagrams.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			1	
Energy and Renewable Energy Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP212	Heat Transfer			4 CH
Prerequisites	Thermodynamics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		3
Required SWL	200	Equivalent ECTS	8	
Course Content				
Thermal Conduction: The General Equation, Steady One Dimensional Conduction, Conduction without Heat Generation, Plane Wall, Composite Plane Wall, Composite Plane Wall Subjected to Convection, Overall Heat Transfer Coefficient, Cylindrical Shell, Composite Cylindrical Wall Subjected to Convection, Spherical Shell, Composite Spherical Shell Subjected to Convection, Extended Surfaces (Fins), Conduction with Uniform Internal Heat Generation, Conduction with Variable Thermal Conductivity, Steady Two Dimensional Conduction, Unsteady One Dimensional Conduction (Transient Conduction), Periodic Conduction. Convection: Types of Convection, Dimensionless Groups, Dimensional Analyses, Buckingham's Pi Theory, Dimensionless Groups in Convection, Natural Convection, Forced Convection. Heat Exchanger: Heat Exchanger Types, Logarithmic Mean Temperature Difference, Effectiveness of Heat Exchangers. Thermal Radiation: Basic Concepts, Setfan-Boltzmann Law, Planck's Law, Radiation Properties of Real Surfaces, Emissivity and Absorptivity, Kirchoff's Law, Emissivity of Real Surfaces, Gray Surfaces, Selective Surfaces, Heat Exchange by Radiation, Heat Exchange between Two Planes, Heat Exchange between Two Cylinders or Spheres, Heat Exchange between Gray Surfaces, View Factors. Mass Transfer, Fick's Law of Diffusion, Mass Transfer Rate from a Pool of Liquid, and from a Liquid Droplet.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Energy and Renewable Energy Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP213	Thermal Analysis of Buildings			3 CH
Prerequisites	Mathematics (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
Integration of fundamentals of thermodynamics (Basic concepts and definitions, System and control volume, Property and state, Processes and cycles, Ideal gases, State equation, Specific heat at constant pressure and volume, First law of thermodynamics, Internal energy and enthalpy). Integration of fundamentals of heat transfer (One and multi‹dimensional steady and unsteady conduction heat transfer, Free and forced convection, Radiation heat transfer as applied to building materials and geometries).				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP214	Thermal Power Engineering			3 CH
Prerequisites	Engineering Chemistry, Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Thermal System, Control Volume, States of the Working Medium, Processes and Cycles, Calculation of Work, Heat Exchange with the Surroundings, Ideal Gases, Equation of State, Pure Substances, Phase Equilibrium, Tables of Thermodynamic Properties, First Law of Thermodynamics on Steady State Steady Flow Open Systems, and Applications such as simple Steam Rankine cycle, Brayton cycle, Diesel cycle, Otto cycle (introduction to Internal Combustion Engines), Heat transfer of electrical and electronic devices.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Discipline Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	25%		0%	50%

MEP311	Combustion			3 CH
Prerequisites	Thermodynamics, Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Fuel Bonding Energies, Chemical Structure Change due to Oxidation, Fuel Heating Values, Adiabatic and Non-Adiabatic Combustion Temperatures, Concentrations of Combustion Products under Chemical Equilibrium Conditions, Rates of Chemical Reactions, Stabilization of Premixed Flames, Laminar Flame Speed, Turbulent Flame Speed, Flame Stabilization at Higher Flow rates, Reaction Zones in Non-Premixed Flames, Diffusion Flame Length, Diffusion Flame Blowout Limits, Combustion Efficiency and Flame Generated Pollution, Liquid Fuel Sprays, Atomizers, Time of Fuel Droplet Evaporation, Physical and Chemical Ignition Delays, Combustion of Solid Fuels on Grates, Pulverized Coal Combustion, Proximate and Ultimate Analysis of Coal, Detonation and Explosives.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Energy and Renewable Energy Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	25%		15%	40%

MEP312	Fundamentals of Internal Combustion Engines			3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150		Equivalent ECTS	6
Course Content				
Classification of Internal Combustion Engines. The Fuel-Air Standard Cycle, Indicated Cycle Deviations between the Indicated Cycle and Fuel-Air Standard Cycle, Combustion Chambers, Fuel Properties and its Impact on Engine Performance. Combustion in Diesel Engines and Gasoline Engines, Detonation and Diesel Knock. Friction and Lubrication, Effect of Engine Operating Conditions on Friction Loss, Engine Performance at Constant Speed, Effect of Engine Speed on Friction Loss, Engine Performance at Variable Speeds and Constant Load, Properties and Classification of Engine Lubricating Oil, Testing of the Lubricating Oil, Oil Filters for the Engines, Cooling Loss, Effect of Engine Operating Conditions on Cooling Loss, Factors Affecting the Cooling of the Engine Surfaces, Temperatures Limit for the Engine Cooling Surfaces, Engine Cooling Systems, The Engine Actual Thermal Cycle.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP 313	Thermal Power Plants			3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150		Equivalent ECTS	6
Course Content				
Rankine Cycle Processes and Calculations, Methods of Improvement in Rankine Cycle Thermal Efficiency, Superheat, Reheat, Regenerative Rankine Cycles, Regeneration with an Open Type Feed Water Heater, Regeneration with a Closed Type Feed Water Heater, Fire Tube Boilers, Construction and Operation, Water Tube Boilers, Superheaters, Economizers, Air Heaters, Steam Generator Losses and Efficiency, Work of Turbines, Impulse Turbines, Reaction Turbines, Effect of Dryness Fraction on the Turbine Efficiency and Turbine Life-Time, Types of Condensers, Deareators, Ejectors, Construction of Feed Water Heaters, Steam Pipes and Steam Traps, Cooling Towers, Natural Draft and Forced Draft, Water Pumps.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

<table>
<tr><td colspan="2">MEP 314</td><td colspan="9">Power Plant Technology</td><td>4 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Thermal Power Plants</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">3</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Co-Generation Plants, Combined Cycles, Heat Recovery Boilers, Efficiency of Combined Cycles, Performance Characteristics of Power Stations, Heat Rate and Incremental Rate, Optimum Load Division Among Power Generation Units, Control of the Steam Generators, Convection and Radiant Type Superheaters, Governing of Steam Turbines, Steam Partial Admission and Full Admission, Load Frequency Characteristics, Speed Regulation, Parallel Operation, Lubrication Systems, Protection and Tripping Systems, Start-Up and Shut Down Procedures, Procedure of Meeting the Power Demands: Adding Peaking Load Units, Connection between Zones of Different Longitudes, Energy Storage, Introduction to Nuclear Energy Power Plants, Economical Consideration of Thermal Power Plants.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program</td><td colspan="4">3</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="2">MEP411</td><td colspan="9">Control Systems of Internal Combustion Engines</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Fundamentals of Internal Combustion Engines</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">1</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">The Performance Map of 4-Stroke and 2-Stroke Engines. Knock Resistance, Supercharging: Methods, Turbocharging Control, Matching of the Engine and Supercharger. Ignition: Types and Components, Conventional and Electronic Ignition. Spark Timing Control, Governors: Types, Components and Testing. Sources of Pollutant Emissions from Internal Combustion Engines to the Atmosphere and the Methods of Emissions Control. Engine Management Systems, Engine Control Functional Subsystems, Gas-Phase Flow Control (Air System), Liquid-Phase Flow Control (Fuel System), Torque Control, Engine Speed Control, Engine Protection. Mixture Preparation in Spark Ignition Engines and Compression Ignition Engines. Fuel Injection Systems in Diesel Engines. Diesel Engine Characteristics and Analysis. Modern Injection Systems with High Injection Pressures, Common Rail and HEUI, and the Utilization of Sophisticated Electronic Control Methods.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="3">25%</td><td colspan="3">15%</td><td colspan="3">40%</td></tr>
</table>

MEP412	Heat Engines			3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Thermodynamic Cycles and Heat Engines, Stirling Engine as an Example of a Heat Engine, Ideal Stirling Cycle, Actual Stirling Cycle, Deviation between the Ideal and Actual Cycles. Arrangements of Stirling Engines, Drive Mechanisms, Working Fluids in Stirling Engines, Heaters – Types, Methods of External Heating. Coolers, Regenerators, Advantages and Disadvantages of Stirling Engines, Applications of Stirling Engines.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP413	Gas Fueled Engines			3 CH
Prerequisites	Fundamentals of Internal Combustion Engines			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Alternative Fuels for Internal Combustion Engines, Availability and Suitability to Piston Engines. Concept of Conventional Fuels. Potential Alternative Fuels. Ethanol. Methanol. DEE / DME, Hydrogen, Liquified Petroleum Gas. Natural Gas. Producer Gas and Vegetable Oils Use in Internal Combustion Engines. Merits and Demerits of Various Fuels. Alcohol Fuels Properties as Engine Fuels, Flexible Fuel Vehicle, Emulsions, Dual Fuel Systems, Spark Assisted Diesel Engines, Surface Ignition Engines, Ignition Accelerators, Manufacturing of Alcohol Fuels. Gaseous Fuels, Hydrogen, Properties, Use in Compression Ignition Engines, Use in Spark Ignition Engines, Storage Methods, Safety Precautions, Production Methods. Producer Gas and Biogas, Raw Materials, Gasification, Properties, Cleaning up, the Gas Use in Spark Ignition Engines and Dual Fuel Engines. Liquified Petroleum Gas and CNG, Properties, Use in Spark Ignition and Compression Ignition Engines.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP414	Biomass and Waste Conversion Technology			3 CH
Prerequisites	Combustion, MEP 212 Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Characterization of Waste, Types of Biomass, Biomass Properties, Pre-Treatment of Biomass, Thermo-Chemical Processes, Fast and Slow Pyrolysis, Gasification, Transesterification, Design of Gasifiers, Drying and Devolatilization, Heat and Mass Transfer across Small and Large Biomass Particles, Combustion, Chemical Kinetics, Types of Reactors, Incinerators, Bio-Chemical Conversion, Anaerobic Digestion and Fermentation, Operation of Biomass Boilers and Stoves, Use of Bio-Fuels in Internal Combustion Engines and Gas Turbines, Emissions, Cost Considerations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

E3.2 Energy Efficiency and Sustainability Courses

MEP221	Fluid Mechanics and Turbo-Machinery			4 CH
Prerequisites	Thermal Physics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		1
Required SWL	175	Equivalent ECTS		7
Course Content				
Properties of Fluids, Density, Pressure, Pressure Measurement, Forces on Submerged Bodies, Viscosity, Viscous Boundary Layers, Continuum Hypothesis, Streamlines, Velocity and Acceleration, Continuity Equation, Classification of Flow Fields: Pipe Flow, Jet Flow, Wake Flow, Boundary Layer Flow, Flow in Closed Conduits, Bernoulli's Equation, Major and Minor Losses in Pipes, Laminar and Turbulent Flows, Similitude and Dimensional Analysis, Lagrangian and Eulerian Coordinates, Transport Theorem on a Control Volume, Navier Stokes Equation, Flow around Immersed Bodies, Drag and Lift Forces, Compressible Flow, Stagnation Properties, Mach Number and Sonic Velocity, Equations of Gas Dynamics, Flow through Nozzles, Shock Waves, Classification of Turbo-Machines, Operation of Pumps, Series and Parallel Operation, Selection of Pumps.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Energy and Renewable Energy Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP222	Introduction to Fluid Mechanics			3 CH
Prerequisites	Thermal Physics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125	Equivalent ECTS		5
Course Content				
Properties of Fluids, Density, Pressure, Pressure Measurement, Forces on Submerged Bodies, Viscosity, Viscous Boundary Layers, Continuum Hypothesis, Streamlines, Velocity and Acceleration, Continuity Equation, Classification of Flow Fields: Pipe Flow, Jet Flow, Wake Flow, Boundary Layer Flow, Flow in Closed Conduits, Bernoulli's Equation, Major and Minor Losses in Pipes, Laminar and Turbulent Flows, Similitude and Dimensional Analysis, Lagrangian and Eulerian Coordinates, Transport Theorem on a Control Volume, Navier Stokes Equation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP321	Incompressible Flow Machines			3 CH
Prerequisites	Thermodynamics, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Centrifugal Pumps: Theory, Application, Construction, Components, Performance Curves, Efficiencies, Operation, Pumps in Series, Pumps in Parallel, Cavitation Phenomenon, Radial and axial Thrust, Pump Selection, Maintenance and Trouble Shooting. Axial-Flow Pumps: Theory, Application, Construction, Components, Performance Curves. Positive Displacement Pumps: Theory, Classification, Application, Construction, Components, Performance Curves. Water Turbines: Theory, Impulse Turbines, Reaction Turbines, Application, Construction, Components, Cavitation, Energy Calculation and Performance. Hydro-Electric Power Plants.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Energy and Renewable Energy Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP322	Compressible Flow Machines			3 CH
Prerequisites	Thermodynamics, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Centrifugal Fans, Blowers and Compressors: Theory, Classification, Construction, Application, Performance and Energy Calculation. Airfoil Theory. Axial-Flow Fans and Compressors: Theory, Components Application, Performance and Energy Calculation. Reciprocating compressors: Theory, Components, Application, Performance and Energy Calculation. Steam Turbines: Theory, Types, Components, Application and Energy Calculation. Gas Turbines: Theory, Types, Components, Application and Energy Calculation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Energy and Renewable Energy Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

MEP421	Sustainable Energy			3 CH
Prerequisites	Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Assessment of Current and Potential Future Energy Systems, Covering Resources, Extraction, Conversion, and End-Use Technologies, with Emphasis on Meeting Regional and Global Energy Needs in the 21st Century in a Sustainable Manner. The Course will Examine Various Renewable and Conventional Energy Production Technologies, Energy End-Use Practices and Alternatives, and Consumption Practices in Different Countries. Students will Learn a Quantitative Framework to Aid in Evaluation and Analysis of Energy Technology System Proposals in the Context of Engineering, Social, Economic, and Environmental Goals.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0	40%

MEP422	Energy Storage Technology			3 CH
Prerequisites	Thermal Power Plants			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to Energy Storage, Power versus Energy, Electrochemical Energy Storage; Types of Batteries, Methods of Charging and Discharging of Batteries, Mobile and Fixed Energy Storage. Types of Mechanical Energy Storage; Pumped Hydro, Compressed Gas, Flywheel, Thermal and Phase Change Materials. Applications of Energy Storage Technology in the of Power Generation and in the Field of Refrigeration and Air Conditioning. Introduction to Modeling of Several Types of Energy Storage Systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

<table>
<tr><td colspan="2">MEP423</td><td colspan="9">Hydro-Tidal and Wave Energy</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Incompressible Flow Machines</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Water Renewable Energy Resources, Tidal Energy Principles, Analysis of Tidal Energy Resources and its Relation to Wind, Classification of Tidal Energy Resources, Egypt Tidal Energy, Tidal Energy Utilization, Installation of Turbines for Tidal Energy, Turbines Performance Analysis with Tidal Energy, Energy Storage Techniques with Tidal Energy, Wave Energy Principles, Utilization of Wave Energy, Wave Energy Classification, Wave Energy Turbines, Water and Air Columns, Operation of Wave Energy Turbines, Performance Analysis for Wave Energy Turbines, Characteristics of Used Turbines, Column Separation, Energy Storage Techniques, Wave Energy Utilization in Egypt, Case Studies.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program Concentration</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
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<table>
<tr><td colspan="2">MEP424</td><td colspan="9">Water Distribution Networks</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Incompressible Flow Machines</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">--</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Steady Incompressible Flow Through Pipe Systems, Pipe Flow: Darcy-Weisbach Equation, Moody Diagram, Simple Pipe Problems, Minor Losses, Equivalent Length of Minor Losses, The Siphon Pipes Connections: Pipes In Series, Pipes In Parallel, Graphical Solution, Branching of Pipes, Pumping from One Reservoir to Two Or More Reservoirs, Hazen-Williams Formula, Network of Pipes: Hardy Cross Method, Using Hazen-Williams Formula, Using Friction Factor of Moody Chart, Linear Theory Method, Systems with Multiple Fixed-Pressure-Head Elevations, Pseudo Loops, Hydraulic Path, Graphical Solutions of Branch-Line Pumping Systems: Branches in Closed Loop Systems, Branches In Open-Ended Loop Systems.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program Concentration</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

MEP425	Aircraft Propulsion			3 CH
Prerequisites	Combustion,Compressible Flow Machines			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Air/Gas Flow Across Propulsion Systems, Equation of Thrust, Turbo-Propulsion Aircrafts, Turbo-Jet Propulsion in Jet Engines, Turbo-Fan Engines, By Pass Ratio, Specific Fuel Consumption, Propulsive Efficiency, Overall Efficiency, Air Flow Across Aircraft Wings, Intake, Inlet Stagnation Properties, Compressor, Turbine, Combustion Chamber, After-Burner, Combustion Stability Limits, Pressure Loss, Flow Through the Nozzle, Variable Area Nozzles, Dimensional Analysis for Matching of the Gas Turbine Engine Components, Force Balance, Take-Off, Climbing, Cruising, Landing, Maneuver.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP426	Solar Energy			3 CH
Prerequisites	Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Intensity of Solar Radiation within the Outer Space, Calculation of the Solar Intensity on the Earth, Availability and Usability of Solar Energy, Measurement of the Solar Intensity, Direct and Diffuse Radiation, Reflection from the Ground, Solar Angles, Shades, the Equation of Time, Incidence Angle on Horizontal and Inclined Surfaces, Theory of the Flat Plate Collector, Transmission through Glass, Heat Loss Calculations, Collector Performance, Solar Energy Concentrators, Point and Line Concentrators, Cylindrical Trough, Parabolic Trough, Parabolic Dish, Central Receiver, Heliostat, Heliostat Optimum Placement, Sun Beam Tracking, Shadowing and Blocking, Concentration Ratios, Fresnel Lens, Thermal performance, Heat Transfer Coefficients, Receiver Efficiency.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Energy and Renewable Energy Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP427	Wind Energy			3 CH
Prerequisites	Compressible Flow Machines			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to Wind Energy, Wind Speed Classification, Wind Data and Wind Rose, Statistical Analysis of Wind Data, Types of Wind Turbines, Instrumentations Used for Operating Wind Data, Construction Details of a Wind Turbine, Wind Turbine Control Schemes, Estimation of Wind Power, Betz' Theorem, Blade Element Theory, Translating Wind Power Machines, Vertical-Axis Wind-Turbines – Savonius and Darriews, Airfoil Theory, Horizontal-Axis Wind Turbines, Wind Energy for Water Pumping.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Energy and Renewable Energy Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP428	Hydraulic Transmission			3 CH
Prerequisites	Fluid Mechanics and Turbo-Machinery, Incompressible Flow Machines			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Hydrostatic Power Systems: Theory, Application, Components, Energy Calculation, Energy Storage. Hydrodynamic Power Transmission Systems: Theory, Application, Components, Energy Calculation. Hydraulic Power Generator (Pump): Types, Components, Calculations. Hydraulic Motor (Actuator): Types, Components, Calculations. Hydraulic Accumulators: Dead Weight Loaded Accumulators, Air-Loaded (Pneumatic) and Spring-Loaded Accumulators. Control and Regulation Devices: Different Types of Valves and Alarms. Hydraulic Coupling: Theory, Application, Components, Performance and Control. Hydraulic Torque Converter: Theory, Application, Components, Performance and Control. Hydraulic Servomotors: Theory, Application, Components.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E3.3 Process and Equipment Design Courses

MEP231	Measurement and Instrumentation		2 CH
Prerequisites	Thermodynamics		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	0	3	
Required SWL	125	Equivalent ECTS	5
Course Content			
Characteristics of Sensors, Flow rate Measurement Principles, Orifice-Meter, Venturi-Meter, Coriolis Flow Meter, Turbine Flow Meter, Rotameter, Velocity Measurements, Pitot Tube, Vane Anemometer, Hot Wire Anemometer, Laser Doppler Anemometer, Particle Image Velocimetry, Pressure Measurement, Manometer, Bourdon Tube Gauge, Piezoelectric Sensor, Temperature Measurement, Thermometer, Thermocouple, Thermistor, Optical Pyrometer, Rotational Speed Meters, Tachometer, Torque Measurement, Strain Gauges, Gas Analysis, Electro-Chemical Gas Analyzer, Accuracy, Precision, Statistical Methods Error Analysis and Uncertainty.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechanical Engineering Requirement	2		
Energy and Renewable Energy Engineering Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	25%	15%	40%

MEP331	Digital Control		2 CH
Prerequisites	Automatic Control		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	0	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
Introduction to Digital Control: Types of Control Signals: Analog, Discrete and Digital. Discrete-Time Systems: Difference Equation and Z-Transform, Pulse Transfer Function, Solution of Difference Equation for Open and Closed Systems. Modeling of Digital Control Systems. State Space Representation. Sampling Techniques, Analogue to Digital and Digital to Analogue Converters, Data Acquisition. Programmable Logic Controllers: Logic Gates, Ladder Diagram, Application to Pneumatic Circuits.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechanical Power Engineering Program	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
25%	25%	10%	40%

<table>
<tr><td colspan="2">MEP332</td><td colspan="8">Process control</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Digital control</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">1</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Process Control Principles and Applications: Dynamic Behavior of Linear and Non-Linear First- and Second-Order Systems. Sensors and Actuators. Signal Conditioning Circuits: Filters, Instrumentation Amplifiers and Power Circuits. Process Flow Diagram (PFD). Piping and Instrumentation Drawing (P and ID). The Dynamics and Control of Real Processes: Heat Exchangers, Boilers, Internal Combustion Engines, Turbines.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program</td><td colspan="4">3</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">25%</td><td colspan="3">25%</td><td colspan="3">10%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="2">MEP431</td><td colspan="8">Fire Fighting</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Heat Transfer, Fluid Mechanics and Turbo-Machinery</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Definition the Fire Fighting System, Classification of Occupancies, Types of Sprinkler Systems, Types of Sprinklers, Dry Pipe Sprinkler System, Deluge and Pre-Action System, Refrigerated Spaces, Commercial Type Cooking Equipment, Wet-Pipe Sprinkler System, Basic Design of Sprinkler Systems, How to Design a Project, Sprinkler Distribution inside the Places, Water Network Distribution and Sizing, Hydraulic Calculation Procedures –NFPA13. Using Hydraulic Calculation Program, Pumps Room, Control Stations, Testing and Commissioning, Extinguishing Agents and Portable Fire Extinguishers.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Mechanical Power Engineering Program Concentration</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

MEP432	Computational Fluid Dynamics			3 CH
Prerequisites	MEP 212 Heat Transfer, MEP 221 Fluid Mechanics and Turbomachinery			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Governing Equations of the Reactive and Non-Reactive Flow Fields, Boundary and Initial Conditions, Finite Difference Approximations, Errors, Convergence, Mesh Dependency Analysis, Stability and Consistency, Discretization, Order of Accuracy and Discretization Schemes, Stability and Convergence Criterion, Control Volume Approach, Conduction Heat Transfer across a Plate, Effect of Flow Advection on the Temperature Distribution, Examples of Advection and Diffusion Partial Differential Equations in Heat Transfer and Fluid Mechanics, Source Terms, Jet Flow, Jet Flow with Chemical Reaction, Simple Turbulence Models, Advantages and Disadvantages of Numerical Solutions.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEP433	Management of Mechanical Power Projects			3 CH
Prerequisites	Power Plant Technology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to Mechanical Engineering Projects, Project Classification, Collection of Projects Data, Statistical Analysis of Project Data, Project Finance, Project Budgeting, Bottle Necks of Projects, Asset Management, Facility Management, Equipment Depreciation, Failure and Anticipated Outage, Project Failure Modes, Project Requirements for Success, Estimation of Expenditure, Case Studies, Major Mechanical Projects, Mega Projects and Minor Projects, Utilization of Resources, Ware House Management and its Relation to Project Success, Project Management Techniques.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEP434	Water Desalination and Distillation			3 CH
Prerequisites	MEP 211 Thermodynamics, MEP 212 Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Water Resources Management, Composition of Saline Water, Salinity Levels, Primitive Treatment of Saline Water, Thermal and Membrane Separation of Salts, Post Treatment of Water, Single Effect Evaporation, Single Effect Evaporation with Vapor Compression, Single Effect Evaporation with Mechanical Compression, Single Stage Flashing Desalination, Multi-Stage Flashing Desalination, Reverse Osmosis, Solar Stills, Desalination by Freezing, Cost Consideration, Desalination via Electro Dialysis.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MDP435	Design of Mechanical Power Units			3 CH
Prerequisites	Machine Elements Design, Theory of Machines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Thermal Stresses across Boiler Vessels, Tube Sizing of Fire Tube Boilers and Water Tube Boilers, Axial Thrust Bearing and Journal Bearing of Centrifugal Pumps, Creep and Thermal Stresses in Steam Turbines, Selection of the Material and Diameter of Steam Turbine Shafts, Thermal Stresses in Internal Combustion Engines, Selection of the Material and Diameter of Gasoline and Diesel Engine Cylinders, Determination of the Thickness of Engine Cylinders, Design Consideration for Casting and Producing the Profile Shapes of Centrifugal Compressors, Selection of Axial Thrust and Journal Bearings of Axial Flow Compressors, Thermal Stresses and Deformation of Gas Turbine Nozzles, Thermal Stresses in Gas Turbine Blades and Selection of the Turbine Shaft Diameter and Blade Height.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

E3.4 Environment, Services and Systems Courses

MEP241	Technical Installations			2 CH
Prerequisites	Engineering Drawing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Preliminary Studies for Plumbing, Installations, Design of Water Supply and Drainage Systems, Water Pipe Sizing, Fire Fighting, Sprinkler Systems, Special Structures, Industrial Control of Thermal Environments, Design Criteria and Sustainability for Architectural Conditions, Effects of Shading on the Air Conditioning Thermal Loads, Distribution and Integration of Air Conditioning Exits with Other Building Systems, Air Grilles and Diffusers in Suspended Ceiling.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Discipline Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15 %	40%	

MEP341	Refrigeration and Air Conditioning			3 CH
Prerequisites	Heat Transfer			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Refrigeration: Theoretical Refrigeration Vapor-Compression Cycles, Actual Refrigeration Vapor-Compression Cycles. Multi-Stage Compression Systems, Different Types of Components of Refrigeration Systems, Refrigerants, Cooling Load for Cold Stores. Performance and Selection of Refrigerating Equipment, Control of Refrigeration Capacity, Absorption Refrigeration. Miscellaneous Refrigeration Systems. Air Conditioning: Requirements of Air Conditioning, Filed of Application, Properties of Moist Air, Construction of Psychrometric Chart. Psychrometric Processes. Summer Air Conditioning Cycles. Winter Air Conditioning Cycles. All Year Conditioning Cycles, Air Conditioning Cooling and Heating Load Calculations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP342	HVAC System Design			2 CH
Prerequisites	Thermal Analysis of Buildings			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Principles of HVAC system design and analysis, load estimation. Sustainable design issues and impact on environment, HVAC types and components. HVAC system selection criteria including room air distribution, fans and air circulation, Psychrometric charts and processes such as humidifying and dehumidifying processes, Air ducting design. Air quality standards and thermal comfort. HVAC Control systems and techniques, operational economics, computer applications for load calculations and air ducting design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP441	Applied Building Services Technology			3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Mechanical Systems Including HVAC (Heating Ventilation and Air-Conditioning Systems), Plumbing Systems, and Fire-Fighting Systems. Piping Systems for Chilled Water, Piping Systems for Hot and Cold Water Supply, Drainage and Fire-Fighting, Building Service and Energy System Design for High-Performance Buildings (such as Passive, Near-Zero-Energy and Positive Energy Buildings). Dealing with Plumbing Codes, Fire-Fighting Codes, HVAC Codes. Methods and Tools for Evaluating and Visualizing the Indoor Climate and Energy Performance of Buildings (e.g. Revit Software). Use of Simulation Tools (e.g. IDA ICE) for Evaluating the Indoor Climate and Energy Performance of Buildings in Relation to Certification Schemes such as LEED, and BREEAM.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP442	Thermodynamics of Materials			3 CH
Prerequisites	Engineering Chemistry			
Corequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Treatment of the Laws of Thermodynamics and Their Applications to Equilibrium and the Properties of Materials. Gibbs Free Energy and Phase Diagrams, Describing the State of an Alloy, The Chemical Potential, Stored Energy in Solids, Isotropic and Anisotropic Material Properties, Elastic Work, Entropy Contents in Materials, Generalized Conditions for Equilibrium, the Gibbs Phase Rule and Its Applications, Solution Thermodynamics, Unstable Solutions, Equilibrium Conditions for Solid Solutions, Equilibrium Conditions for Charged Species, Introduction to Surface Thermodynamics. Aspects of Statistical Thermodynamics as they relate to Macroscopic Equilibrium Phenomena. Introduction to Modeling of Thermodynamics Properties of Multiphase Equilibrium.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP443	Petroleum Pipelines			3 CH
Prerequisites	Fluid Mechanics and Turbo-Machinery, Incompressible Flow Machines			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Gas Pipeline, Liquid Pipeline. Mechanical Design of Pipelines: Thickness Calculation, Surge Assessment, Thermal Expansion, Support System Design. Coatings, Painting, Lining, Warping, Cathodic Protection System. Non-Metallic and Metallic Construction of Pipelines, Batch Operation, Handling Various Products. Pigging Scenarios: Above Ground, Buried, Submarine, Through Tunnels. Corrosion: Corrosive and Non-Corrosive Services, Lifetime Expectancy. Operation Scenarios, Surveillance and Monitoring Level. Field of Application: Petrochemical, Refinery, Gas Plant, Fertilizer Plants, Water, Seawater, General Industry. Hydrostatic Testing. Control Valves and Pipe Fittings. Maintenance: Planning for Oil Pipeline Spills. Leak Detection. Rehabilitation: Risk Evaluation. Codes, Specifications and Standard Pipe Details. Piping and Tubing Material. Piping Systems and Plant Utility.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP444	Economics of Energy Conversion				3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery				
Number of weekly Contact Hours					

Lecture	Tutorial	Laboratory
2	2	0

Required SWL	125	Equivalent ECTS	5

Course Content
First and Second Laws Analyses of Thermal Systems. Energy Analysis of Power Cycles, the Cost of Electrical Power Generation, Selection of the Type of Generation Unit, Performance and Operational Characteristics of Power Plants, Load Sharing among Generators. Interest and Depreciation, Present Worth, and Annual Worth. Cost, Levelizing Equations, Economic Evaluation Methods. Construction Cost, Operation and Maintenance Costs, Cogeneration, Economic Scheduling Principles, Load Distribution, Variation of Station Cost with Size of Unit.

Used in Program / Level	
Program Name or requirement	Study Level
Mechanical Power Engineering Program Concentration	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0	40%

MEP445	Environmental Impact of Mechanical Power Projects				3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery				
Number of weekly Contact Hours					

Lecture	Tutorial	Laboratory
2	2	0

Required SWL	125	Equivalent ECTS	5

Course Content
Definition of Environment. Human Effects of Projects: Development, Economical Effects, Social Effects, Cultural Effects, Aesthetics Effects, Healthy and Psychological Effects. Types of Projects: Building Projects: Residential, Touristic, Commercial and General Building. Projects of General Facilities: Power Stations, Water Treatment, Water Supply and Wastewater Network. Road and Railway Networks, Reservoirs, Dams, Canals and Drains. Different Industrial Project: Textures, Iron, Cement, Carpets, Ceramics and Food Industries. Electrical Devices and Automotive Industries. Impact of Projects on the Surroundings: Negative and Positive Impact, Direct and Indirect Effects, Evaluation of Different Experiments: Local and International Strategies to Avoid Negative Impact of Projects on the Environment, Permissible Limits for Agreement of Project with the Environment.

Used in Program / Level	
Program Name or requirement	Study Level
Mechanical Power Engineering Program Concentration	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

<table>
<tr><td colspan="2">MEP346</td><td colspan="5">Refrigerators and AC Systems and Equipment</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">HVAC System Design</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="2">2</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Air conditioning systems and classifications, Air terminal units (air handling units, fan coil units), Sections of air handling units (filters, cooling and dehumidifying coils, heating coils, Humidifiers, Fans), Chillers (air cooled chillers, water cooled chillers, absorption chillers) cooling towers, condensing units and its components, unitary air conditioning units, Desiccant dehumidifiers, Chilled water networks and pumps, energy recovery systems, expansion devices and cold stores.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="5">Mechanical Power Engineering Program Concentration</td><td colspan="3">4</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Assignments & Projects</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">35%</td><td colspan="2">25%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

E3.5 Nuclear Energy Technology Courses

MEP451	Nuclear Energy			3 CH
Prerequisites	Heat Transfer, Fluid Mechanics and Turbo-Machinery			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
This is an Introductory Course in Nuclear Engineering with Focus on Energy Conversion Aspects, Safety Systems and Sustainability of Nuclear Energy. The Course Starts with an Introduction on Nuclear Energy Policy and Regulation; then Moves on to Applied Nuclear Physics Covering Fission and Fusion Energy, Thermal Effects of Decaying Isotopes and Reaction Cross-Section. This is Followed by a Study of Thermal and Fast Reactors Covering Pressurized Water Reactors, Boiling Water Reactors, Gas Cooled Reactors and Fast Breeders Including Passive and Active Control and Safety Systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0	40%	

MEP452	Thermal Aspects of Nuclear Reactors			3 CH
Prerequisites	Heat Transfer			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Fluid Dynamics and Heat Transfer, Thermal and Hydraulic Analysis of Nuclear Reactors, Two-Phase Flow and Boiling, Compressible Flow, Stress Analysis, Energy Conversion Methods, Critical Heat Flux across Steam Boiler Walls.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program Concentration			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEP453	Nuclear Reactions and Interaction with Matter				3 CH
Prerequisites	Thermodynamics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Interaction of Gamma Rays, Neutrons, and Charged Particles with Matter, Nuclear Structure and Radioactive Decay, Cross Sections and Energies of Nuclear Reactions, Nuclear Fission and The Fission Products, Fission and Fusion Reactions as Energy Sources.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Power Engineering Program Concentration				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MEP454	Radioactive Waste Management				3 CH
Prerequisites	Heat Transfer				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Components and Material Flow Sheets for Nuclear Fuel Cycle, Waste Characteristics, Sources of Radioactive Wastes, Composition, Radioactivity and Heat Generation, Waste Treatment Technologies, Waste Disposal Technologies, Safety Assessment of Waste Disposal.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Power Engineering Program Concentration				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MEP455	Methods of Nuclear Risk Analysis				3 CH
Prerequisites	Power Plant Technology				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Methodological Approaches for the Quantification of Technological Risk and Risk Based Decision Making. Probabilistic Safety Assessment, Human Health Risks, Environmental and Ecological Risk Analysis.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechanical Power Engineering Program Concentration				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

E3.9 Graduation Projects

MEP491	Mechanical Power Graduation Project (1)			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		4
Required SWL	150		Equivalent ECTS	6
Course Content				
Selection of a Thermo-Fluid System which is Encountered in the Practical Field, Discussion of the Various Tools by which the Engineer actively Quantifies and Controls the Performance of the System, Determination of the Working Parameters that Affect the Performance of the System, Identifying the Mutual Relationships among the Different Components of the System.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

MEP492	Mechanical Power Graduation Project (2)			3 CH
Prerequisites	Mechanical Power Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		4
Required SWL	150		Equivalent ECTS	6
Course Content				
Designing the Prototype of the Elements under Investigation, Testing under Variable Conditions, Construction of the Operational Maps of the Different Components, Simulation of the System Behavior using CFD codes, Evaluating the System Performance underTransient and Steady State Steady Flow Conditions, Suggesting the Potential Methods for Improving the System Design and Operation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Power Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

E4. Courses offered by Automotive Engineering Department (MEA)

The Automotive Engineering Department is responsible for teaching courses that serve the following programs:

1. One Elective Course in Basic Mechanical Engineering courses as a Mechanical Discipline Requirement.
2. Automotive Engineering Program.

Table 48 List of specializations at the Automotive Engineering Department.

#	Specialization
1	Theory/Aerodynamics
2	Design
3	Maintenance
4	Engine/Fuel
5	Control/Simulation
6	Technology/Manufacturing

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 49 List of MEA courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Theory/Aerodynamics																				
1	2	211	Aerodynamics of Road Vehicles	2	4	100	2	1	0	3				x	35	25	0	40	MEP221	
2	3	311	Automotive Engineering	3	5	125	2	2	0	4				x	35	25	0	40	MEA241	
3		312	Road Vehicle Dynamics	3	5	125	2	2	0	4				x	35	25	0	40	MDP311	
4		313	Automotive Theory	3	5	125	2	2	1	5				x	20	20	20	40	MDP212	
5	4	411	Earth Moving Equipment and Commercial Vehicle Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEA311	
6		412	Race Car Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEA311	
7		413	Motorcycle and Tricycle Technology	3	5	125	2	2	0	4				x	35	25	0	40	MEA311	
2. Design																				
8	2	221	Vehicle Design and Simulation (1)	3	5	125	2	2	0	4				x	35	25	0	40	MDP211	
9	3	321	Vehicle Design and Simulation (2)	3	5	125	2	2	2	6				x	35	25	0	40	MEA221	
10		322	Automotive Design	2	4	100	2	1	0	3				x	20	20	20	40	MDP211	
3. Maintenance																				
11	3	331	Automotive Maintenance Engineering	3	5	125	2	0	3	5				x	15	15	30	40	MEA261	
12	4	431	Automotive After Sales Services	2	4	100	2	1	0	3				x	20	20	20	40	MEA331	
13		432	Workshop Planning & Vehicle Repair Technologies	3	5	125	2	2	0	4				x	35	25	0	40	MEA331	
4. Engine/Fuel																				
14	2	241	Automotive Engines	3	5	125	2	2	2	6				x	20	20	20	40	MEP211	
15	3	341	Automotive Fuel Systems	3	5	125	2	2	1	5				x	20	25	15	40	MEA241	
16		342	Design and Simulation of Automotive Engines	3	5	125	2	2	2	6				x	35	25	0	40	MEA241	MDP211
17	4	441	Engine Management Systems	3	5	125	2	2	0	4				x	35	25	0	40	MEA241	
18		442	Alternative Fuels and Emissions Control Systems	3	5	125	2	2	0	4				x	35	25	0	40	MEA241	
19		443	Powertrain Characterization & Measurement Syst.	3	5	125	2	2	0	4				x	35	25	0	40	MEA241	MEA311
5. Control/Simulation																				
20	3	351	Automotive Mechatronic Systems	3	5	125	2	2	2	6				x	25	20	15	40	ECE215	MCT211
21	4	451	Vehicle Safety Systems and Accident Analysis	2	4	100	2	0	2	4				x	35	25	0	40	MEA221	
22		452	Automotive Control Systems	3	5	125	2	2	0	4				x	35	25	0	40	MEA351	
6. Technology/Manufacturing																				
23	2	261	Introduction to Automotive	2	4	100	2	0	2	4			x		35	25	0	40	MDP112	
24	4	461	Vehicle Manufacturing and Assembly	3	5	125	2	2	0	4				x	35	25	0	40	MEA221	MEA261

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
9. Graduation Project																				
25	4	491	Automotive Graduation Project (1)	3	5	125	1	0	6	7				x	50	0	0	50		
26		492	Automotive Graduation Project (2)	3	5	125	1	0	6	7				x	50	0	0	50	MEP491	

E4.1 Theory/Aerodynamics Courses

MEA211	Aerodynamics of Road Vehicles					2 CH
Prerequisites	Fluid Mechanics and Turbomachinery					
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
2		1			0	
Required SWL		100	Equivalent ECTS		4	
Course Content						
Aerodynamics forces and moments: Air flow over the exterior of the vehicle body and through the vehicle interior. Separation of air flow lines over the vehicle body. Flow properties: Pressure distribution and vortex systems. Principles of aerodynamic force analysis and its effects on the vehicle steady state and transient response stability.						
Used in Program / Level						
Program Name or requirement				Study Level		
Automotive Engineering Program				2		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
35%		25%		0%		40%

MEA311	Automotive Engineering					3 CH
Prerequisites	Automotive Engines					
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
2		2			0	
Required SWL		125	Equivalent ECTS		5	
Course Content						
Tires: Tire forces and moments, tire rolling resistance, Tractive effort, Tire radii, Cornering properties, Ground vehicle dynamics: Road resistance, Traction and tractive effort, performance curves, equations of motion, Dynamic certificate, acceleration and time with distance, grades and overtaking. Braking Systems: brake system requirements, antilock braking system theory.						
Used in Program / Level						
Program Name or requirement				Study Level		
Automotive Engineering Program				3		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
35%		25%		0%		40%

MEA312	Road Vehicle Dynamics			3 CH
Prerequisites	Mechanical Vibration			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Steering Systems: Steering linkages, steering systems design, Ackerman's Theory, Steering geometry error, steering gear ratios, vehicle steering properties: neutral, oversteer and understeer, vehicle directional stability, Vehicle comfort criteria: Human response to vibrations and international standards, sources of random vibrations and road surfaces.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEA313	Automotive Theory			3 CH
Prerequisites	Theory of Machines			
Corequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Automotive propulsion systems: types, traction forces calculations for manual andautomatic transmissions, rolling resistance and tire slip, air and gradient resistances,vehicle acceleration and surplus effort. Automotive braking systems: types andperformance. Automotive basic handling characteristics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

MEA411	Earth Moving Equipment and Commercial Vehicle Technology			3 CH
Prerequisites	Automotive Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Types of earth moving equipment, Tracked vehicle types and performance, hydraulic systems: pumps, pump control systems, valves types, hydraulic plans, hydraulic motors, hydraulic disks, hydraulic components sizing for performance.Types of commercial vehicles, Dynamic performance of commercial vehicles: Buses, Truck trailer, Semi-trailer, Fuel economy.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEA412	Race Car Technology			3 CH
Prerequisites	Automotive Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Race cars: requirements, design constraints and specification, tire combined slip characteristics, applied aerodynamics, Ride and roll rates, suspension, dynamics, steering and braking, practice and testing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

<table>
<tr><td>MEA413</td><td colspan="3">Motorcycle and Tricycle Technology</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Automotive Engineering</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Motorcycle and Tricycles market and product development, Simulation in motorcycle and tricycle development, Vehicle design, Powertrain, Chassis, Ergonomics and Human-Machine Interface, Electric and Electronics, Road traffic accidents and active / passive Safety</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Automotive Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

E4.2 Design Courses

MEA221	Vehicle Design and Simulation (1)			3 CH
Prerequisites	Machine Elements Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Classification of springs, Design of coil springs: Stresses, Deflection, Check on buckling, Fatigue and natural frequency. Leaf springs: Stresses, Deflection, Neutral layer, Spring capacity. Torsion bar: Stresses, Equivalent stiffness, Design of rigid axle beam and king pin Independent suspensions, Design of double wishbone and Macpherson suspensions, Bearings.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEA321	Vehicle Design and Simulation (2)			3 CH
Prerequisites	Vehicle Design and Simulation (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Drum and disc brakes: Mechanical advantage, Assisted brake systems. Introduction to chassis design, Chassis types. Belts: Stresses, Design, Load carrying capacity, Pulleys, Shafts, Clutches, Design of springs, Hydraulic coupling, Gears: Spur, Helical, Worm, Bevel. Gearbox: Gear ratios, Torque distribution, Shifts.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEA322	Automotive Design			2 CH
Prerequisites	Machine Elements Design			
Corequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Dry and Wet automotive clutch design. Manual transmission design. Automotivesuspension system: components, design factors, static and dynamic loads.Automotive steering system: components, static and dynamic loads.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

E4.3 Maintenance Courses

MEA331	Automotive Maintenance Engineering				3 CH
Prerequisites	Introduction to Automotive				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		0		3	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Maintenance: Test required to evaluate engine performance: Compression test,Vacuum test, Leakage test, Homogeneity test, By pass gases test and exhaust gas analysis. Periodic maintenance: Fault diagnosis and testing for Fuel systems components, Ignition systems, Distributor, circuits, Spark plugs, Charging, starting systems, Braking systems, Steering systems,					
Used in Program / Level					
Program Name or requirement			Study Level		
Automotive Engineering Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
15%	15%		30%	40%	

MEA431	Automotive After Sales services				2 CH
Prerequisites	Automotive Maintenance Engineering				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Practical solutions to improve processes, productivity and efficiency of staff, reduce costs and increase bottom line using powerful, proven, measurable ideas that can be implemented in dealership, optimization of customer relationship and CSI, improvement of customer retention strategies. Field visits to multiple aftersales centers.					
Used in Program / Level					
Program Name or requirement			Study Level		
Automotive Engineering Program			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

MEA432	Workshop Planning and Vehicle Repair Technologies			3 CH
Prerequisites	Automotive Maintenance Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Workshop planning: Maintenance operation technologies, calculation of required effort for maintenance and fixture process. Required jobs for maintenance and setup, workstations locations, assisting workshops sizing, optimum workshop planning, job planning and scheduling, workshop-required services.Restoration: replacement, adjustment, welding of all materials used in vehicles, tools used in restoration, restoration advanced technology.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E4.4 Engine/Fuel Courses

MEA241	Automotive Engines				3 CH
Prerequisites	Thermodynamics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		2	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Classification of internal combustion engines, Actual working cycles, Standard air cycles, Standard air and fuel cycles, Combustion in spark ignition engines, Combustion periods, Ignition points, Flammability limits, Detonation, Flame propagation, Pressure rise, Combustion chambers. Friction and lubrication, Lubrication system, Lubricating oil and additives properties, Oil consumption, Oil filters. Engine cooling.					
Used in Program / Level					
Program Name or requirement				Study Level	
Automotive Engineering Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

MEA341	Automotive Fuel Systems				3 CH
Prerequisites	Automotive Engines				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Objective of fuel systems. Classification of fuel systems. Fuel requirement at different operating conditions. Spark ignition and compression ignition engines fuel calibration. Mechanical and Electronic injection systems of spark ignition and compression ignition engines. Procedures for testing of injection systems.					
Used in Program / Level					
Program Name or requirement				Study Level	
Automotive Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	25%		15%	40%	

MEA342	Design and Simulation of Automotive Engines			3CH
Prerequisites	Automotive Engines, Machine Elements Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Cylinders block: Design factors, Cylinder liner types, mechanical and thermal stresses and liner installation, Cylinder head: Design factors, Charge and exhaust tracks, Mechanical and thermal stresses, Piston group: Design factors, Piston types, Connecting rod: Design factors, Connecting rod types, Stresses on thin rings. Valves: Design factors, Cam shape, Forces analysis on different parts. Crankshaft: Design factors, Lubricant effect on bearing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEA441	Engine Management Systems			3 CH
Prerequisites	Automotive Engines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Engine control unit architecture, Gasoline engine fuel and ignition management types, sensors, actuators, Diesel engine fuel supply system, unit injector system, common rail system, exhaust gas treatment, diesel electronic control system, emission control systems, fault diagnosis, tuning methods and upgrades.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

MEA442	Alternative Fuels and Emissions Control Systems			3 CH
Prerequisites	Automotive Engines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Types of alternative fuels, Biofuel, Ethanol, Electricity, Natural Gas, Hydrogen, Propane, Methanol, etc. Modification to engines for operation on alternative fuels. Fuel alternatives emissions and methods of reduction. Effect of alternative fuels on engine service life. Sources of pollution: Exhaust gas, Types of pollution, Effect of engine performance characteristics on pollutants levels in both diesel and petrol engines, Catalytic Converter, PCV Valve, EGR Valve, Air injection.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

MEA443	Powertrain Characterization and Measurement Systems			3 CH
Prerequisites	Automotive Engines, Automotive Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Vehicle Powertrain Concepts, Power Generation Characteristics, Vehicle Longitudinal Dynamics, different Transmission types Design. Introduction for measuring, Different phenomena and measuring of each phenomena. Measuring of: Pressure, Temperature, Linear and rotation speed, Volt, Current, Resistance, Acceleration, Weight, Force, Torque, Strain, Stress, Fuel consumption, Calibration, Static and dynamic measuring, Sensors, Curve fitting, Errors and its probability.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E4.5 Control/Simulation Courses

<table>
<tr><td>MEA351</td><td colspan="3">Automotive Mechatronic Systems</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Electronic Circuits for Mechanical Engineers, Automatic Control</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>2</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction to Mechatronics, Analog electronics, Digital electronics, Sensors, transducers, and Actuators in automotive systems. Basics of Applied electronics in modern vehicles: Integrated circuits, signal condition of sensors, drive circuits of actuators. Automotive systems, smart chassis, X-By-Wire, etc. Electric drive vehicles. Autonomous vehicles and its infrastructure. Introduction to microcontrollers.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Automotive Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>20%</td><td>15%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>MEA451</td><td colspan="3">Vehicle Safety Systems and accident analysis</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Vehicle Design and Simulation (1)</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">0</td><td>2</td></tr>
<tr><td>Required SWL</td><td>100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Road and vehicle safety, active/passive safety. Passive safety, Accident analysis, Momentum. Impact, Coefficient of restitution, Momentum conservation, Energy conservation. Methods of estimation of V accident. Analysis methods, Automotive simulation methods and software: Accident reconstruction techniques, Measuring equipment.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Automotive Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td colspan="4">MEA452</td><td colspan="7">Automotive Control Systems</td><td>3 CH</td></tr>
<tr><td colspan="4">Prerequisites</td><td colspan="8">Automotive Mechatronic Systems</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">State-space: controller design, controllability, observer design, observability. Digital control systems: z-transform, stability, transient response on the z-plane, cascade compensation via the s-plane. Applications to automotive case studies.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Automotive Engineering Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

E4.6 Technology/Manufacturing Courses

MEA261	Introduction to Automotive				2 CH
Prerequisites	Machine Construction				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		0		2	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Ground vehicles types. Vehicle main structure. Engine: types, starting system, fuel supply system and ignition system. Clutch: dry friction, wet friction, hydraulic torque converter. Transmission, Differential and final drive. Tires, Wheel alignments and angles, Braking systems, Suspension systems, Steering systems, Introduction to automotive advanced technologies.					
Used in Program / Level					
Program Name or requirement			Study Level		
Mechanical Engineering Requirement Elective – Automotive Engineering Program Requirement			2		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

MEA461	Vehicle Manufacturing and Assembly				3 CH
Prerequisites	Vehicle Design and Simulation (1), Introduction to Automotive				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Manufacturing and assembly processes: Welding, Riveting, Metal forming, Painting, Molding, Electrical connections. Assembly lines: Engine, Chassis, Power train systems, Brakes, Suspension, Steering. Design of production lines and calculation of each station and person-hours. Quality control and inspection. Testing of the final product. Economics of manufacturing and assembly: Site selection, Area required transportation costs.					
Used in Program / Level					
Program Name or requirement			Study Level		
Automotive Engineering Program			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

E4.9 Graduation Projects

MEA491	Automotive Graduation Project (1)			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	125		Equivalent ECTS	5
Course Content				
Under supervision, the student should approach hisgraduation project within his senior year. The purpose of this graduation project is to provide students with an opportunity to engage in an activity that will allow them to demonstrate their ability to apply the automotive knowledge and skills they have gained throughout their years in the educational system. The project is designed to ensure that students are able to apply the knowledge and analyze and synthesize the information.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

MEA492	Automotive Graduation Project (2)			3 CH
Prerequisites	Automotive Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	125		Equivalent ECTS	5
Course Content				
This graduation project may be seen as a continuation of the first part (MEA 491: Graduation Project (1)) of a major topic, or it might be a new subject that the student is considering to prove his competence in automotive engineering practice.				
Used in Program / Level				
Program Name or requirement			Study Level	
Automotive Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

E5. Courses offered by Mechatronics Engineering Department (MCT)

The Mechatronics Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Mechanical Engineering courses as a Mechanical Discipline Requirement.
2. Manufacturing Engineering Program.
3. Mechatronics Engineering Program
4. Mechatronics Engineering and Automation Program

Table 50 List of specializations at the Mechatronics Engineering Department.

#	Specialization
1	Automation and Control
2	Embedded Design
3	Mechatronics Design and Manufacturing
4	Robotics and Mechatronics Applications

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total
UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement
SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 51 List of MCT courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Automation and Control																				
1	2	211	Automatic Control	3	5	125	3	1	1	5			x		20	20	20	40	MEP231	
2	3	311	Hydraulics and Pneumatics Control	3	5	125	3	1	1	5			x		20	20	20	40	MEP221	/MEP222/
3		312	Industrial Automation	2	4	100	2	1	1	4				x	20	20	20	40	MCT211	CSE131
4		313	Automation	3	5	125	3	1	1	5			x		20	20	20	40	MCT211	
5	4	411	Hybrid Control Systems	3	5	125	2	2	1	5				x	20	20	20	40	MCT211	
6		412	Motion Control	3	5	125	2	2	1	5				x	20	20	20	40	MCT211	
7		413	Modelling and Control of Electrohydraulic Systems	3	5	125	1	2	1	5				x	20	20	20	40	MCT211	MCT313
8		414	Automation & Communication Systems in Manufac.	3	6	150	2	2	1	5				x	20	25	15	40	MCT312	
2. Embedded Design																				
9	4	421	Embedded systems for Automotive	3	6	150	2	1	3	5				x	20	20	20	40	CSE211	
10		422	Automotive Embedded Networking	3	6	150	2	2	1	5				x	20	20	20	40	CSE411	
3. Mechatronics Design and Manufacturing																				
11	1	131	Introduction to Mechatronics	3	6	150	2	2	2	6				x	20	20	20	40		
12	2	231	Engineering Measurements	3	5	125	2	2	1	5				x	20	20	20	40	PHM111	
13		232	Industrial Electronics	3	5	125	2	2	1	5				x	40	10	10	40	ECE213	
14		233	Dynamic Modeling and Simulation	3	6	150	2	2	1	5				x	20	20	20	40	PHM131	PHM112
15		234	Modeling and Simulation of Mechatronics systems	2	4	100	1	2	1	4				x	20	20	20	40	MDP311	
16	3	331	Design of Mechatronic Systems (1)	3	6	150	1	1	3	5				x	40	20	40	0	MCT131	MCT233
17		332	Design of Mechatronic Systems (2)	3	7	175	1	0	3	4				x	60	0	40	0	MCT331	
18		333	Mechatronic Systems Design	3	6	150	1	1	2	4				x	40	20	40	0	MCT131	MCT234
19		334	Sensors and Measurement Systems	3	5	125	2	2	1	6				x	20	20	20	40	MEP231	MCT232
20	4	431	Industrial Communications and Networks Systems	3	5	125	2	2	1	5				x	20	20	20	40		
21		432	MEMS Devices	3	5	125	2	2	1	5				x	20	20	20	40	MCT349	
22		433	MEMS Design	2	4	100	1	2	1	4				x	20	20	20	40	MCT232	
23		434	Engineering Optimization	2	4	100	1	2	1	4				x	20	20	20	40	PHM112	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
4. Robotics and Mechatronics Applications																				
24	3	341	Introduction to Autotronics	2	4	100	2	1	1	4				x	20	20	20	40	MCT131	
25		342	Introduction to Nano-Mechatronics	2	3	75	2	1	1	4				x	20	20	20	40	MCT131	
26		343	Introduction to Bio-Mechatronics	2	4	100	2	1	1	4				x	20	20	20	40	MCT131	
27		344	Industrial Robotics	3	5	125	2	2	1	5				x	20	20	20	40	MDP212	
28		345	Industrial Mechanisms and Robotics	3	5	125	2	2	1	5				x	20	20	20	40	MDP212	
29		346	System Physiology	2	4	100	2	1	0	3				x	65	25	10	40	MCT343	
30		347	Locomotion and Gait Analysis	3	5	125	2	2	1	5				x	20	20	20	40	MCT343	
31		348	Introduction to Biomechanics	3	5	125	2	2	1	5				x	20	20	20	40	MCT343	MDP212
32		349	Material Properties and Characterization	3	5	125	2	2	1	5				x	20	20	20	40	MCT342	
33		350	MEMS/NEMS Characterization: Systems & Methods	3	5	125	2	2	1	5				x	20	20	20	40	MCT342	
34	4	441	Rehabilitation Robots	3	5	125	2	2	1	5				x	20	20	20	40	MCT344	MCT347
35		442	Biomedical Engineering	3	5	125	2	2	1	5				x	20	20	20	40	MCT343	
36		443	Design of Autonomous systems	3	5	125	2	2	1	5				x	20	20	20	40	MCT344	
37		444	Mechatronics in Rehabilitation Technology	2	4	100	2	1	1	4				x	20	20	20	40	MCT131	
38		445	Mechatronics in Automotive Application	2	4	100	2	1	1	4				x	20	20	20	40	MCT131	
39		446	Autotronics	3	6	150	2	0	3	5				x	20	20	20	40	MCT341	MEA313
40		447	MEMS Systems	3	5	125	2	2	1	5				x	20	20	20	40	MCT448	
41		448	MEMS/NEMS Fabrication and Packaging	2	4	100	2	1	0	3				x	20	20	20	40	MCT342	
42		449	Selected topics in Industrial Mechatronics	2	4	100	2	1	0	3				x	20	20	20	40	MCT131	
9. Graduation Project																				
43	4	491	Mechatronics Graduation Project (1)	3	6	150	1	4	0	5				x	60	0	40	0		
44		492	Mechatronics Graduation Project (2)	3	6	150	1	4	0	5				x	60	0	40	0	MCT491	

E5.1 Automation and Control Courses

MCT211	Automatic Control Systems			3 CH
Prerequisites	/Mechanical Vibrations/ /Dynamic Modeling and Simulation/			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction, Examples in: (Robotics, CNC Machines, Internal Combustion Engine (ICE), Industrial Furnaces, Process control, Servos, … etc.). Concepts and Fundamentals of open loop, closed loop, cascaded and feedforward control systems. The application of modelling techniques for control systems analysis. Determination of the plant and system responses in the time and frequency domains (using ODE, Transfer Function, Frequency response, Nyquist and Bode diagrams). Using software packages such as LabVIEW or MATLAB in the Lab to perform the previous aims. The industrial control equipment components (sensors, controllers(P, PI, PID etc.), actuators) and the corresponding specifications. The control system analysis tools and performance evaluation (e.g. steady state error, Stability and performance indices). Design control system compensators using the methods of Root-Locus, Frequency response, and pole- placement. P, PI, and PID controller tuning using Zeigler-Nichols and Cohen-Coon methods and applying that on a mini-Project.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			3	
Mechatronics Engineering and Automation Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

MCT311	Hydraulics and Pneumatics Control			3 CH
Prerequisites	Fluid Mechanics and Turbo-Machinery or Introduction to Fluid Mechanics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Physical principles and fundamentals of fluidic control systems, applications of pneumatic and hydraulic systems. Hydraulic control system components: power units, reservoirs, filters, piping and hoses, accumulators, pumps(positive versus non-positive displacement pumps, vane pumps, gear pumps, variable displacement pumps, piston pumps, swashplate pumps, pump control systems), valves (spoolvalve, poppet valve, pilot-operated valves, pressure control valves, flow controlvalves, check valves, sequence valves, proportional valves, servo valves, cartridgevalves, etc.), actuators (motors and cylinders), hydraulic and electrohydraulic circuits design, interfacing and control. Case studies from industry, heavy and earthmoving equipment. Pneumatic systems: service unit, compressors (piston, screw, rotary), filters,air dryers, lubricators, pressure regulation valves, control valves, etc., electro-pneumatic circuits design and control using sequential approaches.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			3	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam

20%	20%	20%	40%

MCT312	Industrial Automation		2 CH
Prerequisites	Automatic Control, Computer Programming		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
Industrial automation history and applications, automation system structure and components: sensors, signal conditioning, human interface, actuators, drivers, control systems, automation strategies. Logic systems design: principles of digital logic, design of combinational and sequential logic control systems. Hardwired ladder diagram. Programmable Logic Controllers (PLC): Introduction, Hardware, programming Languages, Programming functions, Analogue modules, Special functions. Communications and Networks in automation systems; Supervisory Control and Data Acquisition (SCADA); Applications and relevant case Studies on FMS and CIM in Manufacturing and Production Systems, Digital Factory, Power Systems, Oil and Gas Industry, …, etc.			
Used in Program / Level			
Program Name or requirement		Study Level	
Mechanical Engineering Requirement Elective		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

MCT313	Automation		3 CH
Prerequisites	Automatic Control		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
3	1	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Automation history and applications, Automation system architecture and components, Principles of logic systems design, Boolean Logic, Design of combinational and Sequential logic systems, Hardware considerations and wirings of automated systems. Computer based automation, Human Machine Interfaces (HMIs); PLC based automation (PLC): hardware, wiring, programming Languages (Ladder diagram (LLD), function block (FB), structured text, and sequential functional chart (SFC)), Analogue Modules and Special Functions. Communications and Networks within automation systems; Supervisory Control and Data Acquisition (SCADA); Distributed Control Systems (DCS); Internet of Things (IoT) based Industrial Automation; Automation Systems Security. Applications andcase studies relevant to the mechatronics and mechanical Engineering such as flexible manufacturing systems (FMS), Computer integrated manufacturing (CIM), Manufacturing and production systems, Digital factory, Power systems, Oil and gas industry, …etc.			
Used in Program / Level			
Program Name or requirement		Study Level	
Mechatronics Engineering and Automation Program		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20%	20%	40%

MCT411	Hybrid Control Systems			3 CH
Prerequisites	Automatic Control			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to hybrid control systems: basic concepts, time-driven versus event driven control systems, discrete event system, finite-state automata, hybrid control architecture. Digital control fundamentals, Digital control systems: digitization, analysis of discrete systems, Z-transform, digital control systems design. Design and control of discrete event mechatronic systems, GRAFCET, SFC, Petri-nets: basics, comparison of Petri-nets and automata, control using Petri-nets. Timed and hybrid control: timed automata, timed Petri-nets, hybrid systems. Markov chains, design of controlled Markov chains. Design of fault diagnosis and supervisory control systems. Case studies and applications of hybrid control applications in industrial and manufacturing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

MCT412	Motion Control			3 CH
Prerequisites	Automatic Control			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Review of Mechanics, Force and Torque, Characteristics of Motion Elements, Parameter Measurement, Elements of a Motion Control System, System Requirements, Position, Velocity and Torque/Acceleration Controls, Sensors in Motion Control: Position, Velocity and Acceleration Sensors, Voltage and Current Sensors, Force and Torque Sensors, Motion Actuators: Analysis of The Dynamics of Induction, Brushless DC and Synchronous machines, Scalar VS Vector Control, Parameter Sensitivity and Identification, Stepping and Switched Reluctance Motors, Static and Dynamic Characteristics, Piezoelectric Motors, Motion Systems, Machine, Converter and Controller, Motion Control System Design: Stability, Hierarchical Design Techniques, Error Analysis and Elimination, Disturbance Rejection.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
25%	25%		10%	40%

MCT413	Modelling and Control of Electrohydraulic Systems	2 CH
Prerequisites	Automatic control, Hydraulic and Pneumatic control	

Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	2	1	
Required SWL	100	Equivalent ECTS	4
Course Content			
Electrohydraulic Principles, Proportional Valve: Spools, Nominal Flows, pressure drops, power limits, performance terms, Electronics and Amplifier cards, Servo Solenoid valves, Servo Valves: Torque motor and its analysis, flapper nozzle and its mathematical model, Servo Cylinders, Modelling of Electrohydraulic system using Matlab/Simulink, Linearization of servo cylinder closed loop position control system, Oil filtration and contamination, selective circuits from industrial plant			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechatronics Engineering Program	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20 %	20%	40%

MCT414	Automation and Communication Systems in Manufacturing	3 CH	
Prerequisites	Automation		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	150	Equivalent ECTS	6
Course Content			
Basic concepts, discrete event control systems in manufacturing automation, modeling and analysis of automated manufacturing systems using finite-state automata,Petri-nets, and hidden Markov models. Design of condition monitoring, fault detection and diagnosis, and supervisory control systems of manufacturing systems. Communication networks in industry and automation, signal and data transmission and protocols, network control systems configurations, Industrial network standards and protocols. Basic concepts of machine vision systems, components of machine vision system, camera type and specifications, camera interfaces, basics of image processing and vision techniques, applications of vision systems in inspection, production and manufacturing process. Case studies on automation and communication systems in production and manufacturing systems.			
Used in Program / Level			
Program Name or requirement	Study Level		
ManufacturingEngineering Program	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	25%	15%	40%

E5.2 Embedded and Smart Systems Courses

<table>
<tr><td>MCT421</td><td colspan="4">Embedded Systems for Automotive</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Introduction to Embedded Systems</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">3</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Full review on static code checking in automotive embedded software development. MISRA tools deployed on Code Composer IDE (TM from Texas Instruments) as a practical example. Embedded software development in Real Time Operating System environment. Using TIVAWare in developing embedded automotive software projects. CAN bus standard and TivaWare driver. Programming using CAPL scripting from Vector evaluation version. Understanding OSEK network management state machine. Simulation of OSEK NM on Vector evaluation version. Understanding Autosar concept and partial develop Basic Software component. Understand Virtual function bus and Software Component Concept using AutoSar studio as an example open source tool.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Mechatronics Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Lab Activities</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>25%</td><td colspan="2">10%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>MCT422</td><td colspan="4">Automotive Embedded Networking</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Real-Time and Embedded Systems Design</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">3</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Introduction to automotive embedded networking - Automotive CAN network simulation using CANoe (Vector Germany) evaluation version - Principles of CAPL script to simulate external events and network communications - Introduction to CAN bus protocol - TIVA C embedded development using CAN bus - MISRA static code checking guidelines - MISRA and Code Composer Texas Instruments tools - Real Time Operating System on TIVA C - OSEK network management standard - OSEK NM simulation using CANoe - OSEK state machine C development - Introduction to AutoSar Automotive embedded development standard - AutoSar Real Time Environment (RTE) - AutoSar Basic Software (BSW) - AutoSar Software Components (SWC).</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Mechatronics Engineering and Automation Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Lab Activities</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20 %</td><td colspan="2">20%</td><td colspan="2">40%</td></tr>
</table>

E5.3 Mechatronics Design and Manufacturing Courses

MCT131	Introduction to Mechatronics			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Mechatronics definition, background and history, industrial revolution, mechatronics design philosophy and methodologies, mechatronics and optimal machine design, mechatronics system components, configuration and synergetic integration (mechanical system, electrical/electronics, sensors, actuators, control systems, .., etc.). Case studies of mechatronic systems applications in automotive, industry, manufacturing, medical and healthcare, …, etc.. Beginning levels on programming, building electrical and electronics circuits, building simple mechatronic systems. Practice through Labs and projects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			2	
Mechatronics Engineering and Automation Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT231	Engineering Measurements			3 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the design of measurement systems: functional elements of an instrument, classification and configuration, analog and digital sensors, input-output configuration of instruments, variable conversion elements and signal amplification, methods of correction for interfering and modifying inputs. Design criteria and dynamic performance of ideal measurement systems: generalized performance characteristics of instruments, static and dynamic performance, accuracy, statistical analysis of measurement errors, calibration and regression. Measuring devices and sensors: flow, pressure, temperature, motion, force, and power sensors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20 %	20%	40%	

MCT232	Industrial Electronics	3 CH

Prerequisites	Electronic Circuits		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Operational amplifiers (OP-AMPs): difference amplifier, OP-AMP specifications, frequency characteristics. OP-AMP applications: adder, subtracter, integrator, differentiator, electronic analogue computation, I to V and V to I converters, comparators, Active filters, Schmitt trigger, OP-AMP oscillators (rectangular, sinusoidal, Wien bridge and phase shift). Timing: Ring Oscillators, Relaxation Oscillators, 555 timers, Voltage Controlled Oscillators. Digital to Analog Converters (DACs) and Analog to Digital Converters (ADCs). Voltage to frequency and frequency to voltage conversion. Application of electronic instrumentation methodology (modeling, analysis, and design) and tools (sensors, instruments, basic electronic hardware and simulation software). Data acquisition systems. Applications.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechatronics Engineering Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
40%	10 %	10%	40%

MCT233	Dynamic Modeling and Simulation	3 CH	
Prerequisites	Rigid Body Dynamics, Differential Equations and Numerical Analysis		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction to systems modeling and simulation, Systems modeling: modelling importance and usage, modeling techniques and methods, mathematical modeling. Modeling of mechanical and vibration systems: single degree of freedom, free damped and undamped vibration, forced vibration, multi-degree of freedoms, absorbers. Electrical and electromechanical systems modeling: electrical ciruits, Op-Amps, electrical geared DC motors, speaks, solenoid. Thermal and fluidic systems modeling. Model linearization and analysis, modeling using transfer function and block diagrams,, state space modeling representation.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechatronics Engineering and Automation Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20%	20%	40%

MCT234	Modeling and Simulation of Mechatronics systems	2 CH
Prerequisites	Mechanical Vibrations	
Number of weekly Contact Hours		

Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to modeling and simulation, system definition, classification of systems, linear versus non-linear , discrete-time systems. Systems modeling: modelling importance and usage, modeling techniques and methods, mathematical modeling. Review of mechanical, electrical, electromechanical, thermal, and fluidic systems modeling. Model linearization and analysis, modeling using transfer function and block diagrams, state space modeling representation. Simulation: applications of simulation, simulation techniques, numerical methods of simulation, characteristics of numerical models, discrete-event modeling and simulation, Hardware In the Loop simulation (HIL). Case studies for modeling and simulation of mechatronic systems via projects and assignments.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT331	Design of Mechatronic Systems (1)			3 CH
Prerequisites	Introduction to Mechatronics, Dynamic Modeling and Simulation			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		1		3
Required SWL	150	Equivalent ECTS	5	
Course Content				
Introduction to mechatronics systems: definitions, impact on industry and the technocommercial benefits, mechatronics system hierarchy, basic mechatronics modules. Mechatronics design methodology: traditional approaches, V-model, nested Vmodel, simplified examples. Essential tools for the mechatronics design approach using the V-model: MATLAB/SIMULINK, PROTEUS VSM, SOLID WORKS packages with examples. Basic mechatronics modules and its relation to the hierarchy of the mechatronic systems. Design and implementation of the Discrete Event Mechatronics Module (DE-MM): Choice of sensors, actuators, controller, implementation in the form of mini-projects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
40%	20%	40%	0%	

MCT332	Design of Mechatronic Systems (2)			3 CH
Prerequisites	Design of Mechatronics systems (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	0		3	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Process Control Embedded Mechatronics Module (PC-EMM): implementation using any microcontroller based embedded system in the form of mini-project. Embedded Motion Control Mechatronics Module (MC-EMM): choice of sensors, actuators, controller, control algorithm programming, commercial software, implementation using an industrial servo motor with its drive and a suitable HMI in the form of mini-project. Embedded Machine Vision Mechatronics Module (MV-EMM): image acquisition, processing, features extraction, 3D vision sensors, control, mechatronics applications. Tools required for the development, design, implementation, integration and testing of mechatronics modules: rapid prototyping technologies of mechatronic systems: MATLAB/SIMULINK, real-time workshop, QUARC, LabView and other rapid prototyping techniques. Introduction to autonomous systems: autonomous vehicles, autonomous mobile robots, general layout and construction of mobile robots, the level of mobile robots in the hierarchy of the mechatronic systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Term Work	Mid-Term Exam	Lab Activities	Final Presentation	
60%	0%	0%	40%	

MCT333	Mechatronic systems design			3 CH
Prerequisites	Introduction to Mechatronics, Modeling and Simulation in mechatronics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	1		2	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Mechatronic product development process, Product requirements and needs (customer and engineering requirements/specifications), design constraints, modular mechatronic systems and hierarchy. Mechatronics design methodology: traditional approaches, VDI 2206, V-model, nested Vmodel, simplified examples and case studies. Selections of mechanisms, actuators, sensors, and controllers, actuator and motor sizing. Essential tools for the mechatronics system design using the V-model: MATLAB/SIMULINK, LabVIEW, PROTEUS VSM, SOLIDWORKS, microcontrollers, etc. packages. Design and implementation of mechatronic systems via mini-projects				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
40%	20%	40%	0%	

MCT334	Sensors and Measurement Systems	3 CH
Prerequisites	Measurement and Instrumentation, Industrial Electronics	

Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to sensors and measurement systems: functional elements of an measuring instrument, classification and configuration, analog and digital sensors, input-output configuration of instruments, variable conversion elements and signal amplification, methods of correction for interfering and modifying inputs, statistical analysis of measurement errors, calibration and regression. Measuring devices and sensors: pressure, current, motion (encoder, potentiometer, resolver, LVDT, accelerometer, gyroscope, IMUs, etc.), strain gauges, force, torque, and power sensors. Sensors signal conditioning and processing: Sources of noises in the sensor signals, electromagnetic interference (EMI), electromagnetic compatibility (EMC), grounding and shielding, amplifiers, filters, multisensory fusion. Data acquisition systems of measurement systems.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechatronics Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Lab Activities	Final Exam	
20%	20%		20%	40%	

MCT431	Industrial Communications and Networks Systems				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	4	
Course Content					
Introduction: signaling, data communication, protocols, layered architecture, network standards. Industrial network standards and protocols: EIA-232, EIA-485, DH-485 and industrial local area networks, industrial Ethernet, Power over Ethernet (PoE), fiber optics, Modbus, Modbus+, Modbus/TCP, HART, AS-i, DeviceNet, Controller Area Network (CAN) and CAN bus, FieldBus, ProfiBus, TCP/IP. ZigBee wireless sensor and control network: IEEE 802.15.4 protocol, addressing, routing, ZigBee RF4CE. Industrial network security: vulnerabilities, threat detection, risk assessment, monitoring and control, standards and regulations, securing industrial networks. Applications.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechatronics Engineering and Automation Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Lab Activities	Final Exam	
20%	20%		20%	40%	

MCT423	MEMS Devices			3 CH
Prerequisites	Material Properties and Characterization			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to MEMS design, Second order system and damping in MEMS, Fundamentals of mechanics, MEMS beams, Electrostatic actuators, Thermal actuators, Piezoelectric actuators, Capacitive sensing, Thermal sensing, Piezoresistive sensing, Micromirrors, Microlenses, Microfluidics, Finite element modeling and design, Layout editors, MPW runs and design rules.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

MCT433	MEMS Design			2 CH
Prerequisites	Industrial Electronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction. Design and fabrication issues of MEMS/NEMS devices. Fundamentals of mechanics, micromechanical beams and damping, Electrostatic, mechanical, thermal, piezoresistive, piezoelectric sensing and actuation principles. MEMS Fabrication. CAD tools for MEMS design. Designing simple MEMS devices.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

MCT434	Engineering Optimization							2 CH
Prerequisites	Differential Equations and Numerical Analysis							
Number of weekly Contact Hours								
Lecture			Tutorial			Laboratory		
1			2			1		
Required SWL		100		Equivalent ECTS		4		
Course Content								
Principles of optimization and its applications, design variables, convex functions, objective functions, constraints, optimization problem formulation, single-variable optimization, graphical optimization, multivariable optimization without constraints and with constraints, Linear, quadratic, nonlinear and dynamic programming optimization problems. Heuristic and modern optimization techniques such as genetic algorithms. Applications in engineering design of mechanical, electrical, control systems, .. etc.								
Used in Program / Level								
Program Name or requirement						Study Level		
Mechatronics Engineering Program						4		
Assessment Criteria								
Student Activities		Mid-Term Exam		Lab Activities			Final Exam	
20%		20%		20%			40%	

E5.4 Robotics and Mechatronics Applications Courses

MCT341	Introduction to Autotronics			2 CH
Prerequisites	Introduction to Mechatronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Ground vehicles types. Vehicle main systems: propulsion systems, braking systems, suspension systems, steering systems. Engine starting system, fuel supply system and ignition system. Air conditioning and climate control system. Electric vehicles. Examples of autotronic systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT342	Introduction to Nano-Mechatronics			2 CH
Prerequisites	MCT131: Introduction to Mechatronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to the fundamental knowledge and experience in the design and manufacturing of Nano-Mechatronic systems, Methodologies for design, fabrication, and packaging of Nano-Mechatronic systems, Overview on fabrication and manufacturing technologies for producing Nano-Mechatronic systems. Interdisciplinary nature of Nano-Mechatronic systems will be emphasized via various engineering principles ranging from mechanical and electrical to materials and chemical engineering.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT343	Introduction to Bio-Mechatronics			2 CH
Prerequisites	Introduction to Mechatronics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to biomechatronic systems: definition of biomechatronic, principles of biomechatronics, biotechnology and mechatronic systems design, applying mechatronics theory to biotechnology. Human motion control, physiological sensory system, physiological motor control, central nervous system, impaired motor control, assistive motor control, human-robot interaction, biomimetic and bioinspired systems, bio-interface. Examples: assistive devices and rehabilitation robotics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT344	Industrial Robotics			3 CH
Prerequisites	Theory of Machine and Multi-body			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	1	Equivalent ECTS	5	
Course Content				
Introduction to robotics: history of robotics, types of robotics (Serial, parallel, walking, bipedal, etc.), robotics applications, Transformation. Kinematics analysis: generalized coordinates, rotation representations, Euler angles, rotation matrix, homogeneous transformation matrix, Denavit Hartenberg rules, forward and inverse kinematics, Jacobian matrix, singularities. Trajectory planning: trajectory generation problem, joint and Cartesian planning, cubic polynomial, higher order polynomials. Dynamics analysis: joint space dynamics, Newton-Euler algorithm, inertia tensor, Lagrange equations, inverse and forward dynamics. Control: computed torque techniques, joint space control, PD control stability, trajectory tracking.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			3	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT345	Industrial Mechanisms and Robotics			3 CH
Prerequisites	Mechanics of Machines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Industrial Mechanisms: introduction, historical development of the automation and assembly mechanisms, advantages of automatic assembly. Transfer systems: conveyors, continuous transfer, intermittent transfer, indexing mechanisms. Vibratory feeders: mechanics of vibratory conveying, effect of vibrating frequency, effect of vibrating angle, bowel feeder design, spiral elevators. Non-vibrating feeders: reciprocating tube hopper feeder, centerboard hopper feeder, reciprocating fork hopper feeder. Orientation of parts: effect of active orienting devices on feed rate, natural resting aspects of parts for automatic handling. Feed tracks, parts-placing, gripping mechanisms, biomimetic robotic mechanisms, passive dynamic walking.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Lab Activities	Final Exam
20%	20%		20%	40%

MCT346	System Physiology			3 CH
Prerequisites	Introduction to Biomechatronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Fundamental concepts and terminologies, anatomical basis of human and biological systems, musculoskeletal system, cardiovascular system, respiratory systems,…etc. Electrical Properties of the Neuron: Resting Potential, Action Potential. Signaling, Synaptic Plasticity and Neural Circuits: Synaptic Transmission, Synaptic Plasticity, Neural Coding, Neural Circuits. Sensory Systems: Sensory Pathways, Tactile Sensation, Proprioception, Pain. Motor System: Motor Pathways, Spinal Circuits, Brainstem Circuits, Motor Cortex, Basal Ganglia and Cerebellum, Control of Movement.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Team Work	Mid-Term Exam		Lab Activities	Final Presentation
65%	25%		10%	40%

<table>
<tr><td>MCT347</td><td colspan="3">Locomotion and Gait Analysis</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">introduction to Bio-mechatronics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Basic anatomical terms, anatomical planes, motor control, center of gravity, normal gait, rolling over, rising to stand and sitting down, walking models, climbing stairs and ramps models, jumping models, balance model, pathological and other abnormal gaits, methods of gait analysis, locomotion measurement systems, measurement parameters.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Mechatronics Engineering and Automation Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Lab Activities</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>20%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>MCT348</td><td colspan="3">Introduction to Biomechanics</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Mechanics of Machines, introduction to Bio-mechatronics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction to Biomechanics, soft tissues, the anatomy of human movements, methods of biomechanics analysis, mechanics in physiology, mechanical properties of bone and cartilage, mechanical properties and structural behavior of biological tissues, visco-elasticity of tissues, muscles, Hill's muscle model, modeling of muscle forces and mechanics Bioviscoelastic, kinematics, kinetics, static and dynamics of human models, upper and lower limbs biomechanics of human, biomechanical modeling and simulation of anthropmorphic and biosystems.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Mechatronics Engineering and Automation Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Lab Activities</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>20%</td><td colspan="2">40%</td></tr>
</table>

MCT349	MATERIAL PROPERTIES AND CHARACTERIZATION			3 CH
Prerequisites	Introduction to Nano-Mechatronics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review on Material basics: Atomic structure and crystalline structure, and mechanical properties of materials, Electronic properties of materials, Electronic devices, Thermal properties of materials, Optical properties of materials, Properties of Silicon and other relevant materials like glass, polymers, and ceramics, Reliability tests, Material characterization techniques such as x-ray diffraction, Fluorescence, Raman spectroscopy, IR spectroscopy and Ellipsometry.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT350	MEMS/NEMS CHARACTERIZATION: SYSTEMS AND METHODS			3 CH
Prerequisites	Introduction to Nano-Mechatronics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to MEMS characterization, fundamentals of light, Laser doppler velocimetry, Two-beam interference, Spectrometers, Spectral imaging, Microscopy, Coherence imaging, Optical profilometry, Scanning probe microscopes, Impedance analyzes, Frequency response extraction.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering and Automation Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT441	Rehabilitation Robots					3 CH
Prerequisites	Locomotion and Gait Analysis					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Introduction to rehabilitation robots, the role of robotic in rehabilitation, physical Human-Robot Interaction (HRI), impedance and admittance control, cognitive Human-Machine Interface (HMI), Human- Computer Interface (HCI) and Brain Computer Interface (BCI). Rehabilitation robotics of patients with motor disorders, pathological tremor, stroke, amputation, paralysis and disability management. Game based rehabilitation robotics, design and control of biomechatronic and bionic robots, case studies: upper and lower limb bionic prostheses (prosthetic hand, arm, leg, knee and ankle), upper and lower limb exoskeletons/orthoses, wheelchair, … etc.						
Used in Program / Level						
Program Name or requirement				Study Level		
Mechatronics Engineering and Automation Program				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Lab Activities		Final Exam	
20%	20%		20%		40%	

MCT442	Biomedical Engineering					3 CH
Prerequisites	Introduction to Bio-Mechatronics					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Fundamental of biomedical engineering, tissue engineering, artificial organs, implanted prostheses, lower and upper prosthetic and orthotics types and designs, basic concepts of medical instrumentation, biological signals, biomedical sensors: biopotential measurements, blood gas sensors, EMG, ECG, and EEG Sensors. Biosignal processing: physiological origins of biosignals, signal acquisition and manipulation, frequency domain representation of biological signal, wavelet transform and Fourier analysis, Fourier transform, sampling and filtering, EKG acquisition principle and analysis, medical imaging.						
Used in Program / Level						
Program Name or requirement				Study Level		
Mechatronics Engineering and Automation Program				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Lab Activities		Final Exam	
20%	20%		20%		40%	

MCT443	Design of Autonomous Systems				3 CH
Prerequisites	Industrial Robotics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to autonomous systems: autonomous versus automatic systems, automated and autonomous human-centered technical systems, semi-autonomy, autonomous behavior. Perception: multi-sensor fusion, localization, navigation and mapping, obstacle recognition and detection. Planning and actuation: task decomposition, reactive behavior, preplanned knowledge and skill-based behavior. Knowledge-base: facts and procedures, acquisition, exploration, skill transfer, learning. Autonomous systems architecture: behavioral principles, expert systems, knowledge-bases, multi-level control concepts. Applications of autonomous systems.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechatronics Engineering and Automation Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Lab Activities	Final Exam	
20%	20%		20%	40%	

MCT444	Mechatronics in Rehabilitation Technology				2 CH
Prerequisites	Introduction to Mechatronics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		2		1	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Introduction to biomechatronics, rehabilitation and assistive devices, principles, Human motion control, Physiological motor control and sensory systems, Impaired Motor control, Human-Robot Interaction, Biointerface and Biological Signals (EMG, ECG, and EEG). Case studies and applications in assistive Devices, Rehabilitation Robotics, Upper and Lower Limb Prostheses (prosthetic hand, arm, leg, knee and ankle), Upper and lower Limb Exoskeletons.					
Used in Program / Level					
Program Name or requirement				Study Level	
Mechatronics Engineering Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Lab Activities	Final Exam	
20%	20%		20%	40%	

MCT445	Mechatronics in Automotive Application			2 CH
Prerequisites	Introduction to Mechatronics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	2		1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to Autotronics, Vehicle main components and subsystems: propulsion systems, suspension systems, braking systems, steering systems, Engine starting system, fuel supply system and ignition system. Advanced vehicle systems: Anti-lock Braking system, Brake-By-Wire system, semi-active and active suspension systems, driving assistance systems, drive-By-Wire system, passive and active driving safety systems, and Steering-By-Wire systems. Electric vehicles and hybrid vehicles.				
Used in Program / Level				
Program Name or requirement		Study Level		
Mechatronics Engineering Program		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT446	Autotronics			3 CH
Prerequisites	Introduction to Autotronics, Automotive theory			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		3	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Modeling and control algorithms of advanced braking systems: Anti-lock Braking system, electronic braking distribution system and Brake-By-Wire system. Modeling and control algorithms of semi-active and active suspension systems. Driving assistance system: automatic cruise control system, Drive-By-Wire system, passive and active driving safety systems. Traction and stability control systems. Modeling and control algorithms of advanced handling systems: electronics steering assist and Steer-By-Wire systems. Advanced engine emissions control systems for gasoline and diesel engines. Hybrid vehicles: types, configurations and control strategies. Automated Manual transmission: types and control strategies.				
Used in Program / Level				
Program Name or requirement		Study Level		
Mechatronics Engineering and Automation Program		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Lab Activities	Final Exam	
20%	20%	20%	40%	

MCT447	MEMS Systems		3 CH
Prerequisites	MEMS/NEMS Fabrication and Packaging		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
MEMS applications such as RF MEMS. Biomedical MEMS, Optical MEMS, Optofluidics. Example of Microsystems such as accelerometers, gyroscopes, telecommunication, MEMS FTIR spectrometers, MEMS OCT. System issues and considerations such as Noise in MEMS systems, Signal amplification, Sensor specification, Sensors electronics interfaces, System design and analysis flows.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechatronics Engineering and Automation Program	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20%	20%	40%

MCT448	MEMS/NEMS Fabrication and Packaging		2 CH
Prerequisites	Introduction to Nano-Mechatronics		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
Introduction to microfabrication and micromachining (surface vs bulk), Photolithography, Thermal oxidation, Dry & Wet etching, Deposition techniques, Sputtering and shadow masking, Thermal oxidation, Doping, Deep reactive ion etching, Surface smoothing, MEMS packaging overview, Wafer bonding and encapsulation, Dicing, 3D integration and via technologies, Die packaging and wire bonding, On-wafer measurement.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechatronics Engineering and Automation Program	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20%	20%	40%

MCT449	Selected topics in industrial mechatronics			2 CH
Prerequisites	Determined according to course contents			

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	1	0

Required SWL	125	Equivalent ECTS	4

Course Content
Selected topics in recent directions and applications in industrial mechatronics will be presented in this course.

Used in Program / Level	
Program Name or requirement	Study Level
Mechatronics Engineering and Automation Program	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Lab Activities	Final Exam
20%	20%	20%	40%

E5.9 Graduation Projects

MCT491	Mechatronics Graduation Project (1)			3 CH
Prerequisites	At Least 130 CH, /Mechatronic Systems Design//Design of Mechatronics system (2)/			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	125		Equivalent ECTS	5
Course Content				
This course represents the first part of the graduation project, where the students work in the graduation projects under the supervision of faculty members. The graduation project should be linked with the Mechatronics Field.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			4	
Mechatronics Engineering and Automation Program			4	
Assessment Criteria				
Term Work	Mid-Term Exam	Final Report	Final Presentation	
50 %	0%	25%	25%	

MCT492	Mechatronics Graduation Project (2)			3 CH
Prerequisites	Mechatronics Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		4		0
Required SWL	125		Equivalent ECTS	5
Course Content				
As a continuation of the first part of the graduation project 1, the students continue work in the graduation projects under the supervision of faculty members				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechatronics Engineering Program			4	
Mechatronics Engineering and Automation Program			4	
Assessment Criteria				
Term Work	Mid-Term Exam	Final Report	Final Presentation	
50 %	0%	25%	25%	

E6. Courses offered by Architecture Engineering Department (ARC)

The Architecture Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Architecture Engineering courses as an Architecture Discipline Requirement.
2. Architectural Engineering Program.
3. Landscape Architecture Program.
4. Environmental Architecture and Urbanism Program.
5. Housing and Urban Development Program.

Table 52 List of specializations at the Architecture Engineering Department.

#	Specialization
1	Architectural Design
2	Theories of Design and Architecture
3	History of Architecture
4	Computer Applications and Design Skills
5	Building and Working Drawings
6	Environmental Studies
7	Projects Management
9	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl Level
CH Credit Hour
ECTS European Credit Transfer System
SWL Student Work Load
Lec Lectures
Tut Tutorials
Lab Laboratory
TT Total

UR University Requirement
FR Faculty Requirement
DR Discipline Requirement
PR Program Requirement

SA Student Activities
MT Mid-Term Exam
PE Practical Exam
FE Final Exam

Table 53 List of ARC courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Architectural Design																				
1		111	Principles of Architecture Design Studio	3	6	150	1	5	0	6			x		60	20	0	20	CEP011	
2	1	112	Creativity and Design Studio	4	8	200	0	8	0	8				x	60	20	0	20	CEP011	
3		113	Vernacular Architecture Design Studio	3	6	150	0	6	0	6				x	60	20	0	20	ARC111	
4		211	Building Type Design Studio	4	8	200	0	8	0	8				x	60	10	10	20	ARC111	
5	2	212	Multi Story Accommodation Building Design Studio	4	8	200	0	8	0	8				x	60	10	10	20	ARC111	
6		213	Environmental Architecture Design Studio (1)	3	6	150	0	6	0	6				x	60	10	10	20	ARC111	
7		214	Environmental Architecture Design Studio (2)	3	6	150	0	6	0	6				x	60	10	10	20	ARC213	
8		311	Smart Systems Design Studio	4	8	200	0	8	0	8				x	60	0	20	20	ARC211	ARC321
9	3	312	Sustainable Architecture Design Studio (1)	3	6	150	0	6	0	6				x	60	0	20	20	ARC214	
10		313	Sustainable Architecture Design Studio (2)	3	6	150	0	6	0	6				x	60	0	20	20	ARC312	
11		411	Thematic Design Studio	4	8	200	0	8	0	8				x	60	0	40	0	ARC311	
12	4	412	Technological Design Studio	4	8	200	0	8	0	8				x	60	0	40	0	ARC311	ARC351 ARC362
13		413	Smart Housing Design Studio	4	8	200	0	8	0	8				x	60	0	40	0	UPL352	
2. Theories of Design and Architecture																				
14	2	221	Design Methods	3	4	100	2	2	0	4				x	40	20	0	40	ARC112	
15		321	Theory and Philosophy of Contemporary Arch.	3	5	125	3	0	0	3				x	20	40	0	40		
16	3	322	Architectural Criticism and Project Evaluation	2	4	100	1	2	0	3				x	40	20	0	40		
17		323	Built Environment Accessibility	2	4	100	1	2	0	3				x	40	20	0	40		
18		421	Ergonomics and Interior Design Principles	2	3	75	1	2	0	3				x	40	20	0	40		
19		422	Human Aspects in Architecture	3	5	125	2	2	0	4				x	40	20	0	40		
20	4	423	Identity and Contemporaneity in Middle East Architecture	3	5	125	2	2	0	4				x	40	20	0	40		
21		424	Introduction to Modern Art Movements	3	5	125	2	2	0	4				x	40	20	0	40		
22		425	Contemporary Vernacular Architecture	2	4	100	1	2	0	3				x	40	20	0	40		
3. History of Architecture																				
23		131	History of Arts and Architecture (1): Ancient Civilizations	3	4	100	3	0	0	3				x	20	40	0	40		
24	1	132	History of Arts and Architecture (2): History of Islamic and Western Architecture	3	5	125	2	2	0	4				x	20	40	0	40	ARC131	
25		133	Introduction to History and Theory of Arts and Architecture	3	4	100	3	0	0	3				x	20	40	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
4. Computer Applications and Design Skills																				
26	1	141	Architectural Representation	3	5	125	1	4	0	5			x		40	20	0	40	CEP011	
27		142	Digital Presentation of The Built Environment	2	4	100	1	0	3	4			x		50	10	40	0		
28		143	Building Engineering Drawing	3	6	150	2	2	2	6				x	25	20	15	40	CEP011	
29	2	241	Modeling of The Built Environment	2	5	125	1	0	3	4			x		50	10	40	0	ARC142	
30	3	341	Photography and Architecture	2	4	100	1	2	0	3				x	60	0	40	0		
31	4	441	Building Information Modeling (BIM)	3	5	125	1	4	0	5				x	60	0	40	0	ARC241	ARC351
32		442	Principles of Parametric Design	3	4	100	2	2	0	4				x	60	0	40	0	ARC241	ARC321
33		443	Computer Applications in Environmental Engineering	3	5	125	2	2	2	6				x	25	20	15	40	ARC161 MEP342	ARC263
5. Building and Working Drawings																				
34	1	151	Building (1): Conventional Construction Systems	3	5	125	2	3	0	5			x		50	10	0	40	CEP011	
35		152	Building (2): Finishing Works	3	5	125	2	3	0	5			x		50	10	0	40	ARC151	
36	2	251	Building (3): Advanced Construction and Finishing Works	3	5	125	2	3	0	5				x	50	10	0	40	ARC152	
37		252	Building (3): Mass Housing Production Techniques and Finishing Works	3	5	125	2	2	0	4				x	50	10	0	40	ARC152	
38		253	Building (3): Sustainable Construction	3	5	125	2	3	0	5				x	50	10	0	40	ARC152	
39		254	Building (3): Landscape Construction	2	3	75	1	3	0	4				x	50	10	0	40	ARC152	
40	3	351	Working Design (1): Execution Drawings Coordination, Annotating and Coding	3	6	150	1	4	0	5			x		50	10	20	20	ARC152	CES225 MEP241 /CEP251/ /CES225/
41		352	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs	3	6	150	1	4	0	5			x		50	10	20	20	ARC351	
42	4	451	Working Design (3): Execution Documents Complexity	3	5	125	1	4	0	5				x	60	0	40	0	ARC352	
43		452	Working Design (3): Residential Towers Execution Documents	3	6	150	1	4	0	5				x	60	0	40	0	ARC352	
44		453	Housing Maintenance, Post-occupancy Evaluation and Value Engineering	3	5	125	2	2	0	4				x	40	20	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
6. Environmental Studies																				
44	1	161	Introduction to Lighting Systems	2	4	100	2	1	0	3				x	40	20	0	40	PHM022	
45	2	261	Control of Thermal Environment	2	3	75	1	2	0	3			x		40	20	0	40		
46		262	Principles of Sustainable Architecture	3	5	125	2	2	0	4				x	40	20	0	40		
47		263	Fundamentals of Building Acoustics	2	4	100	2	1	0	3				x	40	20	0	40	PHM022	PHM032
48	3	361	Lighting in Architecture	2	3	75	1	2	0	3				x	40	20	0	40	PHM022	
49		362	Acoustics in Architecture	2	3	75	1	2	0	3				x	40	20	0	40	PHM022	
50		363	Renewable Energy and Buildings	2	3	75	1	2	0	3				x	40	20	0	40		
51		364	Outdoor Lighting and Effects	2	3	75	1	2	0	3				x	40	20	0	40	PHM022	
52		365	Building Performance Simulation	3	5	125	1	4	0	5				x	60	0	40	0	ARC241	
53		366	Responsive Architecture Installations	2	4	100	1	2	0	3				x	40	20	0	40	ARC261	UPL365
54		367	Indoor Air Quality	3	5	125	2	2	0	4				x	40	20	0	40	MEP213	
55		368	Soundscape and Aural Architecture	2	4	100	1	2	0	3				x	40	20	0	40	PHM022	
56	4	461	Daylighting and Thermal Performance	3	4	100	2	2	0	4				x	60	0	40	0	ARC241	ARC261
57		462	Sustainable Building Rating Systems	2	4	100	1	2	0	3				x	40	20	0	40		
58		463	Renewable Energy Systems and Economics	2	3	75	1	2	0	3				x	40	20	0	40		
59		464	Sustainable Rehabilitation of The Built Environment	2	3	75	1	2	0	3				x	60	0	40	0		
60		465	Building Acoustics	3	5	125	2	2	0	4				x	40	20	0	40	ARC263	
61		466	Building Envelope Design	2	4	100	2	1	0	3				x	40	20	0	40	MEP342	
62		467	Building Energy Conservation Technologies	3	5	125	2	2	0	4				x	40	20	0	40	ARC161 MEP342	ARC263
63		468	Building Illumination and Day Lighting	3	5	125	2	2	0	4				x	40	20	0	40	ARC161	
7. Projects Management																				
64	3	371	Architecture Project Management	2	4	100	2	1	0	3			x		40	20	0	40		
65	4	471	Feasibility Studies	2	4	100	2	1	0	3				x	40	20	0	40		
66		472	Maintenance of Buildings	3	5	125	2	2	0	4				x	40	20	0	40		
67		473	Building Life Cycle Assessment	3	5	125	2	2	0	4				x	40	20	0	40		
68		474	Building Commissioning	3	5	125	2	2	0	4				x	40	20	0	40		
9. Graduation Project																				
69	4	491	Architecture and Building Technology Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	0	40	ASU112	
70		492	Architecture and Building Technology Graduation Project (2)	6	7	425	0	12	0	12				x	60	0	40	0	ARC491	
71		493	Environmental Engineering Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	0	40	ASU112	
72		494	Environmental Engineering Graduation Project (2)	6	7	425	0	12	0	12				x	60	0	40	0	ARC493	

E6.1 Architecture Design Courses

ARC111	Principles of Architecture Design Studio		3 CH
Prerequisites	Projection and Engineering Graphics		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	5	0	
Required SWL	150	Equivalent ECTS	6
Course Content			
This course aims at educating students the fundamental skills to use principles of graphic communication and model making techniques effectively as a design tool. The course also introduces design fundamentals where students can experiment and explore conceptual, formal, and spatial aspects of architecture. The course develops students' basic skills, ideas and techniques through simple design exercises. aiming to provide students with a framework which will support and guide their exploration of the design process.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Requirement	1		
Housing and Urban Development Program	1		
Environmental Architecture and Urbanism Program	1		
Landscape Architecture Program	1		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	20%	0%	20%

ARC112	Creativity and Design Studio		4 CH
Prerequisites	Projection and Engineering Graphics		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	8	0	
Required SWL	200	Equivalent ECTS	8
Course Content			
This course aims at assisting students to develop more skills and build confidence to be more creative. The design studio introduces students to the perception of architectural spaces and develops their abilities to design small scale projects with simple spatial requirements involving concepts of design, ideas and imagination. Students are introduced to basic design concerns of circulation, orientation, spatial compositions and structure. Examples of selected projects would be private residences, kinder gardens, activity centers and libraries for children, and simple service buildings in public places.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Requirement	1		
Housing and Urban Development Program	1		
Landscape Architecture Program	1		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	20%	0%	20%

<table>
<tr><td>ARC113</td><td colspan="4">Vernacular Architecture Design Studio</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Principles of Architecture Design Studio</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">0</td><td colspan="2">6</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">The course aims at applying the fundamentals of vernacular architectural design through the design process, analysis, concepts, development and presentation. The process includes simple projects focusing on the environmental responsiveness to accommodate different adaptations. Design objectives include responding to local needs, construction materials and reflecting local traditions. The Students should be able to present their design concepts based on their acquired presentation skills.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Environmental Architecture and Urbanism Program</td><td colspan="2">1</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>60%</td><td colspan="2">20%</td><td colspan="2">0%</td><td>20%</td></tr>
</table>

<table>
<tr><td>ARC211</td><td colspan="4">Building Type Design Studio</td><td>4 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Principles of Architecture Design Studio</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">0</td><td colspan="2">8</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>200</td><td colspan="2">Equivalent ECTS</td><td colspan="2">8</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">This course aims at developing a public project of a cultural, recreational, or institutional building of a complex program with different functions, circulation and construction systems. Site limitations and context and the application of specified codes would be taken into consideration. Examples of selected projects would be office buildings, museums, libraries, hospitals … etc.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Architectural Engineering Requirement</td><td colspan="2">2</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Oral Jury</td><td>Final Exam</td></tr>
<tr><td>60%</td><td colspan="2">10%</td><td colspan="2">10%</td><td>20%</td></tr>
</table>

ARC212	Multi Story Accommodation Building Design Studio			4 CH
Prerequisites	Principles of Architecture Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
This course aims at assisting students to develop more skills through exercising an architectural multi story residential building situated in an urban complex. It explores the fundamentals of urban context and its relation with the built environment. The design studio introduces students to the perception of architectural spaces and develops their abilities to design large scale projects with complex spatial requirements involving concepts of design, ideas and imagination. Students are introduced to multiple concerns of vertical and horizontal circulation, orientation, spatial compositions and structure. By the end of the course, the student is capable of designing a residential multi story building in urban context with certain potentials and limitations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	10%	10%	20%	

ARC213	Environmental Architecture Design Studio (1)			3 CH
Prerequisites	Principles of Architecture Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		6		0
Required SWL	150		Equivalent ECTS	6
Course Content				
The course aims at understanding architecture in its surrounding environment. Study of architectural projects involving simple programs. Spatial Design according to climatic issues. Study the relation of the building with its setting and orientation according to natural requirements with special emphasis on the local environment and human needs.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	10%	10%	20%	

<table>
<tr><td colspan="3">ARC214</td><td colspan="7">Environmental Architecture Design Studio (2)</td><td colspan="2">3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Environmental Architecture Design Studio (1)</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">0</td><td colspan="4">6</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">The course aims to develop architectural design capacities reflecting environmental behavior and focusing on the role of structural systems in stimulating forms and design ideas enabling the translation of concepts into built forms. Researching different structural systems. The choice of building materials as an integral part of the design. Multiple circulation networks are also addressed.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Environmental Architecture and Urbanism Program</td><td colspan="4">2</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Oral Jury</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">60%</td><td colspan="3">10%</td><td colspan="3">10%</td><td colspan="3">20%</td></tr>
</table>

<table>
<tr><td colspan="3">ARC311</td><td colspan="7">Smart Systems Design Studio</td><td colspan="2">4 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Building Type Design Studio, Theory and Philosophy of Contemporary Architecture</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">0</td><td colspan="4">8</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">200</td><td colspan="3">Equivalent ECTS</td><td colspan="3">8</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">This course aims at highlighting the progressive technical design approaches embracing the intelligent adaptivity of buildings to the continuously changing dynamic environment including natural, man-made features and dynamic occupancy. Students will intensify their knowledge regarding BMS, BEMS managing different high-tech components of the building through architectural design strategies.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Architectural Engineering Program</td><td colspan="4">3</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Oral Jury</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">60%</td><td colspan="3">0%</td><td colspan="3">20%</td><td colspan="3">20%</td></tr>
</table>

ARC312	Sustainable Architecture Design Studio (1)			3 CH
Prerequisites	Environmental Architecture Design Studio (2)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	6		0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
The design studio focuses on designing buildings that include energy saving and environmentally friendly features. Emphasizing throughout the various design stages on the green aspects of the project that will lower costs and emissions while designing towards the most sustainable practice. The design studio employs energy harvesting and control of the natural elements as resources to enhance the sustainable cycle.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	0%	20%	20%	

ARC313	Sustainable Architecture Design Studio (2)			3 CH
Prerequisites	Sustainable Architecture Design Studio (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
0	6		0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
This course is intended to be a comprehensive application of sustainable principles in the studio sequence. Each student engages in an architectural project study of a significant scale and magnitude to embrace the ramifications and diversity of sustainable design from conceptual stages to construction systems and detailing and employs prior studies in environmental controls and building systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	0%	20%	20%	

ARC411	Thematic Design Studio			4 CH
Prerequisites	Smart Systems Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
Building on the previous design courses, this course aims to develop the students' analytical capacities applied in the design of architectural and urban projects of complex nature, taking into account the local environment, nature and modern theories in design. This studio is designed to address specific themes relevant to architecture. The student should focus on applying all what is learnt in architectural design while illustrating his professional abilities through self- expression of the different interpretations of the modern theories.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	0%	40%	0%	

ARC412	Technological Design Studio			4 CH
Prerequisites	Smart Systems Design Studio Working Design (1): Execution Drawings Coordination, annotating and Coding Acoustics in Architecture			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
This course aims at applying the technological systems to a comprehensive design project that is functionally, aesthetically, and environmentally sound. Integration of theoretical knowledge acquired at various disciplines of technical sciences is significantly applied. This studio focuses on innovative materials and structure selection and tackles the architectural aspects of environmental control with rational energy consumption. The applications emphasize the ability to integrate building techniques into design requirements, both as a whole and in detail.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	0%	40%	0%	

ARC413	Smart Housing Design Studio				4 CH
Prerequisites	Neighborhood Planning & Design Studio				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		8		0	
Required SWL	200		Equivalent ECTS	8	
Course Content					
This course aims to develop the students' analytical capacities applied in the design of housing projects of complex nature, taking into account the local environment, nature and modern theories and smart systems in design. This studio is designed to address specific themes relevant to architecture. The student should focus on applying all what is learnt in architectural design while illustrating his professional abilities through self- expression of the different interpretations of the modern theories.					
Used in Program / Level					
Program Name or requirement			Study Level		
Housing and Urban Development Program			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Oral Jury	Final Exam	
60%	0%		40%	0%	

E6.2 Theories of Design and Architecture Courses

ARC221	Design Methods			3 CH
Prerequisites	Creativity and Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course aims at understanding architectural problem solving via two modules; The way designers think, and creative problem solving (CPS). The first module discusses different root maps of design process in order to enhance student's analytical abilities while developing designs concepts and selecting approaches in solving architectural problems. The second module aims at exploring the importance of creative problem solving in architecture. Scales used for evaluating creative products are also introduced.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC321	Theory and Philosophy of Contemporary Architecture			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at traversing history, theory and criticism domains for better understanding, interpretation and reasoning behind architectural artifacts. The course digs into the theoretical foundations of architectural movements from the innovations of the Industrial Revolution till the rich pluralism of Contemporary Architecture. Socio-cultural, political, economic and industrial conditions are figured out, values are extracted, concepts are captured, and canonical characteristics are discussed and explained. Involving students in different interactive activities to boost their critical thinking skills is a crucial part of this course in order to understand the past and be able to build for the future.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	40%		0%	40%

ARC322	Architectural Criticism & Project Evaluation			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
The course emphasizes the multiplicity of architectural thinking. It introduces the theoretical approaches of contemporary architectural thoughts. The course discusses concepts of integration and comprehensiveness in architectural solutions, Principles of architectural criticism and techniques of evaluating projects are discussed.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			3	
Environmental Architecture and Urbanism Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ARC323	Built Environment Accessibility			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Enabling students to understand thevarious ‘disability’ needs in the built environment, the course introduces the “Design for All” concepts and regulations on the urban andarchitectural levels. The course qualifies the students torecognize and learn about the architectural and urban planning role in taking theright measures towards accessible design, understanding the goals of accessible design and examining the impacts ofthe social and physical environment on persons with disabilities. Students are also introduced to the key principles of “Disability Access Certificates” and “AccessAuditing” to ensure all aspects of the built environment are accessible, learning different methodologies of auditing the level of accessibility through evaluating the effectiveness to facilitate the equality, andindependence of all types of users as well as suggesting solutions for ensuring accessibility.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			3	
Housing and Urban Development Program Elective			2	
Environmental Architecture and Urbanism Program Elective			3	
Landscape Architecture Program Elective			3	
Assessment Criteria				
Assignments & Projects	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ARC421	Ergonomics (Designing Livable Spaces) & Interior Design Principles			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
This course aims at developing a detailed understanding of the profession of interior design. The course provides an overview of interior design principles and concepts; including perspective, color theory, design aesthetic, and presentation methods. It tackles interior space elements through project-based activities (walls, ceilings, floors, windows, doors, furniture and accessories). It also focuses on the stages of concept development, and presentation toward the goal of creating a beginning interior design portfolio.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC422	Human Aspects in Architecture			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at exploring the way active human use of physical settings influences or is influenced by aspects of sustainability in the built environment. This includes categories of human experience such territoriality, way finding, cultural expression, visual and non-visual aesthetics, and task performance. The methods used in identifying and analyzing such kinds of social and cultural dimensions; ethnography, photo elicitation, agent-based modeling as a key for developing evidence based sustainable design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC423	Identity and Contemporaneity in Middle East Architecture			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course traces the modern architectural developments in the Middle East from late nineteenth century onwards. The relationship between contemporary architecture and regional identity is contemplated putting into consideration context and culture. Students would develop an understanding of how can modern architecture be more responsive to regional realities and aspirations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC424	Introduction to Modern Art Movements			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course focuses on a series of art movements and artists contributing to modern art evolution. A chronological study is conducted starting from the beginning of the twentieth century onwards. Movements will be discussed in terms of concepts, ideas, media, techniques, influences and social and cultural relevance.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			4	
Housing and Urban Development Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC425	Contemporary Vernacular Architecture		2 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
This course emphasizes on the prevailing issues of the contemporary vernacular architecture by using the induction analytical method. Students will define the notion of contemporary architecture, its featured ideologies along with its relationship to international architectural schools. They will assess different debates between intellectual and cultural variables that affect the local, political and social decisions regarding architecture via various examples and case studies.			
Used in Program / Level			
Program Name or requirement	Study Level		
Environmental Architecture and Urbanism Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

E6.3 History of Architecture Courses

ARC131	History of Arts and Architecture 1: Ancient Civilizations		3 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
3	0	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
This course aims at elaborating the relation between the architectural concept and the philosophy of design in different ages. It tackles the effects of physical, cultural, natural and constructional possibilities on the different architectural elements, through a study of art and architecture for different ancient eras: Ancient Egyptian, West Asiatic and Mesopotamia, Babylonian, Assyrian, Persian, Greek, Roman, the early Christian and byzantine period.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Requirement	1		
Landscape Architecture Program	1		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	40%	0%	40%

ARC132	History of Arts and Architecture 2: History of Islamic and Western Architecture		3 CH
Prerequisites	History of Arts and Architecture 1: Ancient Civilizations		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
This course aims at exploring history of arts and architecture in two different eras through two modules. First Module: investigating the meaning, principles and development of the Islamic art and architecture in a chronological order in the Islamic world with special reference to Egypt clarifying the impact of the different political, economic, cultural, and environmental factors on the architectural space and elements through different periods and typologies. Second Module: investigating architecture in Western Europe from Romanesque architecture till the nineteenth century Neoclassical architecture. The module discusses the concepts influencing architectural characteristics of each era discussed in relationship to the cultural context, including philosophical, religious, political, economic and environmental factors.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Requirement	1		
Landscape Architecture Program	1		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	40%	0%	40%

<table>
<tr><td colspan="3">ARC133</td><td colspan="5">Introduction to History and Theory of Arts and Architecture</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="6"></td></tr>
<tr><td colspan="9">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="3">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">3</td><td colspan="3">0</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">100</td><td colspan="3">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="9">Course Content</td></tr>
<tr><td colspan="9">This course aims to clarify the relation between the arts and architectural concept, and the philosophy of design in different ages. It focuses on the effects of physical, cultural, natural and constructional possibilities on the different architectural elements. It proceeds through a comparative analytical study of art and architecture for different old cultures.</td></tr>
<tr><td colspan="9">Used in Program / Level</td></tr>
<tr><td colspan="6">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="6">Housing and Urban Development Program</td><td colspan="3">1</td></tr>
<tr><td colspan="6">Environmental Architecture and Urbanism Program</td><td colspan="3">1</td></tr>
<tr><td colspan="9">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">40%</td><td colspan="2">0%</td><td colspan="3">40%</td></tr>
</table>

E6.4 Computer Applications and Design Skills Courses

ARC141	Architectural Representation						3 CH
Prerequisites	Projection and Engineering Graphics						
Number of weekly Contact Hours							
Lecture		Tutorial			Laboratory		
1		4			0		
Required SWL		125		Equivalent ECTS		5	
Course Content							
This course aims at understanding and applying architectural representation techniques. It includes; studying the fundamental skills of freehand drawing techniques and investigates the different visual design elements and principles. Different exercises are to be applied in both 2D and3D. Students would acquire an ability to communicate simple forms graphically by transforming visual information into a 2d image with shade and shadows, and to visualize 3D objects and present them in terms of perspective.							
Used in Program / Level							
Program Name or requirement					Study Level		
Architectural Engineering Requirement					1		
Housing and Urban Development Program					1		
Environmental Architecture and Urbanism Program					1		
Landscape Architecture Program					1		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
40%		20%		0%		40%	

ARC142	Digital Presentation of the Built Environment						2 CH
Prerequisites							
Number of weekly Contact Hours							
Lecture		Tutorial			Laboratory		
1		0			3		
Required SWL		100		Equivalent ECTS		4	
Course Content							
This course addresses the Modeling and Graphics component of the computer aided architectural design (CAAD) curriculum. It explains computers usage as a tool for architects to be used in 2D/3D drawings representation, three-dimensional digital models production, focusing on the basic concepts of raster and vector graphics. Detailed modeling procedures are discussed, including texture mapping and navigation, in addition to basics of lighting, rendering and animation. Students will also practice the use of digital programs that relate to the architecture profession such as Adobe Photoshop and 3DS MAX.							
Used in Program / Level							
Program Name or requirement					Study Level		
Architectural Engineering Program					1		
Housing and Urban Development Program					1		
Environmental Architecture and Urbanism Program					1		
Landscape Architecture Program					1		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
50%		10%		40%		0%	

ARC143	Building Engineering Drawing			3 CH
Prerequisites	Projection and Engineering Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Engineering drawings in building projects including plans, sections and elevations. Development stage of project drawings; layout, concept design, detail design, shop drawings and as-built drawings. Scales and symbols. Selection of building materials, Structural systems including skeleton frames: concrete, steel and load bearing wall systems. Computer Aided Architectural Drafting (CAAD). CAD standards and uniform drawing system. Building sub-systems and related graphics standards and terms. Project: representation of a building and its sub-systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

ARC241	Modeling of the Built Environment			2 CH
Prerequisites	Digital Presentation of the Built Environment			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		3
Required SWL	125		Equivalent ECTS	5
Course Content				
This course aims at enhancing student abilities to use computers as a medium for 3D modeling, form generation, and the analysis and evaluation of architectural design models. Students are introduced to concepts of wireframe modeling, surface modeling, solid modeling, parametric modeling, and generative design, and are exposed to software tools such as 3DStudio Max, Rhino and its graphic algorithm editor Grasshopper. Students are also introduced to principles of building information modeling (BIM) and how it is used, through tools such as Autodesk Revit and other analysis tools, to model, analyze and evaluate designs, with emphasis on form finding and performance based evaluation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			2	
Housing and Urban Development Program			2	
Environmental Architecture and Urbanism Program			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	10%	40%	0%	

ARC341	Photography and Architecture				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		2		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
The course aims at capturing the essence of architecture through photography. the connection between photography and architecture is highlighted through documentation in different scales; photography of architectural models, photography of enclosed and open spaces and photography of buildings and urban spaces. The course helps students develop a critical framework for understanding and evaluating architectural photography and acquire the skill of using photography equipment (analogue and digital cameras).					
Used in Program / Level					
Program Name or requirement			Study Level		
Architectural Engineering Program Elective			3		
Environmental Architecture and Urbanism Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
60%	0%		40%	0%	

ARC441	Building Information Modeling (BIM)				3 CH
Prerequisites	Modeling of the Built Environment Working Design (1): Execution Drawings Coordination, annotating and Coding				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		4		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
The course introduces BIM (Building Information Modeling) as an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. This course focuses on the process and tools that help architects to develop their designs and to create, coordinate, and manage the tender drawings. Student will learn how to use one of BIM software such as Revit to develop the schematic design and to generate its tender documents. Application will be on moderate scale architecture projects such as administration building, clubhouse, small MPUs, and similar projects.					
Used in Program / Level					
Program Name or requirement			Study Level		
Architectural Engineering Program			4		
Housing and Urban Development Program Elective			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
60%	0%		40%	0%	

ARC442	Principles of Parametric Design			3 CH
Prerequisites	Modeling of the Built Environment, Theory and Philosophy of Contemporary Architecture			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
This course addresses the Generative Design and Digital Fabrication component of the computer aided architectural design (CAAD) curriculum. It explores the potential of parametric modeling, algorithms and generative systems in architectural design. Two complementary themes are under deep investigation throughout the course: parametric form generation, and performance-based evaluation, with the aim of integrating both themes in a comprehensive design process. Students are free to explore and build on a wide and extensible palette of parametric modeling, scripting, and analysis tools during their experimentation with form generation, evaluation and optimization methods. Students will also develop their understanding through rapid prototyping and digital fabrication using CNC equipment. Throughout the course, students will practice the use of tools such as Rhino, Grasshopper, and fabrication tools such as Pepakura and 123D Make.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	40%	0%	

ARC443	Computer Applications in Environmental Engineering			3 CH
Prerequisites	Introduction to Lighting System, Fundamentals of Building Acoustics, HVAC System Design			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		2	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Computer modeling principals. Energy transfer theories Comprehend the practical application of modeling to solve problems regarding environmental issues. How to apply numerical techniques to simulate complicated environmental assessments. Errors and deviation expected from computer applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering ProgramElective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

E6.5 Building and Working Drawings Courses

ARC151	Building (1): Conventional Construction Systems			3 CH
Prerequisites	Projection and Engineering Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at understanding the building construction process and the construction of basic and essential components of any building. Students will learn about the main conventional construction systems, building's essential needs such as building protection against sun heat and dampness, bridging wall openings, retaining soil, and connecting different levels. Course topics will be: the load bearing walls, the RC skeleton, Arches, Lintels, Retaining walls, and also, design, construction, and finishing of linear and spiral staircases.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			1	
Housing and Urban Development Program			1	
Environmental Architecture and Urbanism Program			1	
Landscape Architecture Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		0%	40%

ARC152	Building (2): Finishing Works			3 CH
Prerequisites	Building (1): Conventional Construction Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at understanding the building finishing process and materials. Students will learn about the carpentry work of doors and windows, and the process and materials of finishing architectural internal spaces; floors, walls, and ceiling. Course topics will be: timber Doors & Windows, floor finishing: tiles, rolls, fabric, cast in situ, and boards, wall cladding, tiles, plastering, paints, boards, paper, ceiling finishing: tiles, boards, plastering, and paints.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			1	
Housing and Urban Development Program			1	
Environmental Architecture and Urbanism Program			1	
Landscape Architecture Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		0%	40%

ARC251	Building (3): Advanced Construction and Finishing Works			3 CH
Prerequisites	Building (2): Finishing Works			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at understanding the advanced building construction process and technologies. Students will learn about the wide span structure systems, precast and post tension systems, and Structural Glazing system. In addition, the student will learn about advanced finishing and cladding materials and techniques such as: raised floors, curtain walls, Stretched ceiling, GRC and GRP.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		0%	40%

ARC252	Building (3): Mass Housing Production Techniques and Finishing Works			3 CH
Prerequisites	Building (2): Finishing Works			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims at understanding the coordinates system and the advanced building construction processes for the mass housing and technics of emergency production. Students will learn about the innovative structure systems for mass production, considering safety systems, especially precast system. In addition, the student will learn about landscape construction and advanced finishing and cladding materials and techniques.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		0%	40%

ARC253	Building (3): Sustainable Construction			3 CH
Prerequisites	Building (2): Finishing Works			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	3		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
The course aims at understanding the vernacular building construction materials and technologies. Student will know about earth construction materials such as: wet loam, rammed earth, adobe or raw block, burnet brick, natural stones, straw bales, and earth bags. In addition, they will learn native technologies, and techniques to construct small scale buildings. They will learn how to build: rammed earth walls and domes, adobe vaults and domes, the Jack arch floors, rubble work (either random, squared, or polygonal) , and other similar technologies such as earth bag shelters and straw bales houses.				
Used in Program / Level				
Program Name or requirement		Study Level		
Environmental Architecture and Urbanism Program		2		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	10%	0%	40%	

ARC254	Landscape Construction			2 CH
Prerequisites	Building (2): Finishing Works			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	3		0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
This course provides the students with the knowledge of different architecture and landscape constructing materials and possibilities of their usages, added to the finishing materials. Students learn how to implement some simple combinations through models with different scales; they will also be able to pinpoint various hardscape, softscape and street furniture details.				
Used in Program / Level				
Program Name or requirement		Study Level		
Landscape Architecture Program		2		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	10%	0%	40%	

ARC351	Working Design (1): Execution Drawings Coordination, Annotating and Coding			3 CH
Prerequisites	Building (2): Finishing Works, Technical Installations, Concrete & Steel Structures			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		4	0	
Required SWL	150		Equivalent ECTS	6
Course Content				
The course aims at informing students about execution drawings as needed to construct buildings, and spatial needs for basic technical systems, to coordinate between the technical systems, and organize related information. Also, it aims at training students on documenting data and information, preparing architectural execution drawings, and coding them according to the US CSI coding system. The aims are realized through a study of technical and drafting systems; preparation base drawings that guarantee appropriateness of spaces for structural, sanitary, electrical, air condition, and movement systems; organization data and annotations in plans, sections, and elevations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			3	
Housing and Urban Development Program			3	
Environmental Architecture and Urbanism Program			3	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		20%	20%

ARC352	Working Design (2): Blow Ups Detailing and Items Specifications and BOQs			3 CH
Prerequisites	Working Design (1): Execution Drawings Coordination, annotating and coding			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		4	0	
Required SWL	150		Equivalent ECTS	6
Course Content				
The course aims at informing students about detailing architectural spaces. Student will start to investigate and design internal finishing, installations, accessories, and fixtures. Student will train to analyze, evaluate, and choose the optimum specifications of different items. In addition, student will integrate these specifications and manufacturer's details into the design. Also, student will learn how to make "Component", "Sub-Component" and "Assembly Drawings" and quantity surveying to produce BOQs.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			3	
Housing and Urban Development Program			3	
Environmental Architecture and Urbanism Program			3	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	10%		20%	20%

ARC451	Working Design (3): Execution Documents Complexity		3 CH
Prerequisites	Working Design (2): Blow Ups Detailing and Items Specifications and BOQs		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
The course aims at training students to conduct professional execution documents of complex moderate scale projects. Advanced supplementary systems and technical installations will be discussed such as systems of: Security, Firefighting, Fire Alarm, BMS, Automation, and other similar systems. Advanced technologies and systems will be used in case of the basic supplementary systems; structure, HVAC, circulation mechanisms, and lighting. Student will be asked to produce a full set of execution drawings in addition to the project items specifications and BOQs.			
Used in Program / Level			
Program Name or requirement		Study Level	
Architectural Engineering Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	0%	40%	0%

ARC452	Working Design (3): Residential Towers Execution Documents and Tender Documents		3 CH
Prerequisites	Working Design (2): Blow Ups Detailing and Items Specifications and BOQs		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	150	Equivalent ECTS	6
Course Content			
The course aims at training students to conduct professional execution documents of complex moderate scale housing projects. Coordinates systems and allocation, advanced supplementary systems and technical installations will be discussed such as systems of: Security, Firefighting, Fire Alarm, BMS, Automation, and other similar systems. Advanced technologies and systems will be used in case of the basic supplementary systems; structure, HVAC, circulation mechanisms, and lighting. Student will be asked to produce a full set of execution drawings in addition to the project items specifications and BOQs.			
Used in Program / Level			
Program Name or requirement		Study Level	
Housing and Urban Development Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	0%	40%	0%

ARC453	Housing Maintenance, Post-occupancy Evaluation, and Value Engineering			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course aims to introduce a systematic and organized approach to providing the necessary functions in a project at the lowest cost through the phase of designing buildings using value engineering systems as well as keeping their efficiency though the operating phase and the maintenance phase after the occupancy. The course highlights conservation and recycling: Performance of construction materials and components, rehabilitation of constructed facilities, materials and methods for conservation work, recycling of old buildings and its advantages. The course highlights also on the process of obtaining feedback on a building's performance in use. The value of POE is being increasingly recognized, and it is becoming mandatory on many public projects				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E6.6 Environmental Studies Courses

ARC161	Introduction to Lighting Systems						2 CH
Prerequisites	Electricity and Magnetism						
Number of weekly Contact Hours							
Lecture			Tutorial		Laboratory		
2			1		0		
Required SWL	100		Equivalent ECTS		4		
Course Content							
Importance of Lighting and influence on product ability. Design standards (lux level, luminary type, lamp type… etc.), Lighting Systems. Provides general introduction to the visual environment, including subjective and objective scales of measurement, visual perception, photometry, brightness, luminance, illumination, natural and artificial lighting. Design problems, field measurements, computer, and other models will be used to explore major topics and energy savings options.							
Used in Program / Level							
Program Name or requirement					Study Level		
Building Engineering Program					1		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
40%		20%		0%		40%	

ARC261	Control of Thermal Environment						2 CH
Prerequisites							
Number of weekly Contact Hours							
Lecture			Tutorial		Laboratory		
1			2		0		
Required SWL	75		Equivalent ECTS		3		
Course Content							
The course addresses the design of the indoor thermal environment, including the appropriate application of building envelope materials and assemblies, and an introduction to the principles of sustainability. Beginning with the basics of human thermal comfort, followed by the concept and practice of solar heating, passive cooling, daylighting, indoor air quality. Students will learn how to shape the form of a building to respond to climate and the needs of its occupants' thermal comfort.							
Used in Program / Level							
Program Name or requirement					Study Level		
Architectural Engineering Requirement					2		
Housing and Urban Development Program					2		
Environmental Architecture and Urbanism Program					1		
Landscape Architecture Program					2		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
40%		20%		0%		40%	

ARC262	Principles of Sustainable Architecture			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
The course examines the underlying principles of sustainable design within the built environment. It focuses on environmental issues and design processes that enable professionals to create a more sustainable world. Students will develop an understanding of the concepts and terminologies of sustainable design and how these have evolved over time. The course provides context for the green building movement and will help students understand the scope of this field of study. Students will gain an understanding of sustainable design by examining the impact of human interactions, the built environment, and natural processes. This course also examines the underlying principles of sustainable design including energy efficiency, public policy, indoor environmental quality, ecology, and land use.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC263	Fundamentals of Building Acoustics			2 CH
Prerequisites	Electricity and Magnetism& Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	100		Equivalent ECTS	4
Course Content				
Fundamentals of sound, its sources and propagation. The subjective and objective scales of measurement and laws of psychophysics are covered. The relationship between sound and listener in different settings, outdoor, indoor and adjacent rooms, is explored. The course addresses the sonic design of acoustic spaces. Noise control at high and low frequency; effects of noise and vibration on humans and buildings; design of noise control systems; calculation of airborne and impact sound insulation, noise and vibration control applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

<table>
<tr><td>ARC361</td><td colspan="4">Lighting in Architecture</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electricity and Magnetism</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">75</td><td colspan="2">Equivalent ECTS</td><td>3</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">This course explores natural and artificial lighting that integrates occupant comfort, energy efficiency in an architectural context. Visual perception and light, basic artificial lighting source, light and visual effects, the quantitative and qualitative design of artificial lighting, some simulation programs used in the design of artificial lighting. Students will also establish new practices of urban space and buildings' facades lighting as well as landscape elements.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Architectural Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="4">Environmental Architecture and Urbanism Program</td><td colspan="2">2</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>40%</td><td colspan="2">20%</td><td colspan="2">0%</td><td>40%</td></tr>
</table>

<table>
<tr><td>ARC362</td><td colspan="4">Acoustics in Architecture</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electricity and Magnetism</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">75</td><td colspan="2">Equivalent ECTS</td><td>3</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">This course aims at increasing students' perception of natural and artificial environment through studying sound behavior. First, architectural acoustics: Definition of architectural acoustics and its importance in building, the main terminologies, behavior of sound waves in enclosures, sound absorption and reflection, sound isolation, the main acoustical defects and the methods of correction. Design for auditorium acoustics is considered. Second, noise control: the course also introduces students to outdoor sound propagation through the urban fabrics, outdoor noise propagation modeling, prediction and strategic mitigation theories.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Architectural Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="4">Environmental Architecture and Urbanism Program</td><td colspan="2">2</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>40%</td><td colspan="2">20%</td><td colspan="2">0%</td><td>40%</td></tr>
</table>

ARC363	Renewable Energy and Buildings			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course introduces renewable energy systems. It covers the fundamental concepts of energy and radiation with specific solar energy applications and photovoltaic, electrical energy storage systems, and thermal energy and storage. The second part covers the basic science of wind energy systems and their electrical system designs. The third part covers the bioenergy systems from resources to final products and conversion technologies. It finally introduces other promising energy sources.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			3	
Environmental Architecture and Urbanism Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC364	Outdoor Lighting and Effects			2 CH
Prerequisites	Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
This course introduces a variety of landscape lighting techniques. This includes different lighting installations and fixtures (columns, bollards, spotlights, signs, buildings, etc.). Students will also establish new practices of urban space and city lightning using buildings' facades as well as landscape elements. Moreover, they will explore the development of contemporary light patterns and technologies along with new visualization techniques. It previews contemporary theatrical lighting effects and techniques. It also covers different practices and mechanisms in lighting designs for gardens, in relation to safety matters and basic infrastructure.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC365	Building Performance Simulation			3 CH
Prerequisites	Modeling of the built environment			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	4		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				

This course aims at enhancing the student's abilities to use computer software as tools to virtually create spaces or buildings whose geometry, materials, environmental factors and occupancy patterns resemble those of questionable existing or assumed buildings, in such that their environmental performance can be predicted by the software, and manipulated by the student. The course introduces the basic concept of simulation with its main requirements. Through the course, student knows about different simulation programs, their required inputs, outputs and level of accuracy. In addition, student specifically learns to use specific software acquiring the expertise of modeling spaces or buildings, ascribing their relevant features and environmental factors, and extracting the required performance parameters from the software outputs which (s)he can judge, therefore change design parameters and re-run the simulation to optimize the predicted performance.

Used in Program / Level	
Program Name or requirement	Study Level
Environmental Architecture and Urbanism Program	3

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	0%	40%	0%

ARC366	Responsive Architecture Installations			2CH
Prerequisites	Environmental Studies & passive energy systems, Control of Thermal Environment			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				

This course provides a design-oriented study of responsive environmental control, life safety and building service systems. The course covers basic principles, applications, performance and design installations of these systems. It reflects that on principles of sustainable design, energy efficiency, optimization of indoor environmental quality and economic soundness. The course also briefly addresses other sustainable design strategies and includes an overview of active systems (solar, photovoltaic panels, geothermal), water reduction and reuse, green materials, and acoustics.

Used in Program / Level	
Program Name or requirement	Study Level
Housing and Urban Development Program Elective	2

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ARC367	Indoor Air Quality			3 CH
Prerequisites	Thermal Analysis of Buildings			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Factors affecting the quality of indoor environment, physical/ chemical characteristics of air contaminants, health effects, building systems and factors affect indoor air quality, design of outdoor air delivery system, air pollutants source control, indoor air quality monitoring and testing, design standards and building codes related to indoor air quality, improving indoor air quality through design, construction, operation and maintenance.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ARC368	Soundscape and Aural Architecture			2 CH
Prerequisites	Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to Archaeo-Acoustics, Architectural and sonorous. Exploring sound or combination of sounds that forms or arises from an immersive environment. Visualization of the sonic environment, sound walks. Biophonic, geophonic and anthrophonic sounds. How to design with aural stimulus, the effect of aural aspects on the architecture expression of buildings. Soniferous structures, parks, buildings and sound marks. Sound sculptures, vocal sculptures, and the effect on the surrounding aural environment. Sound, time, space mapping.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program Elective			4	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ARC461	Daylighting and Thermal Performance		3 CH
Prerequisites	Control of Thermal Environment, Modeling of the built environment		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
This course aims to provide an understanding of the concept of reduction in energy consumption through low energy building design. Students will be familiarized with the key factors that need to be considered while designing daylighting. Introducing systems and techniques to control and enhance daylighting performance. Understanding thermal exchange between the building envelope and the environment. This will include an overview of passive design features and their applicability to different building types and climatic regions. Modeling and evaluating, thermal and daylighting performance and their impact on reducing energy consumption will be investigated.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Program	4		
Landscape Architecture Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ARC462	Sustainable Building Rating Systems		2 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
The course Introduces the concept of building rating systems. Rating system categories, the scoring system. Why the need to achieve certification. How to design towards a certified building environment throughout all design and construction phases. The difference of various rating systems, emphasizing the Egyptian Green Pyramid rating system.			
Used in Program / Level			
Program Name or requirement	Study Level		
Environmental Architectural and Urbanism Program	4		
Housing and Urban Development Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ARC463	Renewable Energy Systems & Economics			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	75		Equivalent ECTS	3
Course Content				
This course introduces renewable energy systems. It covers the fundamental concepts of renewable energy systems including the solar energy applications and photovoltaic, electrical energy storage systems, and thermal energy and storage. It also covers other renewables like the wind energy systems and their electrical system designs as well as the bioenergy systems from resources to final products and conversion technologies. The course also focuses on studying the economic and life cycle assessment of the renewable energy systems in order to be able to make informed decisions when it comes to the design and implementation of them in different buildings.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC464	Sustainable Rehabilitation of the Built Environment			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	75		Equivalent ECTS	3
Course Content				
This course introduces the rehabilitation principles with respect to conservation and energy efficiency. It enhances the students' skills of rehabilitation research, building's technical inspection and architectural management. The course focuses on the critical analysis of rehabilitation and applying effective methods and solutions. Students will also be acquainted with the evaluation and rehabilitation methods of heritage and vernacular architecture.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC465	Building Acoustics			3 CH
Prerequisites	Fundamentals of Building Acoustics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Needs for acoustic regulation, review of existing regulation of noise control criteria around the world, noise control criteria and regulation limits, Instrumentation and testing requirements, types of noise sources in building, outdoor noise, room acoustics review requirements, wall, barriers and enclosure use to get better quality, types of acoustic material and structure to minimize noise effects, vibration and noise control for building, HVAC noise problems and solution. Review of existing codes for building acoustics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC466	Building Envelope Design			2 CH
Prerequisites	HVAC System Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Technical influences in the design of building envelope, including the control of heat flow, air and moisture penetration, building movements, and deterioration. Application of air/vapor barrier and rain-screen systems. Performance assessment and building codes through case studies and design projects. Sustainable design principles. Design of walls, roofs, joints and assemblies. Cause of deterioration and preventive measures, on-site investigation. Relevant building codes and standards.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC467	Building Energy Conservation Technologies			3 CH
Prerequisites	Introduction to Lighting System, Fundamentals of Building Acoustics, HVAC System Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Energy consumption: trends in energy consumption, evaluation of energy performance of existing buildings, standards of energy efficiency in buildings, measurements, total energy consumption. Building thermal environment: external and internal heat sources, methods of heat transfer, evaluating heat transfer, internal thermal environment, building design strategies save energy needed to reach thermal comfort inside building; skin parameters and passive strategies for saving energy, evaluating needs of heating and cooling. Renewable energy sources: passive or active solar systems, wind power geothermal systems. Optimum selection of energy sources. Impact of emerging technologies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC468	Building Illumination and Day Lighting			3 CH
Prerequisites	Introduction to Lighting System			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Production, measurement and control of light. Photometric quantities, visual perception and color theory. Daylight and artificial illumination systems. Radiative transfer, fixture and lamp characteristics, control devices and energy conservation techniques. Design of lighting systems. Solar energy utilization and day-lighting. Integration of lighting systems with mechanical systems for energy conservation and sustainable development.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E6.7 Projects Management Courses

ARC371	Project Management			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
The course introduces the basics of project management and its objectives, Initial costs and running costs. Types of projects turnovers as well as administrative and environmental aspects are discussed. Skills for Planning and time scheduling of jobs through the evaluation of programs, critical path method, "Gantt" chart, Cost-time analysis, progress curves and resource allocation are included.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			3	
Housing and Urban Development Program			3	
Environmental Architecture and Urbanism Program			4	
Landscape Architecture Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC471	Feasibility Studies			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
The course emphasizes the importance of feasibility studies in making design decisions, Land economics, Initial costs and running costs. Projects turnovers and marketing studies. Course also emphasizes the importance of planning and time scheduling of jobs. Evaluation of programs and critical path method, Cost-time analysis.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ARC472	Maintenance of Buildings				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
The course emphasizes the durability of buildings: Life expectancy of different types of buildings, effect of environmental elements such as heat, dampness and precipitation on buildings, effect of chemical agents on building materials, effect of pollution on buildings, effect of fire on buildings, damage by biological agents. Maintenance of buildings: Reliability principles and its applications in selection of systems for routine maintenance of buildings, maintenance cost, specifications for maintenance works. Conservation and recycling: Performance of construction materials and components, rehabilitation of constructed facilities, materials and methods for conservation work, recycling of old buildings and its advantages.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

ARC473	Building Life Cycle Assessment				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
The course introduces the techniques used in evaluating life-cycle costs of competing project alternatives. This includes Identification and delimitation of the system boundary, defining and handling of allocation problems, selection of characterization method, midpoint and endpoint approaches, identification and use of data from LCA databases, collection and use of data from other sources, LCA Software Tools, results reporting and application.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program Elective				4	
Environmental Architecture and Urbanism Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

<table>
<tr><td>ARC474</td><td colspan="3">Building Commissioning</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4"></td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">The course introduces the building commissioning process, building systems to be commissioned, preparing a commissioning plan, the process required for commissioning of each system, developing the owner’s project requirement document, developing commissioning check lists for design and construction stages. Preparing a commissioning report, the commissioning process as a major part of sustainable building design and construction.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Environmental Architecture and Urbanism Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

E6.9 Graduation Projects

ARC491	Architecture and Building Technology Graduation Project (1)			2 CH
Prerequisites	Report Writing & Communication Skills			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
The course aims at preparing the preliminary study of the graduation project which is the main design project. Students synthesize their previous studies inside the program in one major project. Topics are selected by students under supervision from the faculty members. Students prepare all necessary research works and analysis regarding their design topics and approaches as per concentration: Architecture or Building Technology.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Report Presentation		Final Exam
40%	20%	40%		0%

ARC492	Architecture and Building Technology Graduation Project (2)			6 CH
Prerequisites	Architecture and Building Technology Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		12		0
Required SWL	450		Equivalent ECTS	18
Course Content				
Continuation of graduation project (1), Students develop a comprehensive design project. The goal is to achieve the project objectives according to students' field of interest and concentration. The "Graduation Project (2)" is considered a cap stone that reflects students' understanding and ability of practicing "Architecture" professionally.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury		Final Exam
60%	0%	40%		0%

<table>
<tr><td>ARC493</td><td colspan="3">Environmental Architecture Graduation Project (1)</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Report Writing & Communication Skills</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">The students will have to develop a project at an architectural and urban scale based on a real subject chosen by the coordinator. Analysis of collected data regarding the proposed site. Analysis and discussion of similar projects and preparing a technical report concerning the environmental analysis of the site, comparative study with similar projects. The final report leads to the final architectural program of the project.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Environmental Architecture and Urbanism Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Report Presentation</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td>40%</td><td colspan="2">0%</td></tr>
</table>

<table>
<tr><td>ARC494</td><td colspan="3">Environmental Architecture Graduation Project (2)</td><td>6 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Environmental Architecture Graduation Project (1)</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">0</td><td colspan="2">12</td><td>0</td></tr>
<tr><td>Required SWL</td><td>400</td><td>Equivalent ECTS</td><td colspan="2">16</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">The student will build on the technical report presented by him regarding studies and program of graduation project. He is supposed to make use of all the skills, the fundamentals, and the technical information he gained during his study. The student will utilize all this background information in his designs. He should prove through his work and at oral exam, his complete understanding of the elements of the project and his capability to apply them in his future career.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Environmental Architecture and Urbanism Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Oral Jury</td><td colspan="2">Final Exam</td></tr>
<tr><td>60%</td><td>0%</td><td>40%</td><td colspan="2">0%</td></tr>
</table>

E7. Courses offered by Urban Design and Planning Department (UPL)

The Urban Design and Planning Department is responsible for teaching courses that serve the following programs:

1. Several Basic Architecture Engineering courses as an Architecture Discipline Requirement.
2. Architectural Engineering Program.
3. Landscape Architecture Program.
4. Environmental Architecture and Urbanism Program.
5. Housing and Urban Development Program.

Table 54 List of specializations at the Urban Design and Planning Department.

#	Specialization
1	Urban Design
2	Regional and City Planning
3	Urban Planning
4	Landscape
5	Housing
6	Environmental Studies
7	Sociology and Urban Economy
8	Urban Informatics
9	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total
UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement
SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 55 List of UPL courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Urban Design																				
1	2	211	Context and Place Design Studio	4	8	200	0	8	0	8			x		60	10	10	20	ARC112	
2		212	Principles of Urban Design and Landscape	3	4	100	2	2	0	4			x		40	20	0	40		
3		213	Mixed-use Design Studio	4	7	175	0	8	0	8				x	60	10	10	20	UPL211	
4	3	311	Urban and Landscape Design Studio	4	8	200	0	8	0	8			x	x	60	0	20	20	UPL211	
5		312	In Situ Development Design Studio	4	8	200	0	8	0	8				x	60	0	20	20	ARC212	
6		313	Eco Urban Design	3	5	125	1	4	0	5				x	60	10	10	20	UPL212	
7	4	411	Mega Projects Urban Design Studio	4	8	200	0	8	0	8				x	60	0	40	0	UPL311	
8		412	Sustainable Contextual Architectural Design Studio	3	6	150	0	6	0	6				x	60	0	40	0	ARC313	
9		413	Introduction to Urban Design	3	5	125	2	2	0	4				x	40	20	0	40		
2. Regional and City Planning																				
10	2	221	History and Theory of Urbanism	3	4	100	2	2	0	4			x		40	20	0	40		
11	3	321	Participatory Planning and Community	2	4	100	2	1	0	3				x	40	20	0	40		
12	4	421	Town and Regional Planning	2	3	75	1	2	0	3				x	40	20	0	40	UPL221	
13		422	Smart Cities and Intelligent Residential Buildings	3	4	100	2	2	0	4				x	40	20	0	40		
14		423	City Governance and Land Management	3	5	125	2	2	0	4				x	40	20	0	40		
15		424	Selected Topics in Architecture and Urbanism	3	4	100	2	2	0	4				x	40	20	0	40		
3. Urban Planning																				
16	2	331	Planning and Urban Upgrading	3	5	125	1	4	0	5			x		40	20	0	40	UPL221	
17		332	Sustainable Urban Development	3	4	100	2	3	0	5				x	40	20	0	40	UPL221	
18	3	333	Urban Infrastructure	3	3	75	2	2	0	4				x	40	20	0	40	PHM022	(PHM032)
19		334	Site Analysis (Spatial Analysis and Land Mapping)	2	4	100	1	2	0	3				x	40	20	0	40		
20		431	Strategic Action Planning Studio	4	8	200	0	8	0	8				x	60	0	40	0	UPL311	
21		432	Urban Engineering	3	4	100	2	2	0	4				x	40	20	0	40		
22	4	433	Land Management and Land Subdivision	3	5	125	2	2	0	4				x	40	20	0	40	UPL331	
23		434	Sustainable Urban Mobility	2	3	75	1	2	0	3				x	40	20	0	40		
24		435	Urban and Architectural Heritage	3	5	125	2	2	0	4				x	40	20	0	40		
25		436	Urban Renewal	3	5	125	2	2	0	4				x	40	20	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
4. Landscape																				
26	2	241	Principles of Residential Urban Spaces and Landscape	3	4	100	2	2	0	4				x	40	20	0	40		
27		242	Sustainable Urban Landscape	3	5	125	1	4	0	5				x	40	20	0	40	UPL212	
28	3	341	Horticulture and Garden Design	2	4	100	1	2	0	3				x	40	20	0	40		
29		342	Arid Landscape Architecture Design Studio	4	7	175	0	8	0	8				x	60	0	20	20	UPL311	UPL341
30		343	Landscape Working Design (1): Landscape Detailed Working Documents	3	4	100	1	4	0	5				x	40	20	0	40	ARC352	
31		344	Landscape for Dwellings and Public Buildings	2	4	100	1	2	0	3				x	40	20	0	40		
32	4	441	Landscape Working Design (2): Landscape Execution Documents Complexity	3	5	125	1	4	0	5				x	40	20	0	40	ARC254	UPL343
33		442	Ecological Landscape	3	5	125	2	2	0	4				x	40	20	0	40		
5. Housing																				
34	2	251	Residential Complex Design Studio	4	8	200	0	8	0	8				x	60	10	10	20	ARC112	ARC212
35	3	351	Housing Studies	3	4	100	1	4	0	5			x		40	20	0	40	UPL221	
36		352	Neighborhood Planning & Design Studio	4	8	200	0	8	0	8				x	60	0	20	20	UPL312	
37		353	Housing Policies, Strategies and Action Plans	2	3	75	1	2	0	3				x	40	20	0	40		
38	4	451	Housing Studies & Real Estate Development	3	5	125	2	2	0	4				x	40	20	0	40		
6. Environmental Studies																				
39	1	161	Environmental Studies and passive energy systems	2	3	75	1	2	0	3				x	40	20	0	40		
40	3	361	Outdoor Noise Propagation in Built Environment	2	4	100	1	2	0	3				x	40	20	0	40		
41	4	461	Contemporary Environmental Issues	3	4	100	2	2	0	4				x	40	20	0	40		
42		462	Urban Ecology and Environmental Studies	2	3	75	1	2	0	3				x	40	20	0	40		
43		463	Environmental Impact Assessment	3	5	125	2	2	0	4				x	40	20	0	40		
44		464	Environmental Planning	3	5	125	2	2	0	4				x	40	20	0	40		
7. Sociology and Urban Economy																				
45	2	271	Society and Housing Economics	2	4	100	2	1	0	3			x		40	20	0	40		
46	3	371	Human Behavior and the Built Environment	2	4	100	1	2	0	3				x	40	20	0	40		
47		372	Equity and urban Justice	2	4	100	1	2	0	3				x	40	20	0	40		
48	4	471	Urban Economics	2	4	100	2	1	0	3			x		40	20	0	40		
49		472	People and Environment	3	5	125	2	2	0	4				x	40	20	0	40		
50		473	Urban Sociology & Human Settlements	3	5	125	2	2	0	4				x	40	20	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
8. Urban Informatics																				
51	3	381	Introduction to Geographic Information Systems (GIS)	2	4	100	1	2	0	3				x	40	20	40	0	ARC142	
52		481	Urban Informatics	3	5	125	2	2	0	4				x	40	20	40	0	(CSE031)	ARC142
53	4	482	Introduction to Geo Design	3	5	125	1	4	0	5				x	40	20	40	0	CSE03)	ARC142
9. Graduation Projects																				
54	4	491	Urban Design Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	40	0	ASU112	UPL311
55		492	Urban Design Graduation Project (2)	6	18	450	0	12	0	12				x	60	0	40	0	UPL411	UPL491
56		493	Urban Planning Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	40	0	ASU112	UPL311
57		494	Urban Planning Graduation Project (2)	6	18	450	0	12	0	12				x	60	0	40	0	UPL431	UPL493
58		495	Landscape Architecture Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	40	0	ASU112	UPL342
59		496	Landscape Architecture Graduation Project (2)	6	18	450	0	12	0	12				x	60	0	40	0	UPL411	UPL495
60		497	Housing & Urban Development Graduation Project (1)	2	4	100	1	2	0	3				x	40	20	40	0	ASU112	UPL352
61		498	Housing & Urban Development Graduation Project (2)	6	18	450	0	12	0	12				x	60	0	40	0	ARC413	UPL497

E7.1 Urban Design

UPL211	Context and Place Design Studio			4 CH
Prerequisites	Creativity and Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
This course explores the relationship between architecture and its urban context focusing on the relation with the built environment The course stresses upon the meanings of the integrated architectural design situated in an urban complex with heritage dimension. It reinforces the basics of cultural and aesthetic values, environmental and construction challenges, and the role of urban context in shaping the architecture/urban forms. The students learn the design process of creating public or residential building defining relationship between indoor and outdoor. They experiment different architectural treatments and approaches to build within the heritage site, considering certain potentials and limitations.				
Used in Program / Level				
Program Name or requirement			Study Level 2	
Architectural Engineering Requirement			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	10%	10%	20%	

UPL212	Principles of Urban Design and Landscape			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course aims at developing an understanding of the urban context and its surrounding landscaping elements. This course is an introduction to urban design meanings, theories and practices.Also, it analyzes the elements of the urban landscape: open spaces, greenery, and street furniture and movement patterns. The student acquires a clear understanding of the meaning of urban morphology, and the vocabulary of urban form and space and best practice of urban design and its surrounding landscape elements through cases study and sites visits				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL213	Mixed-Use Design Studio			4 CH
Prerequisites	Context and Place Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	175		Equivalent ECTS	7
Course Content				
The design studio focuses on designing mixed use buildings gathered by one or more open spaces. Emphasizing throughout the various design stages on the philosophical aspects. Students acquire the skill to integrate inner and outer spaces through designing medium / large buildings in a landscape context. Moreover, they should be capable of designing landscape elements details through aesthetic forms and functions with the use of natural and man-made materials.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	10%	10%	20%	

UPL311	Urban and Landscape Design Studio			4 CH
Prerequisites	Context and Place Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
This course aims at the students to understand the relationship between architecture and urban landscape through designing a themed urban complex project and exploring the meaning of public and private spaces. The principles of the legibility, the permeability are explored through the studio with focus on connectivity, walkability needs of the communities, and the quality of exterior and interior spaces. The students apply the design process to embrace the ramifications and diversity of urban design from conceptual design to details, using tools of landscaping and theories of urban design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			3	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Oral Jury	Final Exam	
60%	0%	20%	20%	

UPL312	In-Situ Development Design Studio		4 CH
Prerequisites	Multi Story Accommodation Building Design Studio		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	8	0	
Required SWL	200	Equivalent ECTS	8
Course Content			
This course aims at developing an in-situ upgrading project of a deteriorated area, through studying its physical, environmental and socio-economic needs. The project would consider planning codes and regulations, as well as context constraints and limitations. The project would also explore housing issues in developing countries, urbanization challenges and informal growth. Examples of selected projects would be upgrading of informal areas, revitalization of residential within historical areas, urban regeneration projects, …etc.			
Used in Program / Level			
Program Name or requirement		Study Level	
Housing and Urban Development Program		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Oral Jury	Final Exam
60%	0%	20%	20%

UPL313	Eco Urban Design		3 CH
Prerequisites	Principles of Urban Design and Landscape		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
The course offers a theoretical basis in the principles of urban design and the possibilities of creating more sustainable and harmonious urban spaces, public transportation systems, architecture, urban landscaping, ecology and master planning. This theoretical study teaches students some tools and techniques for analysis of the health and efficiency of different urban environments around the world. Then, students will be able to analyze cases from the surrounding current urban environment. Analysis looks at a specific aspect such as traffic, uses, view shed, skyline, wind, solar exposure, urban grid, urban resource supply and demand, etc. These analyses then become the basis for an urban design strategy to be proposed and developed by students.			
Used in Program / Level			
Program Name or requirement		Study Level	
Environmental Architecture and Urbanism Program		3	
Landscape Architecture Program (Elective)		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Oral Jury	Final Exam
60%	10%	10%	20%

UPL411	Mega Projects-Urban Design Studio				4 CH
Prerequisites	Urban and Landscape Design Studio				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		8		0	
Required SWL		200	Equivalent ECTS		8
Course Content					
The course will focus on the design of a complex themed urban project with various uses and spaces situated in a remote area. The student will experiment all previous accumulated knowledge in urban/architecture design to embrace the ramifications of the project theme and its brand. More advanced focus on urban/architecture design issue. Examines modern theories, urban/architecture paradigms. Based on the site intervention, the student will be explore constraints and potentials, and will be able to integrate various aspects through urban/architecture design processes. Sustainability principles and future trends will be the framework for idea collaborations and concepts. By the end of the course the student will be well prepared to start his graduation phase.					
Used in Program / Level					
Program Name or requirement				Study Level 4	
Architectural Engineering Program				4	
Landscape Architecture Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Oral Jury		Final Exam
60%	0%		40%		0%

UPL412	Sustainable Contextual Architecture Design Studio				3 CH
Prerequisites	Sustainable Architectural Design Studio (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		6		0	
Required SWL		150	Equivalent ECTS		6
Course Content					
A design studio focusing upon the study of sustainable building concepts within its specific urban context, green architecture strategies, and systems development. An understanding of these issues is gained through research activity practical simulations covering the latest developments in the field of environmental interdependence, and the building performance. A comprehensive studio design project will encompass site and environmental planning, material and system selection, and integration of technology to create works that are functionally, aesthetically, and environmentally sound and comprehensive. Students will develop integrated design solutions in public, commercial, or industrial contexts.					
Used in Program / Level					
Program Name or requirement				Study Level	
Environmental Architecture and Urbanism Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Oral Jury		Final Exam
60%	0%		40%		0%

<table>
<tr><td colspan="3">UPL413</td><td colspan="4">Introduction to Urban Design</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="3">2</td><td colspan="2">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Students taking this course should learn the principles and theories of urban design and their inter-relation with the surrounded urban environment context. They should be able to analyze the different elements of urban design (open spaces, built form, plants, street furniture, paths, etc.). Moreover, Students should understand and evaluate the built environment on the monographic scale through visual studies, case studies as well as site designs and visits.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="5">Environmental Architecture and Urbanism Program Elective</td><td colspan="3">4</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">40%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

E7.2 Regional and City Planning

UPL221	History and Theory of Urbanism			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100	Equivalent ECTS		4
Course Content				
This course aims at understanding the evolution of cities and meaning of urbanism and the evolution of social housing development. It stresses the emergence and evolution of the city and their Locations. It emphasis on Egyptian historical cities, main Egyptian capital schemes through eras – Cairo urban history - Forces influencing the shaping of Cairo. The course develops the basic knowledge at understating the urban patterns and morphologies, utopia philosophers and urbanism - industrial revolution and its implications for cities - the students will have an overview of the history and form of urban spaces in cities of different civilization, and the factors affecting its form.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			2	
Housing and Urban Development Program			2	
Environmental Architecture and Urbanism Program			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL321	Participatory Planning and Communities			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100	Equivalent ECTS		4
Course Content				
This course introduces participatory approaches for urban development with practical applications of methods used in project planning and sustainable community development. The course illustrates a set of tools and techniques for the integration of theory and the community participation practices among urban challenges and city strategies. The course focuses on the importance of involvement of different stakeholders throughout the decision-making process and focuses on strategies to empower local community and local government.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL421	Town and Regional Planning			2 CH
Prerequisites	History and Theory of Urbanism			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	75		Equivalent ECTS	3
Course Content				
This course aims at the students to introduce basic concept and frameworks for regional planning as well as introducing issues for urban and regional development. It explore contemporary dimensions of how cities form and develop- and how human interventions shape these complex processes. The students would draw upon a diverse range of sources to examine the past, present, and future of cities by looking at four distinct yet interrelated themes- environment, equity, economy, and culture. They learn how to develop land use plans and programs that help create communities, accommodate population growth, and revitalize physical facilities in towns, cities, counties, and metropolitan areas.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL422	Smart Cities and Intelligent Residential Buildings			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	75		Equivalent ECTS	3
Course Content				
This course aims at the students to explore the “smart city” and the intelligent buildings and the IT that underpins their operations in order to save energy consumption and to reduce carbon and ecological foot print. The course aims at improving the students' technical knowledge about the different aspects of smart cities e.g. energy, mobility and buildings, giving students an overview of current smart city related projects and enable students to develop a vision on which steps can be taken to transform our cities to smart cities.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

<table>
<tr><td>UPL423</td><td colspan="3">City Governance and Land Management</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4"></td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">The course aims at the students to examine governance from legal, political, social, and economic perspectives. In addition, we will discuss how these structures constrain collective decision making about particular urban issues. It invites students to reflect upon the problems confronting those who have to make decisions about land management and resource use. It analyses the various forces, institutions, and movements that guide economic and physical development, the distribution of resources, social interactions, and other aspects of daily life in urban areas focusing on the contemporary problems of urban management in Egypt.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Architectural Engineering Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="3">Housing and Urban Development Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td>0%</td><td colspan="2">40%</td></tr>
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<table>
<tr><td>UPL424</td><td colspan="3">Selected Topics in Architecture and Urbanism</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4"></td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">This course is designed to introduce students to contemporary challenges in the Architecture and Urbanism fields and improve their critical understanding of their local context. Students will work in groups on a case study related to contemporary issues under the guidance of a supervisor. Through this course, students should enhance their communicative and management skills. The typical tasks for the group are the following: Analyze the problem of the case study and describe it in detail, develop objectives and methods of the group work, Implement the project independently while distributing tasks and roles within the group, Develop and discuss solutions within the team and finally Document the status of the work and project management during implementation.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Environmental Architecture and Urbanism Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

E7.3 Urban Planning

UPL331	Planning and Urban Upgrading			3 CH
Prerequisites	History and Theory of Urbanism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	125		Equivalent ECTS	5
Course Content				
This course aims at the students to explore planning theories and approaches and methodology. It provides an understanding of urban hierarchy and different sociological and cultural, urban political, demographic and ethnic issues and their impact on the urban built environment. It introduces types of urban upgrading, renewal, and rehabilitation. Development policies of urban upgrading are reviewed through comparative analysis based on local and international examples through field surveys the student will be able to diagnose the urban problems with focus on the reasons of deterioration of the urban environment specifically in the third world. An Identification of types of slums and squatters; understand the historical context for urban deterioration.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			3	
Housing and Urban Development Program			3	
Landscape Architecture Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL332	Sustainable Urban Development			3 CH
Prerequisites	History and Theory of Urbanism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course discusses the current debates on sustainable urban development. It reviews the evolution of the concept and defines weak and strong sustainability. It discusses the objectives, challenges, constraints and principles for sustainable development. It explores the relationship between economy, ecology and equity and explains what ıs meant by a sustainable city. The course analyzes best practices of sustainable development projects from around the world to draw lessons and identify the theoretical and methodological challenges which face urban development.				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL333	Urban Infrastructure					3 CH
Prerequisites	Electricity and Magnetism (Dynamics)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	75		Equivalent ECTS		3	
Course Content						
The course will develop the application of knowledge, and communication skills, as well as proficiency in the identification and solution of complex civil engineering problems. The course will preview all basic services and utilities including electricity, gas, water supplies, sewage systems, solid waste disposal, storm networks and telecommunication, in addition it will Introduce transportation planning. Students should articulate basic designs of infrastructure planning as well as their impact on the environment, public health and safety. Moreover, they should identify regulations of safety, and environmental laws that control infrastructure utilities.						
Used in Program / Level						
Program Name or requirement				Study Level 4		
Housing and Urban Development Program				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
40%	20%		0%		40%	

UPL334	Site Analysis (Spatial Analysis and Land Mapping)					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
1		2		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
The course aims to provide the students with the academic and practical knowledge to analyze and evaluate projects locations. This is achieved through a practical study of one of real projects locations. The study includes the analysis of the location, the neighborhood context, size and zoning, legal documentation, natural and man-made features, circulation networks, utilities networks, sensory, human and culture and climate. The student by the end of the course can prepare and analyze all spatial site condition and produce needed maps and graphics and data base.						
Used in Program / Level						
Program Name or requirement				Study Level		
Architectural Engineering Program Elective				3		
Housing and Urban Development Program Elective				2		
Landscape Architecture Program Elective				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
40%	20%		0%		40%	

UPL431	Strategic Action Planning Studio			4 CH
Prerequisites	Urban and Landscape Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
0		8	0	
Required SWL	200	Equivalent ECTS	8	
Course Content				
This studio aims to raise the student skill to the systematic design of a strategic plan, applying various (technical, functional as well as exploratory) design methods and planning techniques. The plan as a spatial and policy frame (a vision concerning the intended development of the area and a spatial concept) on the one hand and an action plan (projects, measures) on the other. Students are meant to design a process (leading to a strategic plan) as well as the plans and projects that relate to it. The object of the studio will be a complex area on a supra local scale (region, large city) in order to explore the relationship between different spatial scales and eventually the related policy levels. Another main objective is to emphasize the relationship between the long term vision, the phase of conceptualization, the implementation and action				
Used in Program / Level				
Program Name or requirement			Study Level 4	
Architectural Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	40%	0%	

UPL432	Urban Engineering			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
The course will preview all basic services and utilities including electricity, gas, water supplies, sewage systems, solid waste disposal, storm networks and telecommunication, in addition it will Introduce transportation planning: roads & highway classification, streets' hierarchy, design control and criteria, roads cross section elements, horizontal and vertical alignment, types of intersections. Students should articulate basic designs of infrastructure planning as well as their impact on the environment, public health and safety.				
Used in Program / Level				
Program Name or requirement			Study Level 4	
Architectural Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL433	Land Management & Land Subdivision				3 CH
Prerequisites	Planning and Urban Upgrading				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
This course aims at the students to prepare details plans and their accreditation. It includes a deep understand for building and land subdivision law, its implementing regulation, its impact of legislation on urbanism, basics and principles of land management, land readjustment and informal settlement regularization. It comprises an introduction of the problems confronting those who have to make decisions about land management and resource use legislations that govern practicing the profession – the students will be capable to submit needed documents of land subdivision and detailed planning according to Egyptian regulation.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program Elective				4	
Housing and Urban Development Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
40%	20%		0%		40%

UPL434	Sustainable Urban Mobility				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		2		0	
Required SWL		75	Equivalent ECTS		3
Course Content					
The course aims at the students to examine the complex relationship between transportation, land use and urban form, and the varied instruments available to planners seeking to influence this relationship. It discusses how different urban accessibility pathways impact directly on other measures of human development and environmental sustainability. It also presents the enabling conditions for increasing accessibility and low-carbon mobility in cities and what makes a city or neighborhood livable. It addresses the effectiveness of applying policies of green transportation in urban areas.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program				4	
Housing and Urban Development Program				2	
Environmental Architecture and Urbanism Program Elective				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
40%	20%		0%		40%

UPL435	Urban and Architecture Heritage			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The course emphasizes on the importance of architectural and urban heritage. It introduces different criteria for identification, classification, documentation and levels of conservation. Students will identify urban and environmental threats: spaces, negligence and lack of maintenance and deterioration significances. They will also recognize the principles and degrees of conservation and techniques of restoration for urban architectural heritage, and the ways to deals with heritage in the urban context.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			4	
Environmental Architecture and Urbanism Program Elective			4	
Landscape Architecture Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL436	Urban Renewal			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
This course focuses on the reasons of deterioration of the urban environment specifically in the third world. Students identify types of slums and squatters; understand the historical context for urban deterioration. Moreover, they should recall the urban upgrading and development policies as the course reviews case studies on comparative analysis based on local and international examples.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program Elective			4	
Environmental Architecture and Urbanism Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E7.4 Landscape

UPL241	Principles of Residential Urban Spaces & Landscape				3CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
This course aims at the students to develop an understanding of the urban spaces and its landscaping elements within residential context. This course analyzes the elements of the urban landscape according different ages: children, youth, families, and elderly. The course includes tutorials which focuses on space design. The student acquires a clear understanding of community needs, urban form and space and best practice of urban design elements. The course includes cases study and site visits.					
Used in Program / Level					
Program Name or requirement				Study Level	
Housing and Urban Development Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

UPL242	Sustainable Urban Landscape				3 CH
Prerequisites	Principles of Urban Design and Landscape				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		4		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
This course will explore the place and potential of urban agriculture in environmental planning, management, and development. Topics to be covered include fundamentals of a sustainable food system, horticultural principals and techniques, the place of food systems in urban planning, how urban agriculture can be accommodated within the urban built fabric, and contemporary examples of community gardening and urban agriculture locally and in other parts of the country. The principles of storm water and solid waste management, nutrient and water cycles, and sustainable material sourcing will be explored as well.					
Used in Program / Level					
Program Name or requirement				Study Level	
Environmental Architecture and Urbanism Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

UPL341	Horticulture and Garden Design			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course is an introduction to the Flora potentials existing in Egypt. Students should identify various plants (exotic trees, shrubs, grass, etc.) that are common in the Egyptian environment. The course emphasizes on the sustainability of these plants within an environmental context. Students will identify different art techniques of creating plant compositions in the landscape within cultural and biophysical context. They will recognize soil properties along with plant/soil relevant relationships to the built environment. Moreover, they will develop methods of site inventory, plant pallets and plants assemblages based on expressive and functional needs. In addition, Students will compile different techniques to prepare plants before planting. This process includes outlining standards for plants selection based on plants lists and specifications as well as identifying threats to plants and different ways to deal with. By the end of the course, Students should be able to recognize names and characteristics of approximately 200 different types of ever green or deciduous plants as the course covers a wide range of horticulture information.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL342	Arid Landscape Architecture Design Studio			4 CH
Prerequisites	Urban and Landscape Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	175		Equivalent ECTS	7
Course Content				
This course aims to introduce the concepts of architectural & Landscape design in hot arid environments and the way a building form and structure moderates the climate for human comfort. The course addresses both passive and mechanical methods (and the combination of both) to achieve human comfort in arid environments. However, the emphasis understands both established and innovative approaches to passive design methods in hot arid environments.				
Used in Program / Level				
Program Name or requirement			Study Level 2	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		20%	20%

UPL343	Landscape Working Design (1): Landscape Detailed Working Documents			3 CH
Prerequisites	Working Design (2): Blow-Ups Detailing, Items Specifications and BOQs			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	100		Equivalent ECTS	4
Course Content				
In integration and continuation with previous working and construction courses, this course emphasizes profoundly on the implementation of landscape composite materials. Simultaneously, it previews the execution of urban lighting and soft-scape elements along with multiple combinations and different construction stages. It focuses also on how to implement different interfaces with other categories such as infrastructures and natural elements.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL344	Landscape for Dwellings & Public Buildings			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course aims at the students to develop their skills in creating thematic landscape in special purpose. It includes the demonstration and the analysis of different approaches of designing therapeutic gardens, children, and elderly parks that reflect their special needs. Moreover, it includes different approach of green networks and ecological corridors in cities, also it raises the sensitivity of the students to the meaning of conservation and the designs of buffer zones and to ensure biodiversity. The course ends by a design landscape project chosen to match the contemporary era and the special requirements. Student applies all theories gained through the course on his project to be presented as professional primary project output and working drawings of landscape architecture.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL441	Landscape Working Design (2): Landscape Execution Documents Complexity	3 CH
Prerequisites	Building (3): Landscape Construction Landscape Working Design (1): Landscape Detailed Working Documents	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
1	4	0

Required SWL	125	Equivalent ECTS	5

Course Content

In integration and continuation with previous working and construction courses, students should produce and implement, by the end of this course, execution drawings which are in reference to an "*avant-projet*" including inner and outdoor spaces combining natural / man-made landscape elements. The drawings production will probably be with the help of different computer software. Students will develop especial skills in the implementation of architectural and landscape details and materials in coordination with other engineering specialties (electro-mechanical, irrigation, sewage systems, etc.).

Used in Program / Level	
Program Name or requirement	Study Level
Landscape Architecture Program	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

UPL442	Ecological Landscape	3 CH
Prerequisites		

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	0

Required SWL	125	Equivalent ECTS	5

Course Content

The course introduces the principles of ecological landscape. It focuses on integrating the landscapes with ecological systems. It aims to integrate key ecological concepts and their application to the design and management of sustainable landscapes. It covers biogeography and plant selection, assembling plant communities, competition and coexistence, designing ecosystems, materials cycling and soil ecology, plant-animal interactions, biodiversity and stability, disturbance and succession, landscape ecology, and global change towards producing integrated sustainable solutions. The course includes the theoretical and historical backgrounds of landscape studies, site analysis, plant materials and landscape elements.

Used in Program / Level	
Program Name or requirement	Study Level
Landscape Architecture Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

E7.5 Housing

UPL251	Residential Complex Design Studio		4 CH
Prerequisites	Creativity and Design Studio Multi Story Accommodation Building Design Studio		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	8	0	
Required SWL	200	Equivalent ECTS	8
Course Content			
This studio aims at developing a residential complex project or (Clustering) with a cultural, recreational, or themed buildings of a complex program with different functions, circulation and construction systems. Site limitations and context and the application of specified codes would be taken into consideration. Examples of selected projects would be residential complex, accommodation complex, hotels, dorms and hostels … etc.			
Used in Program / Level			
Program Name or requirement	Study Level		
Housing and Urban Development Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	10%	10%	20%

UPL351	Housing Studies		3 CH
Prerequisites	History and Theory of Urbanism		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
This course aims at the students to Understand the Housing market and needs: demand and supply issues, housing provision system, its components and relevant actors. Housing problems, housing typology in terms of types and levels. Assessment of housing and services needs for a neighborhood. Fundamentals of land parceling, with application in real project. Movement network, roads hierarchy, and parking areas. Application of theoretical studies in a project dealing with urban, social, and economic surveys for an existing area. Analysis and diagnosis of alternative solutions to housing projects.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Program	3		
Environmental Architecture and Urbanism Program	2		
Landscape Architecture Program	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

UPL352	Neighborhood Planning & Design Studio			4 CH
Prerequisites	In-Situ Development Design Studio			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		8		0
Required SWL	200		Equivalent ECTS	8
Course Content				
This course aims at the students to design of a residential neighborhood situated in a new cities. The student would consider community needs, and the quality of life with the application of all principles, knowledge and skills obtained through precedent courses to create a livable and sustainable neighborhood. Students will design the neighborhood trough a different ranges of scales from planning till the architecture design of the typical residential units through different high-tech components and environmental treatments of the buildings through architectural design strategies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Oral Jury	Final Exam
60%	0%		20%	20%

UPL353	Housing Policies and Programs			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
The course aims at the students to introduce the housing problems and policies abroad and in Egypt. It highlights the roles of the agencies and the pillars contribution in formulating the housing policies and urban strategies in different cities and their managements. It introduces economic business models and marketing policies for housing projects. Through practical cases study the students will be able to investigate problems and potentials, and then to make needed analysis of partners and stakeholders and formulate the convenient programs, action plan, and log-framework.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL451	Housing Studies and Real Estate Development			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				

This course aims at the students to offer a better understanding of how the real estate market works and how to implement their knowledge in a business setting. Factors affecting the investment in real estate concerning location, opportunities of funding, organizing laws and legislations as well as protection for both the investor and the consumer are included. The course includes the assessment of housing strata and service's needs and land surveying and parceling, with application in real project. Application of theoretical studies in a project dealing with urban, social, and economic surveys for an existing area. Analysis and diagnosis of alternative solutions to area according to real-estate and housing studies.

Used in Program / Level	
Program Name or requirement	Study Level
Architectural Engineering Program Elective	4
Housing and Urban Development Program	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

E7.6 Environmental Studies

UPL161	Environmental Studies & Passive Energy Systems			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
The course addresses the environmental issues in order to raise the students' sensitivity to meaning of sustainability. The course introduces the objectives of neutral carbon emission and saving energy and includes the appropriate consideration in designing urban spaces and buildings to ensure the passive cooling and natural ventilation. Beginning with the basics of human thermal comfort, followed by the concept and practice of solar heating, passive cooling, daylighting, indoor air quality. Students will learn how to shape the form of a building and its surroundings to respond to climate and the needs of its occupants' thermal comfort.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL361	Outdoor Noise Propagation in Built Environment			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
This course will explore the range of discourses and practices that seek to understand sound's relationship to social experience, from an anthropological perspective. It will discuss theoretical and discursive component of sound's role in society. It will focus on the different ways in which humans perceive sound, as a socially constructed phenomenon, and design sonic experiences. The course will also discuss sound-studies theory and practice, explorations of historical audio technologies, imaginative recreations of ancient and early-modern soundscapes. In addition, it will feature a series of practice-based exercises whose outcome is to produce a sonic ethnography.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0 %	40%	

UPL461	Contemporary Environmental Issues			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course introduces the contemporary environmental issues and challenges (pollution, environmental degradation, desertification, erosion, climate change) - Environment as an important factor in the planning process - Conflicts leading to ignoring the environmental factor in planning (political and economic factors) - Development alternatives, resources, input, output, renewable energy, green infrastructure - The concept and aims of sustainable development, types: strong sustainability, weak sustainability. The concept of sustainable development (aims and types) - Natural protectorates (definition, planning process of the surrounding areas).				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL462	Urban Ecology and Environmental Studies			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
This course identifies the relationship between human kind and the natural environment - New trends in environmental architecture and urban Planning - Green aspects that will lower costs - Development of new urban areas in the era of low consumption of energy – New and Renewable Energy – Causes of Pollution, its components and means of mitigation –Rationalizing the consumption of electricity and water – Development of Industrial areas from environmental perspective –Eco-lodge and eco-tourism- Sustainability and its concepts and types, physical and biological systems – Means of transportation from environmental perspective – Solid waste management –Design and planning of universities from an environmental perspective.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL463	Environmental Impact Assessment			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
This course is designed to qualify students to gain insight into the origin and evolution of the Environmental Impact Assessment (EIA) process. Students will explore key aspects of the EIA process and review selected methodologies designed to identify potential impacts of development project activities on the surrounded environment. They will get acquainted to the relationship between planning and EIA process and its implementation in Egypt. Furthermore, they will be introduced to related concepts such as, Strategic Environmental Assessment (SEA) and the contribution of EIA and SEA to sustainable development.				
Used in Program / Level				
Program Name or requirement		Study Level		
Architectural Engineering Program Elective		4		
Housing and Urban Development Program Elective		4		
Environmental Architecture and Urbanism Program		4		
Landscape Architecture Program Elective		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

UPL464	Environmental Planning			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
This course focuses on the examination of the fundamental concepts and issues related to urban environment that planners face. It focuses on land use and open space planning, planning and use of urban resources, interactions of urban residents and the physical environment, and the role of government in formulating appropriate policies and strategies.				
Used in Program / Level				
Program Name or requirement		Study Level		
Environmental Architecture and Urbanism Program Elective		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

E7.7 Sociology and Urban Economy

UPL271	Society and Housing Economics					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
1		2			0	
Required SWL	100		Equivalent ECTS		4	
Course Content						
This course explores the definitions, concepts & main targets of feasibility studies; Economic models for cities and economic trends governing allocating of activities and uses, supply and demand and their effects on urbanization and on the society. Appling feasibility studies techniques in urban projects. It addresses pre-investment, preliminary and final feasibility studies for urban projects. The course outlines different investment opportunities and their costs and factors affecting real estate appraisal. The course outlines different cost and revenues items in different project stages, cost benefit analysis, financial structure of projects, cash flow tables and balance between the execution time table and the financial structure of the urban project.						
Used in Program / Level						
Program Name or requirement				Study Level		
Housing and Urban Development Program				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
40%	20%		0%		40%	

UPL371	Human Behavior & the Built Environment					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
1		2			0	
Required SWL	100		Equivalent ECTS		4	
Course Content						
This introductory course in human behavior is designed to teach students about why people act and communicate the way they do. The course addresses the four most prevalent types of motivation, which include the influence of other people, the environment, psychological factors and individual personalities. Students learn the real-life examples of human behavior that illustrate each of these points. Having endowed on the mutual relationship between the built environment and human behavior, the course objective is to provide an in-depth understanding, addressing, analyzing and diagnosis of this relationship. It will then continue with several advanced topics in the field.						
Used in Program / Level						
Program Name or requirement				Study Level		
Architectural Engineering Program Elective				3		
Landscape Architecture Program Elective				3		
Environmental Architecture and Urbanism Program Elective				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
40%	20%		0%		40%	

UPL372	Equity and Urban Justice			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course introduces the principles of social equity and urban justice in urban planning and housing strategies. The course studies the reflection of these principles on housing provision systems, resources distribution and spatial planning, and investigates causes for segregation and inequality in planning. The course also illustrates the impact of lack of social equity on urban problems and built-environment deprivation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Housing and Urban Development Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL471	Urban Economics			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course explores the definitions, concepts of feasibility studies; Economic models for cities and economic trends governing allocating of activities and uses – Market of goods and services. It aims at the students to apply feasibility studies techniques in urban projects. It addresses pre-investment, preliminary and final feasibility studies for urban projects. The course outlines different cost and revenues items in different project stages, cost benefit analysis, financial structure of projects, cash flow tables and balance between the execution time table and the financial structure of the urban project.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Program			4	
Landscape Architecture Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

UPL472	People and Environment				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
A study of the design of the natural world and the impact of humans on the environment. It also includes a study of the environmental problems created by the technology. Topics include basic ecology, the population explosion, energy and pollution. Students learn to understand the natural processes, the importance of these processes for mankind and to develop approaches for sustainable development. This will be achieved by understanding the fundamental environmental principles and being able to explain the dependency and importance for man. Principles of ecosystem structures, energy flow and elements cycles. Natural resources, Population and Development. Renewable energy. Pollution control and prevention: air pollution, global warming, the depletion of the ozone layer and water pollution. Hazardous substances. Solid waste and recycling.					
Used in Program / Level					
Program Name or requirement				Study Level	
Environmental Architecture and Urbanism Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

UPL473	Urban Sociology and Human Settlements				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
The course aims at the student to Introduce the sociological principles linking the built environment, human behavior and culture concepts. In addition, the course includes a theoretical and analytical approaches of diverse urban communities and their relationship with users of the city, their behavioral patterns, cultural aspects, ethnic backgrounds, and socio-spatial urban change that reflect environmental, cultural and historical aspects of the city, and their impact on the formation of society, behavioral patterns of different social groups. The course offers field research and comparative analytical study.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

E7.8 Urban Informatics

UPL381	Introduction to Geographic Information Systems		2 CH
Prerequisites	Digital Presentation of The Built Environment		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
The course aims at the students to introduce creation and edition of spatial data - Coordination systems and spatial projection - Spatial Data processing - Spatial descriptive statistics - Basic concepts in spatial data analysis - Multiple Criteria Evaluation for Planning & spatial decisions - Theoretical and technical aspects of modeling spatial data – Introduction to remote sensing - Basic satellite image processing tasks - Concepts and tools for representing data in large urban areas - Basic spatial regression models - Practical applications of GIS for urban planners.			
Used in Program / Level			
Program Name or requirement	Study Level		
Architectural Engineering Program Elective	3		
Housing and Urban Development Program Elective	3		
Environmental Architecture and Urbanism Program Elective	3		
Landscape Architecture Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	40%	0%

UPL481	Urban Informatics		3 CH
Prerequisites	(Computing in Engineering) Digital Presentation of The Built Environment		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
This course aims at the students to use information tools to improve urban concentration and decisions. It includes Spatial Data processing - Spatial descriptive statistics - Basic concepts in spatial data analysis - Multiple Criteria Evaluation for Planning & spatial decisions - Theoretical and technical aspects of modeling spatial data – Introduction to remote sensing - Basic satellite image processing tasks - Concepts and tools for representing data in large urban areas - Basic spatial regression models – Through Research Survey , the students will Design of the questionnaire and survey - Data management, analysis and report writing - Statistical tools and their application to survey research - Demographic analysis and population projections methods using statistics computer applications.			
Used in Program / Level			
Program Name or requirement	Study Level 4		
Architectural Engineering Program	4		
Housing and Urban Development Program	3		
Landscape Architecture Program	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	0%	40%	0%

UPL482	Introduction to Geo Design		3 CH

<table>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Computing in Engineering
Digital Presentation of The Built Environment</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">1</td><td colspan="4">4</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">This course introduces: Foundations of geo-design, the science of location-based information to improve human interaction with the functioning of the Earth, Decision/Design support methods, Scenario Analysis, Planning Support Systems, Application of city parametric planning concepts, planning protocols and spatial analysis skills to a complex planning or design problem.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Architectural Engineering Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="8">Housing and Urban Development Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">40%</td><td colspan="3">20%</td><td colspan="3">40%</td><td colspan="3">0%</td></tr>
</table>

E7.9 Graduation Projects

UPL491	Urban Design Graduation Project (1)					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
1		2			0	
Required SWL	100		Equivalent ECTS		4	
Course Content						
The students will have to develop a project at an urban – medium -scale based on a real subject chosen by the coordinator. Analysis of collected data regarding the proposed site. Analysis and discussion of similar projects and preparing a technical report concerning the environmental analysis of the site, comparative study with similar projects. The final report leads to the final architectural program of the project.						
Used in Program / Level						
Program Name or requirement				Study Level		
Architectural Engineering Program				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Report Presentation		Final Exam	
40%	20%		40%		0%	

UPL492	Urban Design Graduation Project (2)					6 CH
Prerequisites	Mega Projects-Urban Design Studio, Urban Design Graduation Project (1)					
Number of weekly Contact Hours						
Lecture		Tutorial			Laboratory	
0		12			0	
Required SWL	425		Equivalent ECTS		17	
Course Content						
The student will build on the technical report presented by him regarding studies and program of graduation project. He is supposed to make use of all the skills, the fundamentals, and the technical information he gained during his study. The student will utilize all this background information in his designs. He should prove through his work and at oral exam, his complete understanding of the elements of the project and his capability to apply them in his future career.						
Used in Program / Level						
Program Name or requirement				Study Level		
Architectural Engineering Program				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
60%	0%		40%		0%	

UPL493	Urban Planning Graduation Project (1)				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		2		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
The students will have to develop a project at an urban – town or city sector -scale based on a real subject chosen by the coordinator. Analysis of collected data regarding the proposed site. Analysis and discussion of similar projects and preparing a technical report concerning the environmental analysis of the site, comparative study with similar projects. The final report leads to the final architectural program of the project.					
Used in Program / Level					
Program Name or requirement				Study Level	
Architectural Engineering Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		40%	0%	

UPL494	Urban Planning Graduation Project (2)				6 CH
Prerequisites	Strategic Action Planning Studio, Urban Planning Graduation Project (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		12		0	
Required SWL	425		Equivalent ECTS	17	
Course Content					
The student will build on the technical report presented by him regarding studies and program of graduation project. He is supposed to make use of all the skills, the fundamentals, and the technical information he gained during his study. The student will utilize all this background information in his plans and designs. He should prove through his work and at oral exam, his complete understanding of the elements of the project and his capability to apply them in his future career.					
Used in Program / Level					
Program Name or requirement				Study Level	
Housing and Urban Development Program				Level 4 - Compulsory	
Assessment Criteria					
Student Activities	Mid-Term Exam		Oral Jury	Final Exam	
60%	0%		40%	0%	

<table>
<tr><td>UPL495</td><td colspan="4">Landscape Architecture Graduation Project (1)</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">This course aims at developing a Landscape Architecture project at an urban scale based on a real subject chosen by the coordinator. The students should apply all skills and knowledge to create the convenient and creative projects through studying and analyzing similar projects – setting the Program of the project components– Analyzing surrounded urbanization and its impact on the project – Putting evaluation criteria – Reviewing all data and tools required for the project and compiling all the outcomes in a report and a presentation.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Landscape Architecture Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Report Presentation</td><td colspan="2">Final Exam</td></tr>
<tr><td>40%</td><td>20%</td><td colspan="2">40%</td><td colspan="2">0%</td></tr>
</table>

<table>
<tr><td>UPL496</td><td colspan="4">Landscape Architecture Graduation Project (2)</td><td>6 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Mega Projects-Urban Design Studio, Landscape Architecture Graduation Project (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">0</td><td colspan="2">12</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">425</td><td>Equivalent ECTS</td><td colspan="2">17</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">This course considers the second phase of the outcome of this program. This course allows students to focus on architectural, urban and landscape design for their projects in addition to some details and special treatments and thematic studies. Students should update and finalize their reports (from the previous course of graduation) including the analysis, methodology, design considerations and concept. The jury and defense will examine the ability to the student to apply his skills and accumulative knowledge to produce an innovative project suitable to its context.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Landscape Architecture Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Oral Jury</td><td colspan="2">Final Exam</td></tr>
<tr><td>60%</td><td>0%</td><td colspan="2">40%</td><td colspan="2">0%</td></tr>
</table>

UPL497	Housing & Urban Development Graduation Project (1)		2 CH
Prerequisites	Land Management and Land Subdivision, Neighborhood Planning & Design Studio		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
This course aims at the students to apply all skills and knowledge to create the convenient housing projects complying with the National Development Plans – Study and analyzing similar projects. Benefiting from the application of science and the principles of planning and systems, the student is required to analyses the situation, set the suitable strategic approach on the planning level and it's the objectives, extract needed actions and its requisites On the urban level, the student starts the Urban Program of the project components and Conceptual zoning–based on the Study surrounded urbanization and its impact on the project –- Project preparation with all its elements, analytical studies, report and perspectives -.			
Used in Program / Level			
Program Name or requirement		Study Level	
Housing and Urban Development Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Report Presentation	Final Exam
40%	20%	40%	0%

UPL498	Housing & Urban Development Graduation Project (2)		6 CH
Prerequisites	Smart Housing Design Studio, Housing & Urban Development Graduation Project (1)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
0	12	0	
Required SWL	425	Equivalent ECTS	17
Course Content			
This course considers the second phase of the outcome of this program. This course allows Students to elaborate his project within one of three tracks: the first track: is to focus on urban design and landscape architecture of the housing projects through urban and architecture scales focusing on the innovation and creation values. The second tracks: is to focus on the real estate development and the business models and marketing process of the project. While the third tack will focus on the mass housing production, its operation, economics and social impacts, as well as it demonstrates values in the innovation of the methods of construction, materials, phasing, operations and sustainable parameters. In addition, the project accompanied by a report (from the previous course of graduation) including the analysis, methodology, design considerations and concept. The jury and defense will examine the ability to the student to apply his skills and accumulative knowledge to produce an innovative project suitable to its context.			
Used in Program / Level			
Program Name or requirement		Study Level	
Housing and Urban Development Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Oral Jury	Final Exam
60%	0%	40%	0%

E8. Courses offered by Electrical Power and MachinesEngineering Department (EPM)

The Electrical Power and Machines Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Electrical Engineering courses as an Electrical Discipline Requirement.
2. Basic Electrical Engineering course as a Mechanical Discipline Requirement.
3. Electrical Power and Machines Engineering Program.
4. Energy and Renewable Energy Engineering Program.
5. Mechatronics Engineering Program
6. Mechatronics Engineering and Automation Program

Table 56 List of specializations at the Electrical Power and Machines Engineering Department.

#	Specialization
1	General Electrical Engineering
2	Electric Machines
3	Electric Power Systems
4	High Voltage Engineering
5	Power Electronics
6	Protection Engineering

The following abbreviations are the legend for the courses table.

Lvl Level
CH Credit Hour
ECTS European Credit Transfer System
SWL Student Work Load
Lec Lectures
Tut Tutorials
Lab Laboratory
TT Total

UR University Requirement
FR Faculty Requirement
DR Discipline Requirement
PR Program Requirement

SA Student Activities
MT Mid-Term Exam
PE Practical Exam
FE Final Exam

Table 57 List of EPM courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. General Electrical Engineering																				
1	1	111	Electrical Circuits (1)	4	7	175	3	2	1	6			x		10	20	10	60	PHM022	
2		112	Electromagnetic Fields	3	5	125	3	1	0	4			x		20	20	0	60	PHM013	PHM022
3		113	Electrical Measurements	3	5	125	2	2	1	5			x		10	20	10	60	EPM111	
4		114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5				x	20	20	20	40	PHM022	
5		115	Fundamentals of Electromagnetic Fields	3	6	150	2	2	0	4				x	35	25	0	40	PHM013	PHM022
6		116	Electrical Circuits and Machines	3	5	125	3	1	1	5			x		10	20	10	60	PHM022	
7		117	Energy Resources and Renewable Energy	3	5	125	2	2	0	4				x	35	25	0	40		
8		118	Electrical and Electronic Circuits	3	6	150	2	2	1	5				x	20	20	20	40	PHM022	
9	2	211	Properties of Electrical Materials	3	4	100	2	1	1	4		x			10	20	10	60	EPM112	
10		212	Electrical Circuits (2)	3	6	150	2	2	1	5			x		10	20	10	60	EPM111	
11		213	Energy and Renewable Energy	3	6	150	3	1	1	5			x		10	20	10	60	EPM112	
12		214	Electrical Systems Simulation	3	6	150	2	2	1	5			x		10	20	10	60	EPM212	
13	3	311	Fundamentals of Photovoltaic	3	6	150	2	2	0	4				x	35	25	0	40	EPM151	
14	4	411	Project Management for Electrical Engineering	2	4	100	2	1	0	3		x			20	20	0	60		
15		412	Microprocessor-Based Automated Systems	3	6	150	2	2	1	5				x	20	20	20	40	EPM114	EPM354
16		413	Energy Management Essentials	3	6	150	2	2	0	4				x	35	25	0	40	EPM113	
2. Electrical Machines																				
17	2	221	Electrical Machines (1)	3	5	125	3	1	1	5				x	20	20	20	40	EPM114	EPM115
18		222	Electrical Machines (2)	3	6	150	3	1	1	5				x	20	20	20	40	EPM221	
19	3	321	Transformer and DC Machines	3	6	150	2	2	1	5				x	10	20	10	60	EPM112	EPM212
20		322	Alternating Current Machines	3	6	150	2	2	1	5				x	10	20	10	60	EPM321	
21	4	421	Special Machines	2	5	125	2	1	0	3				x	20	20	0	60	EPM322	
22		422	Industrial Automation Systems	3	5	125	2	2	0	4				x	20	20	0	60	EPM322	CSE331
23		423	Generating Power Stations	2	5	125	2	1	0	3				x	20	20	0	60	EPM322	MEP214

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
3. Electrical Power Systems																				
24	2	231	Electrical Power Engineering	3	5	125	3	1	1	5				x	20	20	20	40	EPM115	
25		232	Automatic Control Systems	3	6	150	2	2	0	4				x	35	25	0	40	PHM113	
26	3	331	Electrical Transmission Systems	3	5	125	2	2	0	4				x	20	20	0	60	EPM212	
27		332	Power System Analysis	3	6	150	3	1	1	5				x	10	20	10	60	EPM331	
28		333	Electrical Distribution Systems	3	5	125	2	2	0	4				x	20	20	0	60	EPM111	
29		334	Economics of Generation, Transmission & Operation	3	5	125	2	2	0	4				x	35	25	0	40	EPM117	EPM231
30		335	Fundamentals of Power System Analysis	3	6	150	2	2	0	4				x	35	25	0	40	EPM222	EPM231
31		336	Electrical Distribution Systems Installations	3	5	125	2	2	0	4				x	35	25	0	40	EPM114	
32	4	431	Operation and control of Power Systems	3	6	150	2	2	1	5				x	10	20	10	60	EPM213	EPM332
33		432	Electrical Installations and Energy Utilization	3	6	150	2	2	1	5				x	10	20	10	60	EPM333	
34		433	Power Systems Stability	2	5	125	2	1	0	3				x	20	20	0	60	EPM332	
35		434	Planning of Electrical Networks	3	5	125	2	2	0	4				x	20	20	0	60	EPM332	
36		435	Advanced Control on Power Systems	3	6	150	2	2	0	4				x	35	25	0	40	EPM231	EPM232
37		436	Computer Application in Electrical Power Systems	3	6	150	2	2	0	4				x	35	25	0	40	EPM231	
4. High Voltage Engineering																				
38	3	341	High Voltage Engineering	3	6	150	2	2	1	5				x	10	20	10	60	EPM112	
39		342	Switchgear Engineering and Substations	3	5	125	2	2	0	4				x	20	20	0	60	EPM341	
5. Power Electronics																				
40	1	151	Industrial Electronics	3	5	125	2	2	0	4				x	35	25	0	40		
41	2	251	PowerElectronics for Energy Applications (1)	3	5	125	2	2	1	5				x	20	20	20	40	EPM151	
42	3	351	Power Electronics (1)	3	6	150	2	2	1	5				x	10	20	10	60	PHM122	ECE211
43		352	Power Electronics (2)	3	6	150	2	2	1	5				x	10	20	10	60	EPM351	
44		353	Power Electronics and Motor Drives	3	5	125	3	1	1	5				x	10	20	10	60	EPM223	
45		354	PowerElectronics for Energy Applications (2)	3	5	125	2	2	1	5				x	20	20	20	40	EPM251	
46	4	451	Electrical Drives Systems	3	5	125	2	2	1	5				x	10	20	10	60	EPM322	EPM352
47		452	Advanced Applications in Power Electronics	2	5	125	2	1	0	3				x	20	20	0	60	EPM352	
48		453	Power Quality	2	5	125	2	1	0	3				x	20	20	0	60	EPM352	
49		454	Renewable Energy Resources Interfacing	3	6	150	3	1	0	4				x	35	25	0	40	EPM232	EPM354
50		455	Electric Drives	3	6	150	2	2	0	4				x	35	25	0	40	EPM222	EPM354
51		456	Power Quality for Energy Applications	3	6	150	2	2	0	4				x	35	25	0	40	EPM231	EPM354

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
6. Protection Engineering																				
52	4	461	Protection Engineering	3	5	125	2	2	1	5				x	10	20	10	60	EPM332	EPM342
53		462	Advanced Protection in power systems	2	5	125	2	1	0	3				x	20	20	0	60	EPM461	
54		463	Power System Protection	4	7	175	3	2	0	4				x	35	25	0	40	EPM231	
9. Graduation Projects																				
55	4	491	Electrical Power & Machines Graduation Project (1)	3	5	125	1	4	0	5				x	50	0	0	50		
56		492	Electrical Power & Machines Graduation Project (2)	3	5	125	1	4	0	5				x	50	0	0	50	EPM491	
57		493	Energy Graduation Project (1)	3	6	150	1	4	0	5				x	60	0	0	40		
58		494	Energy Graduation Project (2)	3	6	150	1	4	0	5				x	60	0	0	40	EPM493	

E8.1 General Electrical Engineering Courses

EPM111	Electrical Circuits (1)				4 CH
Prerequisites	Electricity & Magnetism				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		2		1	
Required SWL	175		Equivalent ECTS	7	
Course Content					
Electrical Circuits variables and elements, Simple resistive circuits, Analysis of electrical circuits, ohm's law, Kirchhoff's laws, series parallel equivalent, star delta transformation, source transformation, Network theorems: Mesh current method, Nodal voltage method, Thevinin's equivalent, Norton's equivalent, superposition principles. Sinusoidal steady state analysis, Phasor diagram representation, Applications of network theorems on alternating current circuits, Electric power in alternating current circuits, complex power calculations, power factor, circuits with nonlinear resistances, Transients in electrical circuits.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				1	
Electronics and Communication Engineering Program				1	
Computer and Systems Engineering Program				1	
Assessment Criteria					
Student Activities	Mid Term Exam		Practical Exam	Final Exam	
10%	20%		10%	60%	

EPM112	Electromagnetic Fields				3 CH
Prerequisites	Mathematics (2), Electricity & Magnetism				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Vector Analysis, Coulomb's law, Electrical field intensity, Electric flux, Gauss' law, Divergence, Electric energy and potential, Electric Conductors, Electrical resistance, Dielectric material, Electric Capacitance, Electric field plotting, Poisson's equation, Laplace's equation, Steady magnetic fields, Ampere's law, Magnetic Forces, Magnetic Materials, Magnetic Circuits, Inductance, Time varying magnetic fields, Maxwell's equations, Measurement of electromagnetic fields, hazards of electromagnetic fields, Shielding of electromagnetic fields.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				1	
Electronics and Communication Engineering Program				1	
Computer and Systems Engineering Program				1	
Assessment Criteria					
Student Activities	Mid Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

EPM113	Electrical Measurements			3 CH
Prerequisites	Electrical Circuits (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	125		Equivalent ECTS	5
Course Content				
Measurement errors, Accuracy, Statistical analysis, Static Calibration, Resolution and Precision, Dynamic Response, Moving coil instruments, Moving iron instruments, Electro-dynamic instruments, Induction type instruments, Current and voltage measurement instruments, Measurement of power, Measurement of energy and charge, Measurement of frequency and power factor, Measurement of nonelectrical parameters, Cathode Ray Oscilloscope (CRO) applications, DC bridges, AC bridges, Resistance and capacitance measurements, Allocation of cable faults, Strain gauges, temperature transducers, Displacement, velocity and acceleration transducers, Force and pressure transducers, Light transducers, Data converters, Voltage to frequency converters, Digital measurement devices: Digital AVO meters, Digital frequency meters				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			1	
Electronics and Communication Engineering Program			1	
Computer and Systems Engineering Program			1	
Energy and Renewable Energy Program			1	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM114	Fundamentals of Electrical Circuits			3 CH
Prerequisites	Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150		Equivalent ECTS	6
Course Content				
Electrical circuit variables and elements, Simple resistive circuits, Analysis of electrical circuits, Source transformation, Network theorems, Star-delta transformation, Sinusoidal steady state analysis, Phasor diagram representation, Application of network theorems on alternating current circuits, Electric power in alternating current circuits, Complex power calculations, Power factor, Circuits with nonlinear resistance. Transients in electrical circuits, Poly-phase circuits, Magnetically coupled circuits, Mutual inductance, Resonance in electrical circuits, Electric filters, Analysis of electrical circuits with non-sinusoidal alternating currents.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			1	
Communication Systems Engineering			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

EPM115	Fundamentals of Electromagnetic Fields			3 CH
Prerequisites	Mathematics (2), Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Vector analysis, Coulomb's law, Electric field intensity, Electric flux, Gauss's law, Divergence, Electric energy and potential, Electric conductors, Electrical resistance, Dielectric materials, Electrical capacitance, Poisson's equation, Laplace's equation. Steady magnetic fields, Ampere's law, Magnetic forces, Magnetic materials, Magnetic circuits, Inductance. Time varying magnetic fields, Maxwell's equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM116	Electrical Circuits and Machines			4 CH
Prerequisites	Electricity & Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Electrical Circuits: Constants and variables of electrical Circuits, elements of electrical circuits, DC circuits, Network theorems, Sinusoidal alternating current circuits at steady state, Phasor diagram representation of sinusoidal quantities, Applications of network theorems on alternating current circuits, Electric power in alternating current circuits, complex power calculations, power factor. Three phase Circuits and systems, Magnetic circuits, Transformers, DC Machines, Synchronous machines, Induction machines.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM117	Energy Resources and Renewable Energy			3 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS		5
Course Content				
Identifying all energy resources: thermal, chemical, nuclear, kinetic, gravitational field,magnetic field, electric field. Rank and classification of different energies.Regenerative energy resources: solar, wind, biomass, wave energy, geothermal.Possible energy conversions. Cautionary and safety measures and introduction toenvironmental issues.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

EPM118	Electrical and Electronic Circuits			3 CH
Prerequisites	Electricity & Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150	Equivalent ECTS		6
Course Content				
Electrical Circuits: Constants and variables of electrical Circuits, elements of electrical circuits, DC circuits, Network theorems, Sinusoidal alternating current circuits at steady state, Phasor diagram representation of sinusoidal quantities, Applications of network theorems on alternating current circuits, Electric power in alternating current circuits, complex power calculations, power factor. Electronic Circuits: Diodes and Zener models, diode applications: clamping, voltage doupler, clipping, rectification. Op-amp model, op-amp applications: Inverting, non-inverting, buffer, summing, filters, Schmitt trigger, oscillators.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

EPM211	Properties of Electrical Materials			2 CH
Prerequisites	Electromagnetic Fields			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Conducting Materials: Structure of conducting materials, Conductivity in solid materials, Synthesize of alloys, Mechanical characteristics of conducting materials. Insulating Material: Ceramic and polymers, Electrical and mechanical characteristics, PVC and XLPE insulation materials in cables. Magnetic Materials: B-H curve for different magnetic materials, magnetic losses, reduction of losses, Ferro-resonance. Materials used in batteries: Primary batteries, secondary batteries. Silicon semiconductors industries: Metallurgical grade silicon, Electronic grade silicon.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			2	
Electronics and Communication Engineering Program			2	
Computer and Systems Engineering Program			2	
Communication Systems Engineering Program			1	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM212	Electrical Circuits (2)			3 CH
Prerequisites	Electrical Circuits (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Poly phase Circuits, Magnetically coupled circuits, Mutual inductance, Resonance in electrical circuits, Electric filters, Two port network, Locus of phasor diagrams at different frequency, Analysis of electrical circuits with non-sinusoidal alternating current, Higher harmonics and Fourier series.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering			2	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM213	Energy and Renewable Energy			3 CH
Prerequisites	Electromagnetic Fields			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Identifying all energy resources: thermal, chemical, nuclear, kinetic, gravitational field, magnetic field, electric field.Rank and classification of different energies, Conventional methods of energy conversion: Electromechanical energy conversion, Faraday’s law, Lorenz forces, The basic electric generator, The basic electric motor, Magnetically single excited systems, Magnetically multi-excited systems, Dynamic energy conversion equations, conservative fields, coupled magnetic fields, Torque and stored energy in magnetic fields, Co-energy and torque calculations, The reluctance machine, Multi-fed rotating systems, Electrostatic Systems. Renewable energy resources: hydro energy, Solar energy, Wind energy.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			2	
Electronics and Communication Engineering Program			2	
Computer and Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM214	Electrical Systems Simulation			3 CH
Prerequisites	Electrical Circuits (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Mathematical algorithms used in electrical circuits analysis, Numerical analysis methods, programming and simulation of different mathematical algorithms and numerical methods, simulation of simple renewable energy systems design, simulation of real electrical systems in residential and industrial applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			2	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM311	Fundamentals of Photovoltaic			3 CH
Prerequisites	Industrial Electronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Principles of solar cell operation, structure, electrical and optical characteristics, equivalent circuit, Crystalline silicon solar cells, Thin film technologies for PV, Energy production by a PV array, Energy balance in stand-alone PV systems, Standards, calibration and testing of PV modules and solar cells, PV system monitoring.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM411	Project Management for Electrical Engineering			3 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Definitions used in project management, The project life cycle, project stages,relationships and responsibilities of the different project parties, execution phaseresponsibilities, productivity, quality management, Time management, material delivery management, sequencing and scheduling.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Electronics and Communication Engineering Program			4	
Computer and Systems Engineering Program			4	
Communication Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

<table>
<tr><td>EPM412</td><td colspan="5">Microprocessor-Based Automated Systems</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Fundamentals of Electrical Circuits, Power Electronics for Energy Applications (2)</td></tr>
<tr><td colspan="7">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="3">2</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td colspan="2">150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td colspan="7">Numbering systems and Data representations. Basic principles of microprocessors and microcontrollers. Instruction set and microcontroller programming. Microcontroller peripherals: Digital I/O ports, Interrupts, Timer, EEPROM, Analogue ports. Signal conditioning circuits and Interfacing circuits with external devices such as seven segments, switches, and relays. Applications such as look up tables, alarming system, Pulse Width Modulation (PWM), speed control, temperature control.</td></tr>
<tr><td colspan="7">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="5">Energy and Renewable Energy Engineering</td><td colspan="2"></td></tr>
<tr><td colspan="7">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">20%</td><td>60%</td></tr>
</table>

<table>
<tr><td>EPM413</td><td colspan="5">Energy Management Essentials</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Electrical Measurements</td></tr>
<tr><td colspan="7">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="3">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td colspan="7">Energy efficiency and electricity, Energy Efficiency standards and practical considerations Diagnostics through electrical measurement, Selecting relevant measuring instruments, Energy saving opportunities, Motor-related savings opportunities, Lighting, Power factor correction and harmonic filtering, Load management and smart panels, Introduction to building management systems, Evaluating energy savings, Achieving sustainable performance.</td></tr>
<tr><td colspan="7">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="5">Energy and Renewable Energy Engineering</td><td colspan="2"></td></tr>
<tr><td colspan="7">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td colspan="2">35%</td><td colspan="2">25%</td><td colspan="2">0%</td><td>40%</td></tr>
</table>

E8.2 Electrical Machines Courses

EPM221	Electrical Machines (1)			3 CH
Prerequisites	Fundamentals of Electrical Circuits, Fundamentals of Electromagnetic Fields			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Principle of energy conversion: Electromechanical energy conversion, magnetically single excited systems, magnetically multi-excited systems, Torque and stored energy in magnetic fields, Multi-fed rotating systems. DC Machines: the generation of EMF torque, construction of DC machine, the magnetic circuit of the dc machine, armature windings, armature reaction, methods of excitation, load characteristics of dc generators and motors, efficiency, testing of dc machines. Transformers: transformer construction, fundamental laws, equivalent circuits, transformer efficiency, transformer testing, transformer connections and harmonics, auto transformers and tap changers, parallel operation, transformer cooling.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

EPM222	Electrical Machines (2)			3 CH
Prerequisites	Electrical Machines (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Fundamental of rotating AC machines: Construction of rotating machines, rotating fields of single and three phase machines, electromotive force and torque equation of the AC machines. Synchronous machines: construction, fundamental laws, cylindrical rotor machines, basic tests, salient pole machines, synchronous motors, power formulae, stability and damper bars, synchronization of machines, transient performance. Permanent Magnet Synchronous Generators (PMSG) and Switched Reluctance Machine (SRM). Induction machines: construction of different types of induction machine, concept of rotating and pulsating fields, principles of operation of three phase induction motor based on linear magnetic circuit, torque, slip characteristics, conditions and methods of starting of three phase induction motor (double cage and deep bar rotors), speed control of three phase induction motor, induction generator, testing of three phase induction motor.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

<table>
<tr><td>EPM321</td><td colspan="4">Transformer and DC machines</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical Circuits (2), Electromagnetic Fields</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">DC Machines: the generation of EMF torque, construction of DC machine, the magnetic circuit of the dc machine, armature windings, armature reaction, methods of excitation, load characteristics of dc generators and motors, efficiency, testing of dc machines. Transformers: transformer construction, fundamental laws, equivalent circuits, transformer efficiency, transformer testing, transformer connections and harmonics, auto transformers and tap changers, parallel operation, transformer cooling.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Electrical Power and Machines Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>10%</td><td>20%</td><td colspan="2">10%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>EPM322</td><td colspan="4">Alternating current Machines</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Transformers and DC Machines</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>150</td><td colspan="2">Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Fundamental of rotating AC machines: Construction of rotating machines, rotating fields of single and three phase machines, electromotive force and torque equation of the AC machines. Synchronous machines: construction, fundamental laws, cylindrical rotor machines, basic tests, salient pole machines, synchronous motors, power formulae, stability and damper bars, synchronization of machines, transient performance. Permanent Magnet Synchronous Generators (PMSG) and Switched Reluctance Machine (SRM). Induction machines: construction of different types of induction machine, concept of rotating and pulsating fields, principles of operation of three phase induction motor based on linear magnetic circuit, torque, slip characteristics, conditions and methods of starting of three phase induction motor (double cage and deep bar rotors), speed control of three phase induction motor, induction generator, testing of three phase induction motor.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Electrical Power and Machines Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>10%</td><td>20%</td><td colspan="2">10%</td><td colspan="2">60%</td></tr>
</table>

EPM421	Special Machines			2 CH
Prerequisites	Alternating Current Machines			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Two-phase induction motor. Single phase induction motor. Starting of single phase induction motor. Single-phase commutator series motor. Energy convention in doubly salient machines. Three-phase conventional reluctance machines. Salient pole synchronous reluctance machine. Stepper motor operation principles. Permanent magnet stepper motor. Variable reluctance stepper motors. Switched reluctance motors. Linear induction motors. Induction generators. Permanent magnet DC motor. Brushless DC motors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

EPM422	Industrial Automation Systems			3 CH
Prerequisites	Alternating Current Machines, Control Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to industrial automation: mechanization versus automation, advantages of automation, application of automation, types of automation, automation system structure. Programmable Logic Controllers (PLC): introduction, hardwired ladder diagram, PLC programming and hardware fundamentals, programming logic functions, timers, counters, sequential machines, arithmetic functions, special functions. Supervisory control and data acquisition: introduction, fundamental principles, hardware and software, modern applications of SCADA systems. Distributed Control Systems (DCS): introduction, fundamental principles, modern applications of DCS.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

<table>
<tr><td colspan="2">EPM423</td><td colspan="8">Generating Power Stations</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Alternating Current Machines, Thermal Power Engineering</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">World electricity demand and generation. Fuels. Environmental impacts.
Thermodynamic principles. Fuels. Steam power generation cycles. Hydro-plant construction, Types of hydro-turbines
Gas turbine engines and performance. Gas turbine cycles. Combined-cycle power plants.
Diesel engines. Fuels. Emission control. Heat recovery systems.
Basic nuclear physical processes (fission and fusion). Nuclear fuels. Types of reactors. Safety considerations in the nuclear industry. Developments in nuclear fusion. Decommissioning problems of nuclear sites. Nuclear waste disposal systems.
CHP schemes (micro-scale CHP systems, small scale CHP systems, large scale CHP systems including district heating schemes). Application of CHP systems for the provision of heating, cooling and electric power. Selection criteria of CHP prime-movers. Integration of CHP systems into site services. Feasibility analysis of CHP schemes using spreadsheets/software tools. Case study (site appraisal for CHP scheme and evaluation of economic and environmental viability).</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Electrical Power and Machines Engineering Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="3">60%</td></tr>
</table>

E8.3 Electrical Power Systems Courses

EPM231	Electrical Power Engineering			3 CH
Prerequisites	Fundamentals of Electromagnetic Fields			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to electric power system, application of high voltage in electric power system, overhead transmission lines: parameter calculation, modeling, performance, and mechanical design, electric power distribution, underground cables, Determination of faults in underground cables, design of electrical distribution systems, insulated electrical cables, generation of high-voltage, high-voltage measurement, electric insulation types, corona, earthing and safety, Introduction to power system planning				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

EPM232	Automatic Control Systems			3 CH
Prerequisites	Differential and Partial Differential Equations			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Introduction to control systems: terms, concepts and examples, frequency and time-domain analysis, block diagram, representations of control system, feedback and its effects, disturbance and sensitivity analysis, steady-state error analysis, time domain analysis, stability analysis, root locus analysis, Tuning of PID controller, state space representation. Applications in electric power systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

EPM331	Electrical Transmission Systems				3 CH
Prerequisites	Electrical Circuits (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Power system components and system structure, Parameters and modeling of transmission lines, Bus admittance matrix, surge impedance, wave propagation, transmission capacity, Reactive power management, Mechanical design of transmission lines.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
20%	20%		0%		60%

EPM332	Power System Analysis (1)				3 CH
Prerequisites	Electrical Transmission Systems				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL		150	Equivalent ECTS		6
Course Content					
Per unit systems, Symmetrical Components theory, Short circuit current characteristics, Symmetrical and unsymmetrical shunt and series faults, Power flow studies and analysis, P-δ curve of power system, Stability study using equal area criterion, Computer programs for applications in power system analysis.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
10%	20%		10%		60%

EPM333	Electrical Distribution Systems			3 CH
Prerequisites	Electrical Circuits (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Load Curves and load characteristics, Primary distribution system configurations and design, Secondary distribution design and configurations. Power distribution in residential and public buildings, Electric Tariffs, Distribution system earthing, Voltage drop calculations, Short circuit calculations, Protection of distribution systems, Power factor corrections, Active distribution systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

EPM334	Economics of Generation, Transmission, and Operation			3 CH
Prerequisites	Energy Resources and Renewable Energy, Electrical Power Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Load curves, Variation in demand, Load diversity. Power plant layout, Main equipment, Auxiliaries, Bus-bar arrangements. Power plant economics: Capital cost, Operating cost, Fixed charge rate, Selection of plant and size and unit size, Operation and economics of spinning reserve, economic analysis of a transmission system, tariffs, power factor, all-thermal generation allocation problem, hydro-thermal coordination, new energy resources. Transmission access fees assessment and calculations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM335	Fundamentals of Power System Analysis			3 CH
Prerequisites	Electrical Machines (2), Electrical Power Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Symmetrical components: Symmetrical components, Unsymmetrical faults on transmission lines. Synthesis of unsymmetrical phasor diagrams from their symmetrical components, The symmetrical components of unsymmetrical systems, Power in terms of symmetrical components, Positive, negative, and zero phase sequence networks, Unsymmetrical faults: Shunt faults, Series faults, Network matrices: Network topology, System admittance and system impedance matrices, Load flow solutions and control: Load flow equations, The Gauss-Seidal method, Newton-Raphson method and approximations, De-coupling methods, Regulating transformers. Equal Area Criterion.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM336	Electrical Distribution Systems Installations			3 CH
Prerequisites	Fundamentals of Electrical Circuits			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Primary and Secondary distribution system configurations and design. Codes and standards of electrical installations. Power distribution in residential and public buildings, Illumination technologies, Installation of electrical components, Electrical hazards, Inspection and testing, Electrical maintenance. Distribution system earthing, Voltage drop calculations, Short circuit calculations, Protection of distribution systems, LV switchgear: functions & selection, Power factor corrections, Active distribution systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering				
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM431	Operation and control of power systems			3 CH
Prerequisites	Power Systems Analysis, Energy and Renewable Energy			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Types of power plants, Modeling of economic operation for power plants (thermal and hydro), Economic dispatch in power systems, Unit commitment problem, Hydro-thermal coordination, Supervisory and control functions, Automatic load frequency Control (ALFC) in Single area and multi area systems models, Automatic Voltage Regulators (AVR) Modeling and control.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	20%	10%	60%	

EPM432	Electrical installations and Energy utilization			3 CH
Prerequisites	Electrical Distribution Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Codes and standards of electrical installations, Installation of electrical components, Electrical hazards, Inspection and testing, Electrical maintenance, Earth leakage detection, Installation planning, Electromagnetic field compatibility, Illumination technologies, Industrial heating; Conduction, Convection, Forced Convection and radiation, resistance, arc, dielectric, induction, H.F eddy current heating. Ventilation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	20%	10%	60%	

EPM433	Power Systems Stability			2 CH
Prerequisites	Power Systems Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Swing equation in power systems, Voltage vector diagram of synchronous machine, Linearized system stability model, Voltage stability of loads and power systems, Power system stabilizers, Small signal stability analysis.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

EPM434	Planning of Electrical Networks			3 CH
Prerequisites	Power Systems Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Load forecasting: Simple Models, Regression models. Generation planning, Manual and automated generation planning, Planning under uncertainty, Bulk power transmission planning, Transmission planning methodology and examples, Renewable energy sources planning: Solar energy, Wind energy, Tidal energy, geothermal energy. Energy Management: Supply side management, Demand side management. Reliability Studies: Generation system reliability evaluation, Distribution system reliability evaluation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

EPM435	Advanced Control on Power Systems			3 CH
Prerequisites	Electrical Power Engineering, Automatic Control Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Power system control objectives, variables and domains. Modeling of power system for the purpose of controlling the voltage and frequency. Frequency control of power systems. Voltage control of power systems for single area and multi-area systems. Power system stabilizer.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

EPM436	Computer Application in Electrical Power Systems			3 CH
Prerequisites	Electrical Power Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Introduction: Power system matrices, Input and transfer matrices, Admittance matrices of the bus bars, Impedance matrices, Circuits representation, Programming, Large system simulation and programming, Power flow studies concepts and methods, Approximate and fast methods, Separation methods, Distribution factors, Transfer methods, Optimal performance, Generation control, Error analysis, simulation of power system components, Application of some computer packages.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E8.4 High Voltage Engineering Courses

EPM341	High Voltage Engineering			3 CH
Prerequisites	Electromagnetic Fields			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Application of High voltages, Advantages and limitations of using high voltages for transmission, Generation and measurement of high AC voltage and high DC voltage for testing, Generation of impulse waves, The impulse generators, Specifications, precautions and equipment of high voltage laboratories, Insulators for transmission lines and substations: Insulator materials, shapes and types, factors affecting performance of insulators, testing of insulators (destructive and non-destructive insulation tests), Electrical breakdown in gases: ionization and attachment coefficients, electro-negative gases, Electrical breakdown in liquids and solids. Corona discharge, Underground cables: single and three-core cables, electrical stresses in cables, high voltage equivalent circuits, high voltage cables, thermal properties of cables, Earthing systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	20%	10%	60%	

EPM342	Switchgear Engineering and Substations			3 CH
Prerequisites	High Voltage Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Switchgear equipment, Main switchgear schemes, Circuit Interrupters: Fuses: Types and Applications, Circuit breakers: Types (Air, Air-blast, Oil, SF6 and Vacuum), Construction, Performance and ratings, Interruption of fault currents and arcs in circuit breakers. Switching transients and their control. Functions of substation. Voltage levels in HVAC & HVDC substations. Types and essential features of substations. Substation equipment, Substation layout, Busbar schemes, Busbar materials and ratings, Busbar clamp & connectors, Substation structure, Insulators & surge arresters. Protective systems in substations. Clearances & creepage distance, power line carrier. Substation earthing system. Special requirement of EHVAC & HVDC substations, Testing and commissioning at site, Protection, monitoring & control by microprocessors & computers.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

E8.5 Power Electronics Courses

EPM151	Industrial Electronics			3 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
PN Junctions: construction and operation, I-V equation, biasing, circuit applications. Bipolar Junction Transistor (BJT): construction and operation, Types, I-V characteristics. Metal Oxide Semiconductor Field Effect Transistors (MOSFETs): construction and operation, I-V characteristics, biasing techniques. Logic gates using CMOS. FET applications: MOSFET as a resistance, MOSFET as a constant current source. Operational Amplifiers (OP-AMPs): difference amplifier, OP-AMP specifications, frequency characteristics. OP-AMP applications: adder, subtracter, integrator, differentiator, electronic analogue computation, I to V and V to I converters, comparators, Schmitt trigger, OP-AMP oscillators. Sensors and transducers. Digital to Analog Converters (DACs) and Analog to Digital Converters (ADCs).				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM251	Power Electronics for Energy Applications (1)			3 CH
Prerequisites	Industrial Electronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to power electronics, Power electronics devices: power diodes, thyristors, power transistors, Characteristics, Firing circuits and gate requirements, rectifier circuits, Line frequency converters: single-phase and three-phase circuits. Static switches. AC voltage controllers: The single-phase AC thyristor controller, three-phase controller, Phase control of ac controllers, Integral cycle control.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

EPM351	Power Electronics (1)				3 CH
Prerequisites	Semiconductors & Dielectrics, Electronics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Introduction to power electronics, power electronic devices, driving circuits, devices cooling systems, Parallel and series operations, protection circuits, Transients analysis of Single-phase rectifier circuits, Single-phase half wave, full wave converter, Connections Of three phase Rectifiers, Effect of source impedance on 2-3 pulse and multi pulse performance of rectifiers.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
10%	20%		10%	60%	

EPM352	Power Electronics (2)				3 CH
Prerequisites	Power Electronics(1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Ac Voltage regulators, ac static switches, Dc to Dc Converter: buck, boost, buck-boost, Cuk dc/dc converters. Inverter single phase half-bridge and full-bridge, 3phase-bridge inverters, PWM modulation techniques. Application on UPS.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Power and Machines Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
10%	20%		10%	60%	

EPM353	Power Electronics and Motor Drives		3 CH
Prerequisites	Electrical Circuits and Machines		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction to power electronics devices, Single phase Rectifier circuits, three phase rectifier circuits, Ac Voltage controllers, Ac static switches, Dc to Dc Converter: buck, boost, buck-boost converters. Single phase Inverters, 3phase-bridge inverters, PWM modulation techniques. DC motor Drives: soft starting, speed control, Electric braking. AC Drives: voltage control, v/f control, rotor circuit control of induction motors, stepper motor drives.			
Used in Program / Level			
Program Name or requirement	Study Level		
Mechanical Power Engineering Program	3		
Mechatronics Engineering Program	3		
Mechatronics Engineering and Automation Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
10%	20%	10%	60%

EPM354	Power Electronics for Energy Applications (2)		3 CH
Prerequisites	Power Electronics for Energy Applications (1)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
DC choppers: buck, boost, buck-boost, Cuk DC/DC converters. DC/AC converters (Inverters): Single phase circuits, three-phase inverter, modulation techniques. PWM rectifiers (Active rectifiers), Inverter and rectifier mode of operations of converters. Cyclo-converters and Matrix converters.			
Used in Program / Level			
Program Name or requirement	Study Level		
Energy and Renewable Energy Engineering	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

EPM451	Electrical Drives Systems			3 CH
Prerequisites	Alternating Current Machines, Power Electronics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction, mechanical equation of motion, characteristics of mechanical loads and electrical motors, quadrant operations, criteria for selecting drive components, adjustable speed DC drives, Industrial examples, electric traction examples, induction motor drives, slip energy recovery, induction motor, variable frequency AC motor drives, brushless three-phase induction motor drives. Synchronous motor drives, load commutated synchronous motor drives, stepper motor drives, computer controlled drives.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM452	Advanced Applications in Power Electronics			2 CH
Prerequisites	Power Electronics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Switched mode power supplies, Voltage source converters, Interfacing of power electronics and Utility; HVDC Transmission, SVC and renewable energy, Application of resonance converters, New materials for power semiconductor devices.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

EPM453	Power Quality			2 CH
Prerequisites	Power Electronics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Definitions and standards, PQ problems: voltage spikes, sags, swells, voltage fluctuations, voltage unbalance, harmonic distortion, power outages, brownouts, blackouts, frequency variations, electric noise, Causes and solutions to PQ problems, Surge suppressors, snubbers, shielding, active & passive filters, conditioners and UPS, Series & shunt compensations and applications on FACTS, Instantaneous real & imaginary power theory and applications on conditioning. PQ analyzers, parameters analyzed. PQ monitoring and management.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

EPM454	Renewable Energy Resources Interfacing			3 CH
Prerequisites	Electrical Machines (2), Power Electronics for Energy Applications (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
3		1	0	
Required SWL	150		Equivalent ECTS	6
Course Content				
Storage technologies: Supper Capacitors: structure, ratings, characteristics, use with the wind power plant, fuel cells, Superconducting magnetic energy storage (SMES): structure, operation, Batteries: types, characteristics and operation, charge and discharge, Flywheels energy storage. Interface technologies: Concept of Distributed Generation, Type of interface, Interconnection standards, static synchronous generators, control of active power and voltage regulation, Wind turbines and photovoltaic interface topologies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

EPM455	Electric Drives			3 CH
Prerequisites	Electrical Machines (2), Power Electronics for Energy Applications (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Criteria for selecting drive components, DC motor drives, regenerative braking and four quadrant operation, Induction motor drives, slip power recovery, Doubly Fed Induction Motor drive (DFIM), synchronous motor drives, Permanent Magnet Synchronous Machine drive (PMSM): motor and generator applications, Stepper motor drives.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering				
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

EPM456	Power Quality for Energy Applications			3 CH
Prerequisites	Electrical Power Engineering, Power Electronics for Energy Applications (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Analysis and characterization of electric Power Quality: Power Outage, Harmonics, Unbalance, Distortion, Voltage Sag, and Flicker. Standards of power quality and grid interconnection. Shunt and series compensation of various power quality events. Design of passive power filters. Instantaneous real and imaginary power theory and its application into custom power devices. Active filters: types, operation and control. Instantaneous real & imaginary power theory and applications on conditioning. PQ analyzers, parameters analyzed. PQ monitoring and management.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering				
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E8.6 Protection Engineering Courses

EPM461	Protection Engineering			3 CH
Prerequisites	Power Systems Analysis, Switchgear Engineering and Substations			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Protection relaying philosophy and fundamental considerations (zones of protection, primary and backup protection), Effects of short-circuits on power systems, Basic elements of trip circuit, Current and potential transformers. Hardware organization in integrated protection systems, Classification of protective relays, principle of operation and construction: Electromechanical relays, Static relays, Digital relays. Types of protection systems: Overcurrent protection, Distance protection, Differential protection, Reverse power protection. Item protection: Protection of generators, Protection of transformers, Protection of ring main systems, Protection of transmission lines, Protection of bus-bars, Protection coordination.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
10%	20%		10%	60%

EPM462	Advanced Protection in Power Systems			2 CH
Prerequisites	Protection Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to digital protection, basic elements of digital relay, Signal identification, Implementation of digital relays, communication protocols in power systems protection, Wide area measurement, monitoring and control applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

EPM463	Power System Protection			4 CH
Prerequisites	Electrical Power Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	175		Equivalent ECTS	7
Course Content				
Protection Engineering: Introduction, Effects of Short-circuits on power systems. Basic elements of protection gear, Current and potential transformers, Protective relays, Electromechanical and static relays. Switchgear engineering: Circuit breakers, Types, Construction, Performance and ratings. Different types of electromechanical relays, Types of protection in electrical power systems, Differential protection of power systems, Protection of ring main systems, Protection of parallel feeders. Protection relaying philosophy and fundamental considerations. Transmission line protection, Compensating distance relaying. Rotating machinery protection: Relay protection for AC generators, Loss of field relay protection, Power transformer protection, Relay input sources.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E8.9 Graduation Projects

EPM491	Electrical Power and Machines Graduation Project (1)			3 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The student deals with the analysis and design of a complete engineering system using the fundamentals, principles and skills he/she gained during his study. The project report presented by the student should include the details of the analysis and design satisfying the concerned electrical code requirements, The computer applications as well as the experimental work when necessary, in addition to the technical engineering drawing of his design. Throughout the project report and at the oral exam, the student should prove his complete understanding of the elements of the project and his capability to apply them in his future engineering career.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

EPM492	Electrical Power and Machines Graduation Project (2)			3 CH
Prerequisites	Electrical Power and Machines Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	125		Equivalent ECTS	5
Course Content				
The student deals with the analysis and design of a complete engineering system using the fundamentals, principles and skills he/she gained during his study. The project report presented by the student should include the details of the analysis and design satisfying the concerned electrical code requirements, The computer applications as well as the experimental work when necessary, in addition to the technical engineering drawing of his design. Throughout the project report and at the oral exam, the student should prove his complete understanding of the elements of the project and his capability to apply them in his future engineering career.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Power and Machines Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

EPM493	Energy Graduation Project (1)			3 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	150		Equivalent ECTS	6
Course Content				
The student deals with the analysis and design of a complete engineering system using the fundamentals, principles and skills he gained during his study. The project report presented by the student should include the details of the analysis and design satisfying the concerned code requirements. The computer applications as well as the experimental work when necessary, in addition to the technical engineering drawing of his design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

EPM494	Energy Graduation Project (2)			3 CH
Prerequisites	Energy Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	150		Equivalent ECTS	6
Course Content				
A single or group project performed under the supervision of a faculty member and an industrial entity. The student deals with the analysis and design of a complete engineering system as a continuation to Energy Graduation Project (1) obtained results. The final project document should include all results from both Graduation Projects courses. Throughout the project report and at the oral exam, the student should prove his complete understanding of the elements of the project and his capability to apply them in his future engineering career.				
Used in Program / Level				
Program Name or requirement			Study Level	
Energy and Renewable Energy Engineering			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

E9. Courses offered by Electronics and Communication Engineering Department (ECE)

The Electronics and Communications Department is responsible for teaching courses that serve the following programs:

1. Several Basic Electrical Engineering courses as an Electrical Discipline Requirement.
2. Basic Electrical Engineering course as a Mechanical Discipline Requirement.
3. Electronics and Communication Engineering Program
4. Communication Systems Engineering Program

Table 58 List of specializations at the Electronics and Communications Engineering Department.

#	Specialization
1	Electronics
3	Microwave and Photonics
5	Communications
9	Graduation Projects

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 59 List of ECE courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Electronics																				
1	1	111	Electronic Materials	3	5	125	3	1	0	4				x	20	20	0	60	PHM022	
2	2	211	Electronics	3	5	125	3	1	1	5			x		30	20	10	40	PHM122	
3		212	Digital Circuits	3	6	150	2	2	0	4			x		20	20	0	60	CSE111	
4		213	Solid State Electronic Devices	3	7	175	2	2	0	4				x	20	20	0	60	PHM123	ECE111
5		214	Electronic Circuits (1)	4	7	175	3	2	2	7				x	30	20	10	40	ECE213	EPM114
6		215	Introduction to Electronics	2	4	100	2	1	1	4			x		20	20	0	60	PHM022	
7	3	311	Advanced Semiconductor Devices	2	4	100	2	1	0	3				x	20	20	0	60	ECE211	
8		312	Analog Circuits (1)	3	5	125	2	2	1	5				x	30	20	10	40	ECE211	
9		313	Analog Circuits (2)	3	6	150	2	2	1	5				x	30	20	10	40	ECE312	
10		314	VLSI Design	3	6	150	2	2	1	5				x	30	20	10	40	ECE212	
11		315	Electronic Circuits (2)	3	5	125	2	2	0	4				x	20	20	0	60	ECE214	
12		316	Digital Circuit Design	3	7	175	2	2	0	4				x	20	20	0	60	CSE111	ECE214
13		317	Modern VLSI Devices	3	5	125	2	2	0	4				x	40	20	0	40	ECE213	PHM121
14		318	Electronic Measurements and Instrumentation	3	5	125	2	2	2	6				x	30	20	10	40	ECE315	
15	4	411	Integrated Circuits Technology	3	5	125	2	2	0	4				x	40	20	0	40	ECE311	/ECE317/
16		412	Analog Integrated Circuit Design	3	5	125	2	2	0	4				x	40	20	0	40	ECE313	/ECE315/
17		413	ASIC Design and Automation	3	5	125	2	2	0	4				x	40	20	0	40	ECE314	/ECE316/
18		414	RF Circuit Design	3	5	125	2	2	0	4				x	40	20	0	40	ECE412	
19		415	Electronic Instrumentation	3	5	125	2	2	0	4				x	40	20	0	40	ECE313	
20		416	MEMS Design	3	5	125	2	2	0	4				x	40	20	0	40	ECE411	
21		417	Low Power Digital Design	3	5	125	2	2	0	4				x	40	20	0	40	ECE314	
22		418	Selected Topics in Electronics	3	5	125	2	2	0	4				x	40	20	0	40		
23		419	Selected Topics in Circuits and Systems	3	5	125	2	2	0	4				x	40	20	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
3. Waves and Photonics																				
24	1	131	Electrostatics and Magnetostatics	3	5	125	2	2	0	4				x	20	20	0	60	PHM013	PHM022
25	3	331	Electromagnetic Waves	3	6	150	2	2	1	5				x	30	20	10	40	PHM212 /PHM213/	EPM112 /ECE131/
26		332	Waveguides	3	6	150	2	2	1	5				x	30	20	10	40	PHM212	ECE331
27		333	Microwave Engineering	4	6	150	3	2	2	7				x	30	20	10	40	ECE331	
28		334	Optical Fiber Communications	4	5	125	3	2	0	5				x	20	20	0	60	ECE254	ECE333
29		335	Microwave Measurements	3	5	125	2	2	2	6				x	30	20	10	40	ECE333	
30		336	Integrated Optics and Optical MEMS	3	5	125	2	2	0	4				x	40	20	0	40	ECE331	
31		337	Microwave Circuits	3	5	125	2	2	0	4				x	40	20	0	40	ECE333	
32		338	Optical Sensing and Instrumentation	3	5	125	2	2	2	6				x	30	20	10	40	ECE334	
33	4	431	Optoelectronics	3	5	125	2	2	1	5				x	30	20	10	40	ECE311	ECE332
34		432	Antenna Engineering and propagation	2	4	100	2	1	0	3				x	20	20	0	60	ECE332	/ECE333/
35		433	Microwave Circuits and Systems	3	6	150	2	2	1	5				x	30	20	10	40	ECE332	
36		434	Optical Communication Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE332	ECE351
37		435	Fundamentals of Photonics	3	5	125	2	2	0	4				x	40	20	0	40	ECE431	
38		436	Micro Photonic Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE431	
39		437	Selected Topics in Electromagnetics	3	5	125	2	2	0	4				x	40	20	0	40	ECE332	
40		438	Microwave Devices	3	5	125	2	2	0	4				x	40	20	0	40	ECE337	
41		439	Optoelectronic Devices	3	5	125	2	2	0	4				x	40	20	0	40	ECE213	ECE334
42		440	RF and Microwave Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE438	
43		441	Selected Topics in Physical and Wave Electronics	3	5	125	2	2	0	4				x	40	20	0	40		

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
5. Communication Engineering																				
44		251	Signals and Systems Fundamentals	4	6	150	3	2	0	5			x		20	20	0	60	PHM111	PHM113
45		252	Fundamentals of Communication Systems	3	6	150	2	2	0	4			x		20	20	0	60	ECE251	
46	2	253	Signals and Systems	4	8	200	3	2	2	7				x	30	20	10	40	PHM111	PHM213
47		254	Analog Communications	3	5	125	2	2	1	5				x	30	20	10	40	ECE253	
48		255	Digital Signal Processing	3	6	150	2	2	2	6				x	30	20	10	40	ECE253	
49		351	Analog and Digital Communication Systems	3	5	125	2	2	0	4				x	20	20	0	60	ECE252	
50		352	Telecommunication Networks	3	5	125	2	2	0	4			x		20	20	0	60	ECE252	
51		353	Wireless Communication Networks	3	6	150	2	2	1	5				x	30	20	10	40	ECE351	
52		354	Digital Communications	3	6	150	2	2	1	5				x	30	20	10	40	ECE254	
53	3	355	Communication Networks (1)	3	6	150	2	2	0	4				x	20	20	0	60	ECE254	
54		356	Electro-Acoustical Engineering	3	5	125	2	2	0	4				x	40	20	0	40	ECE333	
55		357	Statistical Signal Processing	3	5	125	2	2	2	6				x	30	20	10	40	ECE255	
56		358	Wireless Communications	3	5	125	2	2	0	4				x	40	20	0	40	ECE354	
57		359	Signal Processing for Multimedia	3	5	125	2	2	2	6				x	30	20	10	40	ECE255	
58		451	Digital Signal Processing Basics	2	4	100	2	1	1	4				x	30	20	10	40	ECE251	
59		452	Information Theory and Coding	3	5	125	2	2	0	4				x	40	20	0	40	ECE351	/ECE354/
60		453	Modern Communication Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE351	
61		454	Satellite Communication Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE351	/ECE432/
62		455	Selected Topics in Communication Systems	3	5	125	2	2	0	4				x	40	20	0	40	ECE351	
63	4	456	Selected Topics in Signal Processing	3	5	125	2	2	0	4				x	40	20	0	40	ECE451	
64		457	Selected Topics in Telecommunication Networks	3	5	125	2	2	0	4				x	40	20	0	40	ECE352	
65		458	Communication Networks (2)	3	7	175	2	2	0	4				x	20	20	0	60	ECE355	
66		459	Mobile Communications	3	5	125	2	2	0	4				x	40	20	0	40	ECE354	ECE432
67		460	Machine Learning for Multimedia	3	5	125	2	2	0	4				x	40	20	0	40	ECE359	
68		461	Selected Topics in Signals & Communication Sys.	3	5	125	2	2	0	4				x	40	20	0	40		
9. Graduation Project																				
69	4	491	Graduation Project (1)	3	7	175	1	0	6	7				x	60	0	0	40		
70		492	Graduation Project (2)	3	8	200	1	0	6	7				x	60	0	0	40	ECE491	

E9.1 Electronics

ECE111	Electronic Materials					3 CH
Prerequisites	Electricity and Magnetism					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
3		1		0		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Crystals, Bonding, Basic elements of material science, electronic conduction in metals, electron in a periodic potential, energy bands and energy gaps in solids, Semiconductors, the Fermi level, electrons and holes, Intrinsic and extrinsic semiconductors, n-type and p-type, Diffusion and Drift Current, Excess carriers in semiconductors, Optical generation and recombination, the continuity equation, non homogenous doping, PN-junction: I-V characteristics, Reverse saturation current depletion layer capacitance, Diffusion capacitance, Zener diodes.						
Used in Program / Level						
Program Name or requirement				Study Level		
Communication Systems Engineering Program				1		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
20%		20%		0%		60%

ECE211	Electronics					3 CH
Prerequisites	Physics of Semiconductors and Dielectrics					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
3		1		1		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Diode models. Diode applications and special-purpose diodes. BJT operation and models. MOSFET operation and models. Single-stage amplifiers. Operational amplifiers and their applications. Integrated circuit timers. Digital-to-analog and analog-to-digital conversion. Experiments in the field of analog electronics to support the theoretical contents of the course.						
Used in Program / Level						
Program Name or requirement				Study Level		
Electrical Engineering Requirement				2		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
30%		20%		10%		40%

ECE212	Digital Circuits			3 CH
Prerequisites	Logic Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150	Equivalent ECTS	6	
Course Content				
MOSFET Transistor. The MOSFET as a switch. CMOS Inverter. Logic circuit characterization (Noise Margins, Propagation delay, Power dissipation). CMOS combinational circuits (Static design, logical effort, Pass transistors and transmission gates, Dynamic design). CMOS sequential circuits (Latches and Flip-Flops, synchronous design, timing constraints). Experiments in the field of digital circuits to support the theoretical contents of the course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			2	
Computer and Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE213	Solid State Electronic Devices			3 CH
Prerequisites	Thermal and Statistical Physics, Electronic Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	175	Equivalent ECTS	7	
Course Content				
Semiconductors Review, Theory of junctions and interfaces: p-n and metal-semiconductor junctions, Oxide-semiconductor and heterojunction interfaces, Principles of bipolar transistor operation, Field effect devices: MESFET and MOSFET, Downscaling principles and Submicron devices, Light Emitting Diodes (LED), Laser Diode (LD), Power devices, Device simulators.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE214	Electronic Circuits (1)			4 CH
Prerequisites	Solid State Electronic Devices, Fundamentals of Electrical Circuits			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	175	Equivalent ECTS	7	
Course Content				
Introduction to electronic circuits. Review of physics and operation of diodes and bipolar and MOS transistors. Diode Applications. Small signal models of semiconductor transistors (BJT and MOSFET models). DC biasing circuits. Analysis and design of single-stage and multi-stages amplifiers. Frequency response of amplifiers. Operational amplifier circuits. Introduction to active filters.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE215	Introduction to Electronics			2 CH
Prerequisites	Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100	Equivalent ECTS	4	
Course Content				
Diode and Zener models, diode applications: clamping, voltage doupler, clipping, rectification. Opamp model, opamp applications: Inverting, non-inverting, buffer, summing, filters, Schmitt trigger, oscillators. Analog and Digital signals. A/D and D/A converters.				
Used in Program / Level				
Program Name or requirement			Study Level	
Mechanical Engineering Requirement			2	
Manufacturing Engineering Program			2	
Mechatronics Engineering and Automation Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE311	Advanced Semiconductor Devices						2 CH
Prerequisites	Electronics						
Number of weekly Contact Hours							
Lecture		Tutorial			Laboratory		
2		1			0		
Required SWL		100		Equivalent ECTS		4	
Course Content							
Semiconductors review, Theory of junctions and interfaces: p-n and metal-semiconductor junctions, Oxide-semiconductor and heterojunction interfaces, Principles of bipolar transistor operation, Field effect devices: MESFET and MOSFET, Downscaling principles and Submicron devices, TFET transistors, SOI transistors, Vertical Transistors: FinFET and Surround gate FET.							
Used in Program / Level							
Program Name or requirement					Study Level		
Electronics and Communication Engineering Program					3		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
20%		20%		0%		60%	

ECE312	Analog circuits (1)						3 CH
Prerequisites	Electronics						
Number of weekly Contact Hours							
Lecture		Tutorial			Laboratory		
2		2			1		
Required SWL		125		Equivalent ECTS		5	
Course Content							
Analysis and design of single-stage and multi-stage amplifiers. Frequency response of amplifiers. Differential amplifiers. Current mirrors. Filters. Introduction to feedback. Experiments in the field of analog circuits to support the theoretical contents of the course.							
Used in Program / Level							
Program Name or requirement					Study Level		
Electronics and Communication Engineering Program					3		
Assessment Criteria							
Student Activities		Mid-Term Exam		Practical Exam		Final Exam	
30%		20%		10%		40%	

ECE313	Analog Circuits (2)			3 CH
Prerequisites	Analog Circuits (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Feedback and its properties. Feedback topologies (series-shunt, series-series, shunt-series, shunt-shunt). Feedback circuits. Stability issues and frequency compensation. Oscillators and Voltage Controlled Oscillators. Power Amplifiers. Experiments in the field of analog circuits to support the theoretical contents of the course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE314	VLSI Design			3 CH
Prerequisites	Digital Circuits			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
CMOS Fabrication. CMOS scaling. IC Layout. Interconnect Capacitance and Resistance. Clock and power distribution. Datapath building blocks (Shifters, Adders, Multipliers). Semiconductor Memories. IC variability and reliability. Introduction to Input/Outputs. IC design methods. IC design economics. VHDL and FPGA design. Experiments in the field of digital circuits to support the theoretical contents of the course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE315	Electronic Circuits (2)					3 CH
Prerequisites	Electronic Circuits (1)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL		125	Equivalent ECTS		5	
Course Content						
Analysis and design of differential amplifiers in bipolar and CMOS technologies. Current mirrors and active loads. Negative feedback topologies ((Series–Series), (Series–Shunt), (Shunt–Series) and (Shunt–Shunt)). Stability issues and frequency compensation. Oscillators and Voltage Controlled Oscillators. Power Amplifiers (class A, class B and class AB).						
Used in Program / Level						
Program Name or requirement				Study Level		
Communication Systems Engineering Program				3		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam	Final Exam	
20%		20%		0%	60%	

ECE316	Digital Circuit Design					3 CH
Prerequisites	Logic Design, Electronic Circuits (1)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL		175	Equivalent ECTS		7	
Course Content						
CMOS Inverter: Noise margin, Propagation delay, Power dissipation, CMOS combinational circuits: Static design, Pass transistors and transmission gates, Dynamic design, CMOS sequential circuits: Latches, Flip-flops, Counters, Monostable Ring oscillator, Random Access Memory RAM, Read Only Memory ROM, Emitter Coupled Logic ECL, Bi CMOS circuits.						
Used in Program / Level						
Program Name or requirement				Study Level		
Communication Systems Engineering Program				3		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam	Final Exam	
20%		20%		0%	60%	

ECE317	Modern VLSI Devices				3 CH
Prerequisites	Solid State Electronic Devices, Modern Physics and Quantum Mechanics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Semiconductors Review, Metal Semiconductor Contacts, MOS Capacitor, MOSFET Fundamentals, Short Channel and Nanoscale MOSFETs, High Field Effects, Partially Depleted SOI Devices, Ultra-Thin-Body Fully Depleted SOI Transistors, Multi-gate MOSFETs.					
Used in Program / Level					
Program Name or requirement				Study Level	
Communication Systems Engineering Program Elective				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

ECE318	Electronic Measurements and Instrumentation				3 CH
Prerequisites	Electronic Circuits (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		2	
Required SWL		125	Equivalent ECTS		5
Course Content					
Digital multimeter and oscilloscope, electronic measurements, static and dynamic characteristics, electromagnetic interference, signal sources and acquisition, sensors, amplifiers, noise, voltage references, analog-to-digital conversion, measurement data communication, examples and experiments.					
Used in Program / Level					
Program Name or requirement				Study Level	
Communication Systems Engineering Program Elective				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
30%	20%		10%	40%	

ECE411	Integrated Circuits Technology			3 CH
Prerequisites	Advanced Semiconductor Devices or Modern VLSI Devices			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
IC Processing, Clean Rooms and Clean Room Technology, Bulk Crystal growth, Epitaxial growth, Photolithography, Etching, Oxidation process, Diffusion process, Chemical vapour deposition CVD, Evaporation and multilayer coating, Ionic exchange process, Fabrication of passive and active components, Process integration and standard technologies, Layout design rules, Layout parasitics, Layout techniques, Interconnect modeling.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Communication Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE412	Analog Integrated Circuit Design			3 CH
Prerequisites	Analog Circuits (2) or Electronic Circuits (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Advanced current mirrors. Operational amplifiers (basic, two-stage, Miller, symmetrical, telescopic, folded, fully differential). Stability and frequency compensation. Common-mode feedback circuits. Voltage and current references. Noise. Non-linearity. Mismatches.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE413	ASIC Design and Automation				3 CH
Prerequisites	VLSI Design or Digital Circuit Design				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Fundamentals of design automation of VLSI circuits and systems, HDL languages (VHDL/Verilog), high-level design, high-level synthesis, logic synthesis and technology mapping; Design for test; Layout of complex gates, physical design, placement and routing, chip integration, physical verification.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program Elective				4	
Communication Systems Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

ECE414	RF Circuit Design				3 CH
Prerequisites	Analog Integrated Circuit Design				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Basic concepts of radio frequency circuits and systems, RF transceivers architectures, Noise and non-linearity analysis, harmonic distortion, Impedance matching and smith chart, Basic theory of different building blocks existing in RF systems and Frequency Synthesizers: Low Noise Amplifiers, Mixers, Oscillators, phase noise, RF frequency synthesis, RF Power Amplifiers (class A, class B, class C, class AB).					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program Elective				4	
Communication Systems Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

ECE415	Electronic Instrumentation			3 CH
Prerequisites	Analog Circuits (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Basic architecture. Sensor categories and characterization. Linear and nonlinear analog interface signal conditioning. Noise and interference reduction techniques and lock-in detection. Smart sensors and embedded instrumentation systems. Examples of instrumentation systems in industrial, automotive, biomedical and avionic applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE416	MEMS Design			3 CH
Prerequisites	Integrated Circuits Technology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to MEMS, Review of basic fabrication processes, example of fabrication flows, System modeling, MEMS mechanical design, damping mechanisms, Actuation methods, Sensing elements, some selected applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE417	Low Power Digital Design			3 CH
Prerequisites	VLSI Design			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Importance of low power design. Review of nanometer MOSFET models. CMOS power consumption. Energy vs power. Effect of scaling on power consumption. Energy-delay trade-off. Optimizing dynamic power at design time (multiple supplies, sizing, technology mapping). Optimizing static power at design time (sizing, multiple thresholds, stacking). Optimizing power at the architecture and system level (concurrency, pipelining, hardware accelerators). Optimizing interconnects and clock power. Optimizing power at standby (clock gating, power gating, sizing, body biasing). Optimizing power at runtime (dynamic voltage and frequency scaling, adaptive techniques). Optimizing power in memory circuits. Subthreshold circuit design. Power analysis and estimation. Using low-power techniques in standard cell flow. Unified power format (UPF). Low power verification. Futuristic low power design techniques.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE418	Selected Topics in Electronics			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Selected topics in recent directions in electronics to be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE419	Selected Topics in Circuits and Systems			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions in circuits and systems be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E9.3 Waves and Photonics

ECE131	Electrostatics and Magnetostatics			3 CH
Prerequisites	Mathematics (2), Electricity and Magnetism			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Coulomb's law, Electric field intensity, Field of point charge, line charge, surface charge, and continuous volume charge, Electric flux, Gauss's law, Divergence, Electric energy and potential, Electric conductors, Principle of images, Electrical capacitance, Dielectric materials, Dipoles, Dielectric permittivity, Poisson's equation, Laplace's equation. Steady magnetic fields, Ampere's law, Magnetic forces, Magnetic materials, Magnetic circuits, Inductance, time varying fields, Maxwell's equations, Wave equations, Propagation in free space.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE331	Electromagnetic Waves			3 CH
Prerequisites	Complex, Special Functions, and Numerical Analysis or Complex and Special Functions and Fourier Analysis, Electromagnetic Fields or Electrostatics and Magnetostatics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Maxwells equations of time varying fields, Boundary conditions, Wave propagation equation, Electromagnetic waves in dielectric and conducting media, Skin depth, Surface impedance, Polarization, Phasor notation, Reflection and refraction of plane waves at dielectric-conductor and dielectric-dielectric interface. Normal and oblique incidence, Total internal reflection, Critical angle, Brewster angle, Multiple reflections from a dielectric slab, Energy and momentum in electromagnetic fields, Poynting theorem, Power loss in conductors and dielectrics, Material dispersion, Phase and group velocities, Transmission line theory, Impedance matching, Parallel and series stub matching, Smith chart.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE332	Waveguides			3 CH
Prerequisites	Complex, Special Functions, and Numerical Analysis, Electromagnetic Waves			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Parallel-plate waveguide, Rectangular waveguide, Circular waveguide, Grounded dielectric slab, Planar transmission lines, Microstrip line, Symmetric and asymmetric dielectric slab waveguide, multilayer waveguides, Optical fibers, Plasmonic waveguides, Mode orthogonality and completeness, guided and radiation modes, mode propagation analysis, ray picture, modal picture, Goos-Haenchen shift, Transverse resonance condition, multimode dispersion and chromatic dispersion.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		10%	40%

ECE333	Microwave Engineering			4 CH
Prerequisites	Electromagnetic waves			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Guided waves between two conducting parallel plates, TE and TM waves and their characteristics, Velocities of propagation, Attenuation and quality factor, Wave impedance, Basic closed waveguides, TE and TM waves and their characteristics in rectangular wave guides, Waves solution in cylindrical coordinates, Microstrip transmission line, Attenuation and quality factor of a waveguide, Symmetric and asymmetric dielectric planar waveguide, effective index and normalized parameters, Propagation in multimode waveguide. Equivalent circuit of waveguides, N-port circuit, Circuit description, Scattering parameters, Passive devices: Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid junctions, non-reciprocal devices resonators.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		10%	40%

ECE334	Optical Fiber Communications		4 CH
Prerequisites	Analog Communications,Microwave Engineering		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
3	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Overview of optical fiber communication, Optical fibers, Ray and modal analysis, Dispersion relation of TE, TM, and hybrid modes, Weakly-guiding condition, LP modes, Modal and chromatic dispersion, Attenuation in optical fibers, Coherent and incoherent light sources, Principle of operation of FP, DFB, and DBR semiconductor laser sources, Simplified rate equations, Static, pulsed, and sinusoidal laser response, Direct and external modulation, Photon noise, Relative intensity noise, Quantum efficiency and responsivity of PIN and APD detectors, Photoelectron noise, gain noise, Optical receiver circuits noise, Signal-to-noise ratio, Receiver sensitivity, Bit-error rate, Quantum limited performance of OOK, FSK, and PSK, Optical amplifiers spontaneous emission noise, Power and rise time budgets, design of Point to point optical fiber links, Multichannel transmission systems.			
Used in Program / Level			
Program Name or requirement	Study Level		
Communication Systems Engineering Program	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

ECE335	Microwave Measurements		3 CH
Prerequisites	Microwave Engineering		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
Detection and measurement of microwave power, Impedance measurements, frequency and wavelength measurements. N-port microwave network analyzer, Calibration techniques. Measurement techniques and instrumentation for active and passive microwave components, cavity resonators, waveguides, slotted lines, directional coupler, methods for determining scattering parameters, antenna radiation pattern and grain measurement.			
Used in Program / Level			
Program Name or requirement	Study Level		
Communication Systems Engineering Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
30%	20%	10%	40%

ECE336	Integrated Optics and Optical MEMS					3 CH
Prerequisites	Electromagnetic Waves					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Symmetric and asymmetric single mode dielectric waveguide, 2D waveguide and the effective index method, propagation in Multimode guide, the Multimode interference MMI structures, Integrated optics IO splitters and directional couplers, IO filters and multiplexers, MEMS technology, Micro-mirrors and micro-lenses, Optical MEMS switches, Fiber lens, Variable optical attenuators, Multilayer filter design, Tunable MEMS filters.						
Used in Program / Level						
Program Name or requirement				Study Level		
Communication Systems Engineering Program Elective				3		
Assessment Criteria						
Student Activities		Mid-Term Exam	Practical Exam		Final Exam	
40%		20%	0%		40%	

ECE337	Microwave Circuits					3 CH
Prerequisites	Microwave Engineering					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Planar transmission lines: microstrip, slotlines, coplanar waveguide, coupled lines. Impedance matching networks, microwave filters: periodic structures, insertion loss method, Hi-Low impedance, coupled line filters. Microwave amplifiers: power gain amplifier, wide band amplifier, and low noise amplifier.						
Used in Program / Level						
Program Name or requirement				Study Level		
Communication Systems Engineering Program Elective				3		
Assessment Criteria						
Student Activities		Mid-Term Exam	Practical Exam		Final Exam	
40%		20%	0%		40%	

ECE338	Optical Sensing and Instrumentation			3 CH
Prerequisites	Optical Fiber Communications			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Geometrical optics, Lens design, Optical scanners, Interferometers, Distance measurement, Optical profilometer, Laser doppler vibrometer, Time of flight and LiDARs, Fabry-Perot cavity, Diffraction grating, Optical spectrum analyzer, Refractive index sensing, Fluorescence, IR spectroscopy, Raman spectroscopy, Spectrometers, Gas sensing, Polarization, Ellipsometry, Optical coherent imaging, Spectral imaging.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE431	Optoelectronics			3 CH
Prerequisites	Advanced Semiconductor Devices, Waveguides			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Light-matter interaction, Photons in semiconductors, 3-level and 4-level lasers, Gain coefficient, Gain saturation, Heterojunctions, Fabry-Perot resonators, Double-heterostrcuture semiconductor lasers, Single- and multiple-quantum well lasers, DFB and DBR lasers, FP and travelling wave semiconductor optical amplifiers, Erbium doped fiber amplifiers, Light emitting diodes, Laser and LED dynamics, PIN and APD photodetectors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE432	Antenna Engineering and Propagation				2 CH
Prerequisites	Waveguides or Microwave Engineering				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		100	Equivalent ECTS		4
Course Content					
Fundamentals and definitions, Dipoles array synthesis and antenna arrays, Line sources, Folded dipole antennas, Microstrip antennas, Broadband antennas: Traveling wave wire antennas, Helical antennas, Biconical antennas, Sleeve antennas, Rectangular and circular aperture antenna, Reflector antennas. Feeding networks for wire antennas, Arrays and reflectors, Antennas in communication systems, noise temperature, Atmospheric and ground effects.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program				4	
Communication Systems Engineering Program				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%			60%	

ECE433	Microwave Circuits and Systems				3 CH
Prerequisites	Waveguides				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		1	
Required SWL		150	Equivalent ECTS		6
Course Content					
Network theory, Matching networks, Resonators, Passive components, Planar filter design, Power amplifiers, High power devices, Microwave systems.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
30%	20%		10%	40%	

ECE434	Optical Communication Systems			3 CH
Prerequisites	Waveguides, Analog and Digital Communication Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
Pulse propagation in dispersive medium, Noise in Photodetectors, Noise in optical amplifiers, optical amplification in point-to-point fiber links, Signal-to-noise ratio of analogue transmission systems, High-impedance and Trans-impedance optical receivers, Bit error rate of OOK, FSK, and PSK, Quantum limit, IM-DD Direct detection, Heterodyne and Homodyne detection, Attenuation-limited and dispersion-limited performance, WDM transmission systems and networks.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE435	Fundamentals of Photonics			3 CH
Prerequisites	Optoelectronics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS	5	
Course Content				
Two-dimensional dielectric waveguides, Effective index method, Optical couplers, Optical switches, Multimode interference couplers, Index ellipsoid, Electro-Optics, Acousto-Optics, Second-harmonic generation, Phase and intensity modulators, Multiplexers/Demultiplexers, Optical routers, CAD simulation and design tools.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE436	Micro Photonic Systems				3 CH
Prerequisites	Optoelectronics				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Diffraction grating structures, Micro-optical resonators, Micro-optics technology, Optical MEMS technology, Micro-mirrors, Micro-lenses, Optical MEMS switches, Fiber lens, Variable optical attenuators, Multilayer filter design, Tunable MEMS filters.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program Elective				4	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam		Final Exam
40%		20%	0%		40%

ECE437	Selected Topics in Electromagnetics				3 CH
Prerequisites	Waveguides				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Selected topics in electromagnetics.					
Used in Program / Level					
Program Name or requirement				Study Level	
Electronics and Communication Engineering Program Elective				4	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam		Final Exam
40%		20%	0%		40%

ECE438	Microwave Devices			3 CH
Prerequisites	Microwave Circuits			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Microwave tubes: Reflex klystron, Traveling wave tube amplifiers, Backward wave oscillator, Magnetron oscillators, Gyratron, Microwave solid state devices: Schottky barrier mixer diodes, Tunnel diodes, Transferred electron devices, MESFET, HEMT, HBT, IMPATT, TRAPATT, BARITT, Varactors. Parametric devices: Manley-Rowe relations, Parametric up converters, Negative resistance parametric amplifiers, Microwave transistors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE439	Optoelectronic Devices			3 CH
Prerequisites	Solid State Electronic Devices, Optical Fiber Communications			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Interaction of radiation and atomic systems, Classical electron oscillator model, Einstein model, Rate equations, 3-level and 4-level lasers, gain saturation, Homogeneous and inhomogeneous broadening, Fabry-Perot resonators, Ring resonators, Erbium doped fiber lasers and amplifiers, Photons in semiconductors, Semiconductor gain and loss, Hetero-junctions, Double-Heterojunction lasers, Semiconductor optical amplifiers, FP- and TW-SOAs, Quantum-well lasers, Threshold current computations, Edge and surface emitting LEDs, PIN and APD detectors, Solar cells.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE440	RF and Microwave Systems			3 CH
Prerequisites	Microwave Devices			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
High power microwave sources, Solid state devices, Mixers, Frequency multiplier, microwave oscillators, Detectors, PIN diode, Schottky diodes, Hybrid and Monolithic Microwave Integrated Circuits, Microwave Systems, link budget and link margin, radio receiver architecture, noise characterization of a receiver, Radar systems, Radar Equation, pulse radar, Doppler radar, radar cross section, theory and applications of radiometer systems, microwave communication systems, Microwave heating, biological effects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE441	Selected Topics in Physical and Wave Electronics			3 CH
Prerequisites	Determined according to course contents			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions in physical and wave electronics will be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E9.5 Communication Engineering

ECE251	Signals and Systems Fundamentals			4 CH
Prerequisites	Probability and Statistics Differential equations and partial differential equations			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	2		0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Classification of signals. Basic operations on signals. Systems and their properties. Linear Time-Invariant (LTI) systems. Impulse response of LTI systems. Relation between impulse response and system properties. Convolution integral and convolution sum. Differential and difference equation representation of LTI systems. Block diagram representation of LTI systems. Continuous-time Fourier series (CTFS), continuous-time Fourier transform (CTFT), sampling theory, discrete-time Fourier series (DTFS), discrete-time Fourier transform (DTFT). Laplace transform. Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE252	Fundamentals of Communication Systems			3 CH
Prerequisites	Signal and systems fundamentals			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Basic concepts of communications. Communication system elements. Channel bandwidth. Analog modulation: AM, FM, and PM. FDM. Superheterodyne receiver. Pulse modulation: PAM, PCM, PTM. Nyquist theorem. Line coding. Eye pattern. Generative/non-regenerative repeaters, Passband digital modulation: ASK, FSK, PSK.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE253	Signals and Systems			4 CH
Prerequisites	Probability and Statistics Complex and Special Functions and Fourier Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	200		Equivalent ECTS	8
Course Content				
Continuous-time and discrete-time signals, The unit Impulse and unit step functions, Basic system properties. Linear time-invariant systems: Discrete-Time LTI systems: The convolution sum. Continuous-time LTI systems. System properties and description, Fourier series representation of periodic discrete signals, Filters described by differential equations and filters described by difference equations. The continuous-time Fourier transform (CTFT) and its properties. Discrete time Fourier transform (DTFT) and its properties.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE254	Analog Communications			3 CH
Prerequisites	Signals and Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to communication systems, Analysis of amplitude modulation, Frequency modulation, Phase modulation, Pulse modulation systems, Heterodyne Radio Transmitters and receivers, AGC and AFC, TV broadcasting system, Random Processes: Stationary process, Mean, covariance and correlation functions, Ergodic process, Transmission of Random Process through Linear time invariant filter, Power spectral Density. Noise: Gaussian process and central limit theorem, white noise, Narrow band noise.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE255	Digital Signal Processing				3 CH
Prerequisites	Signals and Systems				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		2	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Review on CTFT and DTFT. Z-transform, Region of convergence, Inverse Z-transform, Properties of Z-transform, Analysis and characterization of LTI systems using Z-transform. Discrete Fourier transform. Fast Fourier transform (FFT). Structures of digital filters. FIR filter design techniques: windowing and frequency sampling. IIR filter design techniques: S-to-Z domain transformation. Introduction to Multi-rate DSP systems, Introduction to adaptive filters.					
Used in Program / Level					
Program Name or requirement			Study Level		
Communication Systems Engineering Program			2		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
30%	20%		10%	40%	

ECE351	Analog and Digital Communication Systems				3 CH
Prerequisites	Fundamentals of Communication Systems				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to analog and digital communication systems. Random process. Noise, Noise temperature / Noise figure / Cascaded systems. Analog modulation noise performance. Digital baseband transmission and Matched filter. ISI and bit error rate. M-ary modulation, QAM, DPSK. Digital passband system noise performance. Shannon Capacity Theorem. Color TV.					
Used in Program / Level					
Program Name or requirement			Study Level		
Electronics and Communication Engineering Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

ECE352	Telecommunication Networks			3 CH
Prerequisites	Fundamentals of Communication Systems			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to telecommunication networks, network topology and architecture, LAN, WAN, circuit switching, packet switching, connection oriented and connectionless. OSI and TCP/IP reference models. Physical layer: transmission media, signal encoding, transmission/propagation delay. Telephones: PSTN, SS7, and DSL. The Data link layer; local area networks, Ethernet and frame structure. Network Layer: IP protocol, protocol header, IP address, subnetting, routing. Transport Layer: TCP, UDP. Network devices: Hub, Bridge, Switch, Router.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE353	Wireless Communication Networks			3 CH
Prerequisites	Analog and Digital Communication Systems			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Wireless channel models, multipath fading, Channel impairments, time and frequency dispersion. Propagation modeling and path loss analysis. Multiple Access Techniques on Wireless channels. Cellular communications: frequency reuse, Handover, Mobile network planning, , Diversity, Multiplexing techniques. Diversity – Multiplexing tradeoffs, 2G, 3G mobile Communication Systems. OFDM-MIMO techniques in Wireless Communications. 4G cellular system. Experiments in the field of communication to support the theoretical contents of the course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE354	Digital Communications			3 CH
Prerequisites	Analog Communications			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	1	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Sampling Process, Pulse amplitude Modulation, Quantization Process, Quantization noise, Pulse Code modulation, time division Multiplexing. Digital multiplexers, Pulse. Transmission: Line Codes, Equalizers, Filter, probability of Errors in baseband, Intersymbol Interference, Nyquist criterion for distortionless baseband transmission, Raised Cosine spectrum. M-ary Probability of error, Regenerative repeaters, Eye Pattern, Power spectrum of pulse amplitude modulation. Signal space analysis, correlation receiver. Passband data transmission, BPSK, QPSK, probability of symbol error. M-ary PSK, Hybrid Amplitude-phase modulation, Coherent Frequency shift keying, M-ary FSK, Noncoherent binary FSK. Differential phase shift Keying.				
Used in Program / Level				
Program Name or requirement		Study Level		
Communication Systems Engineering Program		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE355	Communication Networks (1)			3 CH
Prerequisites	Analog Communications			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Introduction to communication networks, network topology and architecture, LAN, WAN, circuit switching, packet switching, connection oriented and connectionless. OSI reference model and mapping to TCP/IP model. Physical layer: transmission media, signal encoding, transmission/propagation delay, E/T carrier digital hierarchy, SDH/SONET networks. Telephone networks: telephone set, PSTN, SS7, DSL, ADSL. Datalink layer: Medium access control, local area network protocols, Ethernet and its frame structures. Network devices: hubs, repeaters, bridges, switches, routers, gateways. Case studies: Broadband networks, Satellite, Mobile networks.				
Used in Program / Level				
Program Name or requirement		Study Level		
Communication Systems Engineering Program		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

ECE356	Electro-Acoustical Engineering			3 CH
Prerequisites	Microwave Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Basic information of Acoustics, Acoustic measurements and types of waves, Acoustic wave propagation in free space, Environmental noise and wave acoustics, Reverberation time, rooms and ear characteristics, Room Acoustic and sound absorption, Noise control and calibration of microphones, Acoustic transmitters and receivers, Speech analysis, Biomedical Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE357	Statistical Signal Processing			3 CH
Prerequisites	Digital Signal Processing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Discrete Random Process: Difference with Random Variable, Random Process Properties, Independent, uncorrelated, orthogonal, WSP, WS cyclo-stationary, Stationary Process, Auto-Correlation & its Properties, PSD and its Properties. Linear Algebra: Introduction to vectors and Matrices, Singularity and Non-singularity, Error bounds, Solving Linear Systems, Solving LS problems. Adaptive Filters: Wiener Filter, Steepest Descent, LMS, NLMS, Linear Prediction. Signal Estimation: Minimum Variance Unbiased Estimator, Maximum Likelihood, Bayesian Estimators, Linear Model Estimators. Introduction to detection: Signal Detection and Classification, Hypothesis, Testing, Detection of Signals in Noise.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		10%	40%

ECE358	Wireless Communications		3 CH
Prerequisites	Digital Communications		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction to radio communication, Radio frequency spectrum, Path loss, Multipath fading, Shadowing. Large scale propagation: Outdoor Propagation Models, Indoor Propagation Models. Small-scale propagation: Factors affecting the small scale fading, Impulse response model of multipath channels, Various statistical distributions for multipath channel, Parameters of multipath channels, Types of small scale fading channels. Orthogonal Frequency Division Multiplexing (OFDM) basics, Design parameters, block diagram. Multiple Input Multiple Output (MIMO): Space time block coding, Spatial multiplexing.			
Used in Program / Level			
Program Name or requirement	Study Level		
Communication Systems Engineering Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ECE359	Signal Processing for Multimedia		3 CH
Prerequisites	Digital Signal Processing		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	2	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction to multimedia. Introduction to the theory and applications of 2D signal and image processing: 2D signals and systems analysis, 2D sampling and quantization, 2D signals and image transformation, 2D filter design. Image formation. Image enhancement. Image restoration. Morphological operations. Feature extraction. Basics of digital audio. Audio and Speech Acquisition, Representation and Storage. Digital Processing of Speech. LPC and Cepstrum Analysis. Speech Parameter Estimation.			
Used in Program / Level			
Program Name or requirement	Study Level		
Communication Systems Engineering Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
30%	20%	10%	40%

ECE451	Digital Signal Processing Basics			2 CH
Prerequisites	Signals and Systems Fundamentals			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to digital signal processing, the Z-transform, the sampling theory, circular convolution, block convolution, fast Fourier transform (FFT), structures for discrete-time systems, digital filters, FIR filter design, IIR filter design. Multi-Rate processing. Applications in communication systems and audio/image processing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	20%	10%	40%	

ECE452	Information Theory and Coding			3 CH
Prerequisites	Analog and Digital Communication Systems or Digital Communications			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Uncertainty, Information, Entropy and Source-Coding Theorem. Data Compaction, Discrete Memoryless Channels, Mutual Information, Channel Capacity, Channel-Coding Theorem, Differential Entropy and Mutual Information, Shannon Capacity, Linear Block Codes, Cyclic Codes, Convolutional Codes, Maximum Likelihood Decoding of Convolutional Codes, Introduction to LDPC codes and turbo coding.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Communication Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

ECE453	Modern Communication Systems		3 CH
Prerequisites	Analog and Digital Communication Systems		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Modern communication systems as LTE-A Systems, D2D communications, Spectrum sharing, Cognitive Radio networks, Spectrum sensing, Dynamic spectrum allocation, Resources optimization, Digital Video Broadcasting systems.			
Used in Program / Level			
Program Name or requirement	Study Level		
Electronics and Communication Engineering Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ECE454	Satellite Communication Systems		3 CH
Prerequisites	Analog and Digital Communication Systems or Antenna Engineering and Propagation		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction and history of satellite communication systems. Satellite frequency bands and radio regulations. Types of satellite orbits. Choosing satellite orbits. Orbital mechanics, Kepler's laws, Keplerian element set, true, eccentric and mean anomalies, Earth-satellite geometry, acquiring the desired orbit. Geostationary orbits, antenna look angles. Satellite channel and influence of the atmosphere. The satellite link power budget, noise in satellite communication systems. Inter-satellite links. Multiple access techniques in satellite communication systems. Satellite networks. Satellite electronics, on-board processing.			
Used in Program / Level			
Program Name or requirement	Study Level		
Electronics and Communication Engineering Program Elective	4		
Communication Systems Engineering Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ECE455	Selected Topics in Communication Systems					3 CH
Prerequisites	Analog and Digital Communication Systems					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL		125	Equivalent ECTS		5	
Course Content						
Selected topics in recent directions and advances in communication systems.						
Used in Program / Level						
Program Name or requirement				Study Level		
Electronics and Communication Engineering Program Elective				4		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
40%		20%		0%		40%

ECE456	Selected Topics in Signal Processing					3 CH
Prerequisites	Digital Signal Processing Basics					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL		125	Equivalent ECTS		5	
Course Content						
Selected topics in recent directions and advances in signal processing.						
Used in Program / Level						
Program Name or requirement				Study Level		
Electronics and Communication Engineering Program Elective				4		
Assessment Criteria						
Student Activities		Mid-Term Exam		Practical Exam		Final Exam
40%		20%		0%		40%

ECE457	Selected Topics in Telecommunication Networks			3 CH
Prerequisites	Telecommunication Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions and advances in telecommunication networks.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

ECE458	Communication Networks (2)			3 CH
Prerequisites	Communication Networks (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	175		Equivalent ECTS	7
Course Content				
Overview on the communication networks fundamentals. Network Layer: IP protocol, IP header, IP address and subnetting, routing protocols, IPv6. Transport Layer: UDP protocol, TCP protocol, addressing, Congestion control. Error Detection and Error Correction codes. Wireless LAN protocols and standards. Case studies: VoIP, ATM networks, MPLS, NGN.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

ECE459	Mobile Communications			3 CH
Prerequisites	Digital Communications Antenna Engineering and Propagation			

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	0

Required SWL	125	Equivalent ECTS	5

Course Content

Basic concepts of mobile communications, Cell site planning, Traffic engineering, RF propagation characteristics, Fading and Path loss phenomena, Frequency planning, Frequency reuse, Types of interference. GSM system, Multiple access techniques, CDMA spread spectrum systems, Frequency hopping, Power control, Third Generation (3G), fourth Generations (4G), architecture, frame structure, logical channels and physical channels, interleaving, Modulation, Carrier and burst synchronization.

Used in Program / Level	
Program Name or requirement	Study Level
Communication Systems Engineering Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ECE460	Machine Learning for Multimedia	3 CH
Prerequisites	Signal Processing for Multimedia	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	2	0

Required SWL	125	Equivalent ECTS	5

Course Content

Introduction to machine learning, taxonomy of machine learning, Bayesian theory of decision, Bayes classifier, loss functions, discriminant functions, discriminant functions for Gaussian likelihood, clustering (batch k-means, online k-means, self-organizing maps), Gaussian mixture models, expectation maximization algorithm, hidden Markov models (likelihood problem, decoding problem, learning problem), artificial neural networks, single layer and multilayer neural networks, neural network training.

Used in Program / Level	
Program Name or requirement	Study Level
Communication Systems Engineering Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
40%	20%	0%	40%

ECE461	Selected Topics in Signals and Communication Systems			3 CH
Prerequisites	Determined according to course contents			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions in signals and communication systems will be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Communication Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

E9.9 Graduation Projects

ECE491	Graduation Project (1)			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	175		Equivalent ECTS	7
Course Content				
A single or group project performed under the supervision of a faculty member.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			4	
Communication Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

ECE492	Graduation Project (2)			3 CH
Prerequisites	Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		0		6
Required SWL	200		Equivalent ECTS	8
Course Content				
A single or group project performed under the supervision of a faculty member. This project must be a continuation of graduation project (1).				
Used in Program / Level				
Program Name or requirement			Study Level	
Electronics and Communication Engineering Program			4	
Communication Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

E10. Courses offered by Computer and Systems Engineering Department (CSE)

Table 60 List of specializations at the Computer and Systems Engineering Department.

#	Specialization
1	Computer Hardware
3	Software Engineering
5	Computer Networks
7	Systems and Artificial Intelligence
9	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total

UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement

SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 61 List of CSE courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Computer Hardware																				
1	1	111	Logic Design	3	5	125	3	1	1	5			x		20	10	10	60		
2		112	Computer Organization and Architecture	4	8	200	3	2	2	7				x	20	20	20	40	CSE111	CSE131
3	2	211	Introduction to Embedded Systems	3	5	125	2	2	2	6			x		20	10	10	60	CSE111	CSE131
4		212	Computer Organization	3	6	150	2	2	0	4			x		20	20	0	60	CSE111	CSE131
5	3	311	Computer Architecture	3	5	125	2	2	0	4				x	20	20	0	60	CSE212	
6		312	Electronic Design Automation	2	4	100	2	1	1	4				x	20	10	10	60	CSE112	/CSE212/
7		313	Digital Systems Testing and Verification	2	5	125	2	1	1	4				x	20	10	10	60	CSE212	
8		314	Parallel and Cluster Computing	2	5	125	2	1	1	4				x	20	10	10	60	CSE112	/CSE212/
9	4	411	Real-Time and Embedded Systems Design	3	5	125	2	1	1	4				x	20	10	10	60	CSE211	
10		412	Embedded Operating Systems	3	5	125	3	1	1	5				x	20	20	20	40	CSE411	
11		413	Real-Time Operating Systems	2	5	125	2	1	1	4				x	20	10	10	60	CSE411	
12		414	Digital VLSI Systems	2	5	125	2	1	1	4				x	20	10	10	60	CSE212	
13		415	Fault Tolerant Computing	2	5	125	2	1	1	4				x	20	10	10	60	CSE212	
14		416	Selected Topics in Computer Design	2	5	125	2	1	1	4				x	20	10	10	60		
3. Software Engineering																				
15	0	031	Computing in Engineering	2	4	100	2	0	0	2		x			15	25	0	60		
16	1	131	Computer Programming	3	6	150	3	0	2	5			x		20	10	10	60		
17	2	231	Advanced Computer Programming	3	5	125	2	0	2	4				x	20	10	10	60	CSE131	
18		232	Advanced Software Engineering	3	5	125	2	2	0	4				x	40	20	0	40	CSE334	
19		233	Agile Software Engineering	2	5	125	1	0	4	5				x	20	20	20	40	CSE232	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
20		331	Data Structures and Algorithms	3	5	125	2	2	1	5				x	20	10	10	60	CSE231	
21		332	Design and Analysis of Algorithms	3	5	125	2	2	1	5				x	20	20	0	60	CSE331	
22		333	Database Systems	3	5	125	2	1	1	4				x	20	10	10	60	CSE331	
23		334	Software Engineering	3	5	125	2	2	0	4				x	20	20	0	60	CSE131	
24		335	Operating Systems	3	5	125	2	2	0	4				x	20	20	0	60	CSE112	/CSE212/
25		336	Software Design Patterns	2	4	100	2	1	1	4				x	20	10	10	60	CSE231	
26		337	Software Testing	2	5	125	2	1	1	4				x	20	10	10	60	CSE231	
27	3	338	Software Testing, Validation, and Verification	3	7	175	2	2	1	5				x	20	20	20	40	CSE232	
28		339	Software Formal Specifications	2	5	125	2	1	1	4				x	20	20	20	40	CSE334	
29		341	Internet Programming	3	5	125	2	1	2	5				x	20	20	20	40	CSE231	
30		342	Program Analysis	2	5	125	2	1	1	4				x	20	20	20	40	CSE231	
31		343	Software Engineering Process Management	2	5	125	2	1	1	4				x	20	20	20	40	CSE232	
32		344	Dependability and Reliability of Software Systems	2	5	125	2	1	1	4				x	20	20	20	40	CSE232	
33		345	Business Process Modeling	2	5	125	2	1	1	4				x	20	20	20	40	CSE232	
34		346	Advanced Database Systems	2	5	125	2	1	1	4				x	20	10	10	60	CSE333	
35		431	Mobile Programming	3	5	125	2	1	2	5				x	20	20	20	40	CSE341	
36		432	Automata and Computability	3	5	125	2	2	0	4				x	40	20	0	40	CSE332	
37		433	Software Performance Evaluation	3	5	125	3	1	1	5				x	20	20	20	40	CSE232	
38		434	Aspect- and Service-Oriented Software Systems	3	5	125	3	1	1	5				x	20	20	20	40	CSE232	
39	4	435	Secure Code Development	3	5	125	3	1	1	5				x	20	20	20	40	CSE231	CSE451
40		436	Software Quality Assurance	3	5	125	3	1	1	5				x	20	20	20	40	CSE232	
41		437	Selected Topics in Software	2	5	125	2	1	1	4				x	20	10	10	60		
42		438	Selected Topics in Software Product Lines	3	5	125	3	1	1	5				x	20	20	20	40		
43		439	Design of Compilers	3	5	125	2	2	0	4				x	20	20	0	60	CSE131	
44		441	Software Project Management	2	4	100	2	1	0	3		x		x	20	20	0	60	CSE334	
5. Computer Networks																				
45		351	Computer Networks	3	5	125	2	2	0	4			x	x	20	20	0	60		
46		352	Parallel and Distributed Systems	3	5	125	2	2	0	4				x	20	20	0	60	CSE351	
47		353	Industrial Networks	3	5	125	2	2	1	5			x	x	20	10	10	60		
48	3	354	Distributed Computing	3	4	100	2	2	1	5				x	20	20	20	40	CSE231	CSE351
49		355	Parallel and Distributed Algorithms	2	5	125	2	1	1	4				x	20	20	20	40	CSE332	
50		356	Internet of Things	2	5	125	2	1	1	4				x	20	20	20	40	CSE354	
51		357	Networks Operation and Management	2	5	125	2	2	0	4				x	20	20	0	60	CSE351	
52		358	Pervasive Computing and Internet of Things	2	5	125	2	2	0	4				x	20	20	0	60	CSE231	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
53		451	Computer and Network Security	3	5	125	2	1	1	4				x	20	10	10	60	CSE351	
54		452	Wireless Networks	2	5	125	2	2	0	4				x	20	20	0	60	CSE351	
55		453	Digital Forensics	2	5	125	2	1	1	4				x	20	10	10	60	CSE451	
56		454	Quantum Communication and Security	2	5	125	2	2	0	4				x	20	20	0	60	CSE351	
57	4	455	High-Performance Computing	2	5	125	2	2	0	4				x	20	20	0	60	CSE112	/CSE212/
58		456	Cloud Computing	3	5	125	3	1	1	5				x	20	20	20	40	CSE354	
59		457	Mobile and Wireless Networks	3	5	125	3	1	1	5				x	20	20	20	40	CSE351	
60		458	Computer and Network Forensics	3	5	125	3	1	1	5				x	20	20	20	40	CSE451	
61		459	Selected Topics in Networks and Security	2	5	125	2	2	0	4				x	20	20	0	60		
62		461	Selected Topics in Distributed & Mobile Computing	3	5	125	3	1	1	5				x	20	20	20	40		
7. Systems and Artificial Intelligence																				
63	2	271	System Dynamics and Control Components	4	6	150	3	2	1	6			x		20	10	10	60		
64		371	Control Engineering	3	5	125	2	1	1	4			x	x	20	10	10	60	ECE251	ECE253
65		372	Simulation of Engineering Systems	2	5	125	2	1	1	4				x	20	10	10	60	PHM111	
66		373	Digital Control Systems	2	5	125	2	1	1	4				x	20	10	10	60	CSE371	
67		374	Digital Image Processing	2	5	125	2	1	1	4				x	20	10	10	60	ECE251	
68		375	Machine Learning and Pattern Recognition	2	5	125	2	1	1	4				x	20	10	10	60	PHM111	CSE131
69	3	376	Digital Signals Processing	2	5	125	2	1	1	4				x	20	10	10	60	ECE251	
70		377	Pattern Recognition	2	5	125	2	1	1	4				x	20	20	20	40	ECE251	
71		378	Computer Graphics	2	5	125	2	1	1	4				x	20	20	20	40	PHM013	CSE231
72		379	Human Computer Interaction	2	5	125	2	1	1	4				x	20	20	20	40	CSE232	
73		381	Introduction to Machine Learning	2	5	125	2	1	1	4				x	20	20	20	40	PHM111	CSE131
74		382	Data Mining and Business Intelligence	2	5	125	2	1	1	4				x	20	20	20	40	PHM111	CSE333

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
75	4	471	Robotic Systems	2	5	125	2	1	1	4				x	20	10	10	60	CSE371	
76		472	Artificial Intelligence	3	5	125	2	2	0	4				x	20	20	0	60	PHM111	CSE131
77		473	Computational Intelligence	2	5	125	2	1	1	4				x	20	10	10	60	PHM111	CSE131
78		474	Visualization	3	5	125	3	1	1	5				x	20	20	20	40	CSE378	
79		475	Biomedical Engineering	2	5	125	2	1	1	4				x	20	10	10	60	PHM111	CSE131
80		476	Fundamentals of Big-Data Analytics	2	5	125	2	1	1	4				x	20	10	10	60	PHM111	CSE131
81		477	Fundamentals of Deep Learning	2	5	125	2	1	1	4				x	20	10	10	60	CSE375	
82		478	Selected Topics in Systems & Artificial Intelligence	2	5	125	2	1	1	4				x	20	10	10	60		
83		479	Multimedia Engineering	3	5	125	3	1	1	5				x	20	20	20	40	CSE374	
84		481	Computer Animation	3	5	125	3	1	1	5				x	20	20	20	40	CSE378	
85		482	Game Design and Development	3	5	125	3	1	1	5				x	20	20	20	40	CSE378	
86		483	Computer Vision	3	5	125	3	1	1	5				x	20	20	20	40	CSE374	
87		484	Big-Data Analytics	3	5	125	3	1	1	5				x	20	20	20	40	PHM111	CSE131
88		485	Deep Learning	3	5	125	3	1	1	5				x	20	20	20	40	CSE381	
89		486	Bioinformatics	3	5	125	3	1	1	5				x	20	20	20	40	CSE333	
90		487	Selected Topics in Multimedia & Computer Graphics	3	5	125	3	1	1	5				x	20	20	20	40		
91		488	Ontologies and the Semantic Web	3	5	125	3	1	1	5				x	20	20	20	40	CSE472	
92		489	Selected Topics in Data Science	3	5	125	3	1	1	5				x	20	20	20	40		
9. Graduation Projects																				
93	4	491	Computer & Systems Engineering Graduation Project (1)	3	6	150	0	0	5	5				x	40		20	40		
94		492	Computer & Systems Engineering Graduation Project (2)	3	6	150	0	0	5	5				x	40		20	40	CSE491	

E10.1 Computer Hardware

CSE111	Logic Design			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
Review on number systems: positional notation, binary number systems, number base conversion, octal and hexadecimal, negative numbers, and coded number systems. Switching functions: main operators, postulates and theorems, analysis and synthesis of switching functions, incompletely specified functions. Design using NAND and NOR gates. Storage devices:1-bit storage, set-reset FF, clocked SR FF, positive and negative-edge triggered SR-FF, JK-FF, race-around condition, master-slave JK-FF, D-FF, T-FF, excitation table. Sequential circuits: state table and transition diagram, design of digital sequential systems, incompletely specified states, counters, shift registers. Miscellaneous topics: adders, subtractors, decoders, coders, multiplexer/demultiplexer, memories (ROM, PLA, RAM).				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Computer Engineering and Software Systems Program			1	
Communication Systems Engineering Program			2	
Mechatronics Engineering & Automation Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE112	Computer Organization and Architecture			4 CH
Prerequisites	Logic Design, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	200	Equivalent ECTS	8	
Course Content				
Structure and behavior of digital computers at several levels of abstraction. The five classic components of a computer. Moore's law. Measuring and defining performance: the CPU performance equation, Amdahl's law, MIPS, MOPS, and MFLOPS metrics, measuring performance using SPEC. The power wall. The switch from uniprocessors to multiprocessors. Instruction set architecture: operations, operands, registers, memory organization, data transfer instructions, small constant or immediate operands, logical (bitwise) instructions, instruction formats, decision making instructions, addressing in branches and jumps, supporting procedures, strings, addressing modes, instruction set styles, CISC and RISC architectures. Construction of arrays of logic elements, arithmetic and logic units, control units, register files. CPU organization: implementation of the different instruction types, data and control paths, control units. Memory hierarchy: cache memory and virtual memory. Bussing and I/O subsystems: disk and flash storage, designing an I/O system, interfacing I/O devices.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	

20%	20%	20%	40%

CSE211	Introduction to Embedded Systems				3 CH
Prerequisites	Logic Design, Computer Programming				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		2	
Required SWL	125		Equivalent ECTS	6	
Course Content					
Introduction: the importance of microcontrollers, the roles and functions of microcontrollers. Acquaintance with microcontrollers and their simulators and debuggers. Understanding different addressing modes. Programming, debugging, and simulating assembly language programs. Developing a prototype for an embedded system. Interrupts and serial I/O. Memory Expansion. Microcontroller interfaces. Interfacing techniques. Interfacing requirements. A typical microcontroller system is utilized in this course with typical software-based applications. Interfacing with USB, I2C, SPI, CAN, LIN					
Used in Program / Level					
Program Name or requirement				Study Level	
Electrical Engineering Requirement				2	
Computer Engineering and Software Systems Program				2	
Communication Systems Engineering Program Elective				3	
Mechatronics Engineering & Automation Program				3	
Assessment Criteria					
Student Activities		Mid-Term Exam		Practical Exam	Final Exam
20%		10%		10%	60%

CSE212	Computer Organization				3 CH
Prerequisites	Logic Design, Computer Programming				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Structure and behavior of digital computers at several levels of abstraction. Functional organization of computer hardware. The five classic components of a computer. Moore's law. Measuring and defining performance: the CPU performance equation, Amdahl's law in computing, MIPS, FLOPS, MOPS, and MFLOPS metrics, measuring performance using benchmarks, measuring performance using SPEC, reporting performance, summarizing and comparing performance. The power wall. The switch from uniprocessors to multiprocessors. Instruction set architecture: operations, operands, registers, memory organization, data transfer instructions, small constant or immediate operands, logical bitwise) instructions, instruction formats, decision making instructions, program translation hierarchy, addressing in branches and jumps, supporting procedures, strings, addressing modes, instruction set styles, CISC and RISC architectures. Construction of arrays of logic elements, arithmetic logic units, control units, register files. CPU organization: implementation of the different instruction types, data and control paths, control units, different organizations with their advantages and inefficiencies.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer and Systems Engineering Program				2	
Communication Systems Engineering Program				2	

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

CSE311	Computer Architecture			3 CH
Prerequisites	Computer Organization			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Definition and terms of computer architectures: instruction sets, basic data types, and addressing modes. Memory hierarchy: cache basics, cache system performance, virtual memory. Conventional architectures, pipelined processors, superscalar processors, VLIW processors, parallel array (systolic) processors, reconfigurable parallel array processors, and associative processors. Massively parallel processors, shared memory multiprocessors, clusters and other message-passing multiprocessors, and hardware multithreading. I/O systems organization, I/O processors, I/O channels, and I/O support for multiprocessors. Disk modeling, disk cache buffers, concurrent disks, clusters of independent disks, disk arrays, and redundancy in disk arrays. Bussing and I/O subsystems: disk and flash storage, designing an I/O system, interfacing I/O devices to processors, memory, and operating systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		10%	60%

CSE312	Electronic Design Automation			2 CH
Prerequisites	Computer Organization or Computer Organization and Architecture			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Overview of electronic design automation (EDA): VLSI design and typical EDA flows, IC technology. Sequential design. HDL languages (VHDL/Verilog). Functional verification, Logic simulation: models, techniques, hardware acceleration. Logic synthesis: ASIC synthesis, combinational logic minimization, technology mapping, timing analysis, timing optimization. Design for testability: fault models, fault collapsing, fault-simulation, test generation, manufacturing tests, testability analysis, scan design, built-in self-test, test comparison. Physical synthesis, Floor-planning and placement: simulated annealing and analytical approaches. Routing: general-purpose, global, and detailed routing, clock and power/ground synthesis. Chip integration.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Computer Engineering and Software Systems Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	10%		10%	60%

CSE313	Digital Systems Testing and Verification			2 CH
Prerequisites	Computer Organization			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Cost and complexity of logic testing. Testing at different levels of abstraction. Faults, physical fault modeling, stuck-at fault models, single fault models, undetectable (masked) faults, fault equivalence/collapsing. Testability measures: controllability and observability. Combinational and sequential functional test. Exhaustive test. Sensitized path test. Test coverage evaluation. Test pattern generation, fault simulation. Design for Testability (DFT), Ad-hoc DFT. Scan design. Built-in Self Test (BIST), linear feedback shift register (LFSR), Data compaction using LFSR, Pseudo Random Number Generation (PRNG). Boundary Scan/Joint Test Access Group (JTAG). Current test.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE314	Parallel and Cluster Computing			2 CH
Prerequisites	Computer Organization or Computer Organization and Architecture			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Importance of parallel and cluster computing. Instruction Level Parallelism(ILP). Parallel computer architecture. Parallel Random Access Machines (PRAM). Cluster computing and grid computing. Sequential and parallel execution. Synchronization. Principles of pipeline and vector processing. Overview of massively parallel and cluster computers, SIMD and MIMD machines. Network topology and interconnection networks. Routing (e-cube, hyper-switch, wormhole, virtual channels) and flow control. Dependability and scalability. Shared memory and cache coherence.Design of systolic array-based systems: dependence graph, system timing, projection and scheduling, data broadcasting, slicing, and pipelining. Load balancing. Performance of parallel and cluster computing systems. General overview of the architecture of the GPUs and the programming models of parallel and cluster computing environments.Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE411	Real-Time and Embedded Systems Design				3 CH
Prerequisites	Introduction to Embedded Systems				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction: real-time system types, characteristics, and applications. Tasks, scheduling algorithms, and schedulability. Real-time system analysis. Real-time operating systems: shared resources management, concurrency, synchronization, real-time memory management. Developing embedded software, Memory maps and boot kernels, firmware, and ROM-resident system code. Timeline analysis and design. Design of embedded systems using real-time hardware and software components. Communicating, linking, interfacing, and processing techniques for embedded systems. Programming models: disciplines, methods, development. Machine instruction format and instruction timing. Interface between OS, ISA, and RTL layers of the virtual machine model. Interrupts, privilege states, and exception handling. Hardware interfacing and device driver programming. Algorithm analysis of embedded programs. Debugging live systems. Main challenges in the design, implementation, and validation of embedded systems. Secure coding practices. Code compression. Resource access protocols.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer and Systems Engineering Program				4	
Computer Engineering and Software Systems Program				3	
Mechatronics Engineering & Automation Program				3	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam	Final Exam	
20%		10%	10%	60%	

CSE412	Embedded Operating Systems				3 CH
Prerequisites	Real-Time and Embedded Systems Design				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to embedded Linux. Architecture of embedded Linux: Linux kernel architecture, user space, startup sequence. Board support: insertion in kernel build procedure, the boot loader interface, memory map, interrupt management, the PCI subsystem, timers, UART, power management. Embedded storage: flash map. MTD architecture, the flash-mapping drivers, MTD block and character devices, embedded file systems, optimizing storage space, tuning kernel memory. Embedded drivers: Linux serial driver, Ethernet driver, I2C subsystem on Linux, USB gadgets, watchdog timer, kernel modules. Porting applications: application porting roadmap, programming with Pthreads, operating system porting layer (OSPL), kernel API driver. Real-Time Linux: real-time programming in Linux, hard real-Time Linux. Building and Introduction to embedded Linux. Architecture of embedded Linux: Linux kernel architecture, user space, startup sequence. Board support: insertion in kernel build procedure, the boot loader interface, memory map, interrupt management, the PCI subsystem, timers, UART, power management. Embedded storage: flash map. MTD architecture, the flash-mapping drivers, MTD block and character devices, embedded file systems, optimizing storage space, tuning kernel memory. Embedded drivers: Linux serial driver, Ethernet driver, I2C subsystem on Linux, USB gadgets, watchdog timer, kernel modules. Porting applications: application porting roadmap, programming with Pthreads,					

operating system porting layer (OSPL), kernel API driver. Real-Time Linux: real-time programming in Linux, hard real-Time Linux. Building and
Used in Program / Level

Program Name or requirement	Study Level
Computer Engineering and Software Systems Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

CSE413	Real-Time Operating Systems	2 CH
Prerequisites	Real-Time and Embedded Systems Design	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	1	1

Required SWL	125	Equivalent ECTS	5

Course Content
Introduction to embedded Linux. Architecture of embedded Linux: Linux kernel architecture, user space, startup sequence. Board support: insertion in kernel build procedure, the boot loader interface, memory map, interrupt management, the PCI subsystem, timers, UART, power management. Embedded storage: flash map. MTD architecture, the flash-mapping drivers, MTD block and character devices, embedded file systems, optimizing storage space, tuning kernel memory. Embedded drivers: Linux serial driver, Ethernet driver, I2C subsystem on Linux, USB gadgets, watchdog timer, kernel modules. Porting applications: application porting roadmap, programming with Pthreads, operating system porting layer (OSPL), kernel API driver. Real-Time Linux: real-time programming in Linux, hard real-Time Linux. Building and Introduction to embedded Linux. Architecture of embedded Linux: Linux kernel architecture, user space, startup sequence. Board support: insertion in kernel build procedure, the boot loader interface, memory map, interrupt management, the PCI subsystem, timers, UART, power management. Embedded storage: flash map. MTD architecture, the flash-mapping drivers, MTD block and character devices, embedded file systems, optimizing storage space, tuning kernel memory. Embedded drivers: Linux serial driver, Ethernet driver, I2C subsystem on Linux, USB gadgets, watchdog timer, kernel modules. Porting applications: application porting roadmap, programming with Pthreads, operating system porting layer (OSPL), kernel API driver. Real-Time Linux: real-time programming in Linux, hard real-Time Linux.
Used in Program / Level

Program Name or requirement	Study Level
Computer and Systems Engineering Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	10%	10%	60%

CSE414	Digital VLSI Systems	2 CH
Prerequisites	Computer Organization	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	1	1

Required SWL	125	Equivalent ECTS	5

Course Content
Introduction to VLSI technology. CMOS Technology. VLSI Design Techniques, Transistors, wires and vias, layout design, SPICE simulation static complementary gates, switch logic, delay and timing, standard cell based layout, fan-out, Path delay, delay modeling, power analysis, latches and flip-flop layout, clock disciplines, clock skew, ROM, Static RAM, Dynamic RAM, Flash memory, FPGA, Floor planning, power distribution, clock distribution, Hardware description language, Digital Circuit simulation, and synthesis using hardware description languages. Digital Circuit testing, Formal verification.

Used in Program / Level	
Program Name or requirement	Study Level
Computer and Systems Engineering Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	10%	10%	60%

CSE415	Fault Tolerant Computing	2 CH
Prerequisites	Computer Organization	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	1	1

Required SWL	125	Equivalent ECTS	5

Course Content
Origins, goals, and applications of fault-tolerant computing. Defining faults, errors, and failures. Causes, characteristics, and models of faults. Logical and physical stuck-fault models. Design philosophies to combat faults. Error models. Design techniques to achieve fault tolerance: the concept of redundancy, hardware redundancy, information redundancy, time redundancy, and software redundancy. Evaluation techniques: quantitative methods, reliability, safety, availability, and maintainability modeling, system comparisons, and redundancy ratios. The design of practical fault-tolerant systems: the design process, the use of fault avoidance in the design process, long-life applications, critical-computation applications, and high-availability applications. Fault-tolerant design of VLSI circuits and systems.

Used in Program / Level	
Program Name or requirement	Study Level
Computer and Systems Engineering Program Elective	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	10%	10%	60%

<table>
<tr><td>CSE416</td><td colspan="3">Selected Topics in Computer Design</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4"></td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td>1</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Selected topics in recent developments in computer hardware design will be presented in this course. Course material will reflect the needs of the graduating students</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Computer and Systems Engineering Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>10%</td><td>10%</td><td colspan="2">60%</td></tr>
</table>

E10.3 Software Engineering

CSE031	Computing in Engineering			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	0		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
This introductory course in emerging technologies lays out the principles of big data, cloud computing, distributed computing, OS, IoT, content delivery network, Network Protocols, Wireless Network protocol , digital wireless telephony technologies, Internet operations, processors and storage technologies, Embedded Systems, augmented reality), virtual reality , the impact of technology on society. The course covers also computational thinking, problem solving, Abstraction, Problems Analysis, 3G/4G/5G, LTE, IPv4, IPv6.				
Used in Program / Level				
Program Name or requirement			Study Level	
Faculty Requirement			0	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	25%	0%	60%	

CSE131	Computer Programming			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	0		2	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Basic programming concepts using one of the modern general-purpose programming languages. Data types, expressions, mathematical and logical operators, mathematical functions, conditions, decisions, loops, arrays, multi-dimensional arrays, strings, functions, function-call mechanisms, recursive functions, parameter passing, enumerations, addresses, pointers/references, pointers to pointers, pointers to functions, program memory segments, dynamic allocations, basic input/output, streams and files, exception handling, and static and dynamic libraries.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			1	
Computer Engineering and Software Systems Program			1	
Communication Systems Engineering Program			1	
Mechatronics Engineering & Automation Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE231	Advanced Computer Programming			3 CH
Prerequisites	Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		0		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Structured and object-oriented programming paradigms. Classes. Objects. Methods. Interfaces. Polymorphism. Inheritance. Data hiding. Constructors. Destructors. Access specifiers. Operator-overloading. Function overloading. Virtual functions. Friend functions. Abstract classes. Implementation of dynamic data structures. Template functions and classes. Graphical User Interface programming. Graphics. Event-driven programming. Concurrency and multi-threaded programming.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			2	
Computer Engineering and Software Systems Program			1	
Mechatronics Engineering & Automation Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE232	Advanced Software Engineering			3 CH
Prerequisites	Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Differences between structured and object-oriented paradigms. The Unified Modeling Language (UML). Use-case modeling. Class modeling: noun extraction, Class-Responsibility-Collaboration (CRC) cards. Dynamic modeling. State diagrams. Testing during the object-oriented analysis phase. CASE tools for object-oriented analysis and design. Object-oriented design: interaction diagram, detailed class diagram, clients of objects, detailed design and program description languages.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	20%	0%	40%	

CSE233	Agile Software Engineering			2 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
1	0		4	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction. Agile versus waterfall model. Principles of Agile, the people involved, ethics in Agile teams, organizational culture and agile distributed teams. Product manager versus product owner, product backlog versus sprint backlog. Agile reports, Agile planning, time management of Agile projects, Agile solution providers, problems with Agile, Agile testing and quality assurance, transition to an Agile software development environment, applying an Agile process to a transition process, application of Agile principles in non-software projects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE331	Data Structures and Algorithms			3 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Algorithms: definitions, correctness, efficiency. Complexity analysis: The big O-notation, the theta-notation,and the Omega-notation. Elementary data structures: linked lists; (single, double, and circular), stacks, queues, and priority queues. Recursion: tail recursion, indirect recursion, non-tail recursion, nested recursion, and excessive recursion. Trees: binary and search trees and tree operations (insertion, deletion, and balancing). Multiway trees: B-tree, B^*-tree, B^+-tree, R-tree. Graphs. Sorting algorithms: insertion, selection, bubble, merge, quick, and radix. Comparison between sort algorithm using complexity analysis notations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE332	Design and Analysis of Algorithms			3 CH
Prerequisites	Data Structures and Algorithms			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. Fundamental techniques for designing and analyzing algorithms. Asymptotic analysis. Divide-and-conquer algorithms. Recurrences. Merge sort. Linear-time median. Greedy algorithms. Quick-sort algorithm. Dynamic programming. Graph algorithms. Graph search and Dijkstra's algorithm. Minimum Spanning Trees. Randomized algorithms. Hashing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE333	Database Systems			3 CH
Prerequisites	Data Structures and Algorithms			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to database systems. Architecture for a database system. Relational model: Domain, relations, and relational integrity. SQL. The relational database language standard: data definition language, data manipulation language, aggregate functions, views, database modification, database management system and examples such as Oracle and Access. Database design theory and methodology Entity/Relationship model (ERM) and enhanced Entity/Relationship model (EERM). Normalization for relational database.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
10%	10%	10%	70%	

<table>
<tr><td>CSE334</td><td colspan="3">Software Engineering</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Computer Programming</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Fundamental concepts of software engineering. Software processes life-cycle. Software requirements: functional requirements, non-functional requirements. Requirements modeling: flow, behavior, patterns, and web applications. Requirements analysis. Scenario-based modeling. UML modeling. Data modeling. Class-based modeling. Software Requirements Specification (SRS) document. Requirements negotiations. Requirements validation. Use-case representations of requirements. CASE tools for software engineering. Software process models: waterfall model, spiral model, extreme programming model, and evolutionary model. Introduction to software design.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Computer and Systems Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="3">Computer Engineering and Software Systems Program</td><td colspan="2">1</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>CSE335</td><td colspan="3">Operating Systems</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Computer Organization or Computer Organization and Architecture</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td>Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td>0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction. Operating system structures and services. System calls. Process management. Inter-process communication. Threads and multithreading models. CPU scheduling. Scheduling algorithms. Process synchronization. Deadlocks. Memory management. Virtual memory. File systems. Emphasis on a typical operating system as a case study.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Computer and Systems Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="3">Computer Engineering and Software Systems Program</td><td colspan="2">2</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

CSE336	Software Design Patterns			2 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Importance of software reusability. Software patterns and how to detect them. Pattern-based development. The observer pattern. The template method pattern. Factory patterns. The singleton pattern. The iterator pattern. The composite pattern. The facade pattern. The state and strategy patterns. Functions and the command pattern. The adapter pattern. The proxy pattern. The decorator pattern. The chain of responsibility pattern. The visitor pattern. Software design patterns in software reengineering. Searching for patterns in existing software.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Computer Engineering and Software Systems Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE337	Software Testing			2 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Testing requirements, plans, measures. Risk management. Testing lifecycle. Software quality process. Capability Maturity Model (CMM). Testing techniques. Test cases. Inspection process. Testing waterfall model: static testing of requirements, testing checklist, logical, physical, and unit design testing, static and dynamic testing of code. Non-functional testing. CASE tools in testing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE338	Software Testing, Validation, and Verification			3 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	175	Equivalent ECTS	7	
Course Content				
Introduction. Testing, Verification, and Validation (V&V) requirements, plans, measures. Risk management. V&V life-cycle. V&V and UML. V&V of the quality of MOPS, MOSS, and MOBS. Software quality process. Capability Maturity Model (CMM). Testing techniques. Test cases. Inspection process. Testing waterfall model: static testing of requirements, testing checklist, logical, physical, and unit design testing, static and dynamic testing of code. Non-functional testing. CASE tools in testing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE339	Software Formal Specifications			2 CH
Prerequisites	Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction. Mathematical fundamentals. Z scheme. State-based approaches. Event-based approaches. B machines. Algebraic specifications. Petri nets. Temporal logic. Properties of programs. Computational Tree Logic (CTL). Specification. Verification. Model checking.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE341	Internet Programming			3 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction: web servers, the client-server paradigm, web programming models. Static HTML pages. Style sheets. Dynamic pages. Client-side scripting. Server-side programming. Database sever access. The Model-View-Controller (MVC) architecture. Web services. Interactive dynamic pages. Web hosting and web application deployment.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE342	Program Analysis			2 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. First-order logic. Implication. Tableaux. Proofs. Deduction. Dataflow analysis. Abstract interpretation. Symbolic execution. Pointer. Control-flow analysis. Inter-procedural analysis. Model checking. Dynamic analysis. Efficient data structures and program representations for analysis				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE343	Software Engineering Process Management			2 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. Integrated approach to manage development within small teams; including mission statement, synthesis of design concepts, trade-off studies, risk assessment and the interactions encountered in the optimal design, development, manufacture and test of systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE344	Dependability and Reliability of Software Systems			2 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. Factors affecting software quality. Software reliability engineering, Software reliability engineering process. Single failure model. Reliability growth model. Weibull and Gamma failure class models. Early life-cycle prediction models. Serial and parallel system reliability. Active redundancy. Reliability Block Diagram (RBD). Hazard analysis. Failure Modes and Effect Analysis (FMEA). Fault Tree Analysis (FTA). Software fault tolerance: redundancy, design methods, programming techniques. Failure severity. Occurrence probabilities. Code predictability, reliability, and dependability. Simulation and reliability growth tools: SMERFS, SRMP, SoftRel, CASRE.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE345	Business Process Modeling			2 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
The purpose and benefits of Business Process Modeling. The role of process modeling. Process modeling steps and ingredients that are necessary for success. Process boundaries. Modeling techniques to represent existing processes. Modeling processes patterns. Effectiveness of the processes. Modeling of new, improved processes. Measuring the success of business processes. Communicating process models.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE346	Advanced Database Systems			2 CH
Prerequisites	Database Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Query processing and optimization. Database tuning. Transaction processing. Concurrency control. Database recovery. Object databases: standards, languages, and design. Object-relational databases. Database security. Distributed database systems: architecture, data fragmentation, distributed read/update transparency, access primitives, integrity constrains, distributed database design, queries, optimization, concurrency and reliability control. XML, semi-structured, federated, and Internet databases. Data warehousing. Introduction to data mining.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE431	Mobile Programming			3 CH
Prerequisites	Internet Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Mobile operating systems (Windows mobile, iOS, Android, Blackberry ... etc.), mobile databases, client-server agents, application servers, mobile Internet. Mobile applications: context, design, information architecture, development, testing, maintenance, mobile web versus native applications. Development environments. Programming languages and SDKs for mobile application development. Location management. Location-based services. Context-aware mobile programming. Mobile-agent middleware. Caching strategies in mobile environments. Mobile VoIP applications. Fault tolerance and security in mobile environments.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE432	Automata and Computability			3 CH
Prerequisites	Design and Analysis of Algorithms			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Fundamental concepts in automata theory and formal languages including grammar, deterministic and nondeterministic finite automata, regular expression, formal language, pushdown automaton, Turing machines, the halting problem, diagonalization and reduction, decidability, Rice’s theorem, P, NP, and NP-completeness.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	20%		0%	40%

CSE433	Software Performance Evaluation			3 CH
Prerequisites	AdvancedSoftware Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Software metrics: progress, effort, cost, training. Requirements stability. Size stability. Computer resources utilization. Reliability.Openness. Operability. Upgradeability. Usability. Performance analysis. Testing and tuning techniques. Evaluating software scalability. Capacity planning methodologies. Issues related to safety, security, and availability of software. Software performance analysis tools. Static analysis tools. Dynamic analysis tools. Hybrid analysis tools.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE434	Aspect- and Service-Oriented Software Systems			3 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Aspect-Oriented Software, cross-cutting concerns. Nature of aspect-oriented programming, Aspect-oriented requirements engineering, Aspect-oriented system architecture, Aspect-oriented modeling and design, Aspect-Oriented Programming (AOP), Formal method support for aspect-orientation, Aspect-oriented middleware. Service-Oriented Architecture (SOA), Service-Oriented Software Engineering (SOSE), Service-oriented interaction, Service-oriented analysis and design, service oriented modeling, Separation of concerns, Service-Oriented Software Examples and Case Studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE435	Secure Code Development			3 CH
Prerequisites	Advanced Computer Programming, Computer and Network Security			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction. Secure code development principles. Best practices. Security strategies and controls. Malicious code and defensive techniques. Code review and testing. Security documentation and error messages. Secure coding techniques. Access control. Input validation. Threat identifications and modeling. Vulnerability analysis. Automated code analysis. Risk assessment. Secure code development life-cycle: development, maintenance, and refinement. Knowledge catalog: principles, guidelines, vulnerabilities, attack patterns, and historical risks. Coding errors. Breaking software. Web-applications threats and vulnerabilities.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE436	Software Quality Assurance			3 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Integrity and effectiveness of software development processes, Basics of SQA. Techniques and processes for SQA. Software quality assurance plan. Software quality assurance team. Inspections. Product reviews. Walk-throughs and audits. Software quality metrics. Quality assurance in agile, iterative, and incremental development environments. Risk analysis and resolution. Costs associated with quality. Various effective (SQA) guidelines and standards. Software testing. Test Strategies. CMM, CMMI, ISO standards.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE437	Selected Topics in Software			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125	Equivalent ECTS		5
Course Content				
Selected topics in recent developments in computer software will be presented in this course. Course material will reflect the needs of the graduating students				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE438	Selected Topics in Software Product Lines			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125	Equivalent ECTS		5
Course Content				
Selected topics in recent directions in software product lines will be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE439	Design of Compilers			3 CH
Prerequisites	Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Fundamental concepts in automata theory and formal languages including grammar, deterministic and nondeterministic finite automata, regular expression, formal language, pushdown automaton, Turing machines, the halting problem, diagonalization and reduction, decidability, Rice's theorem, P, NP, and NP-completeness. Systems software, compilers, interpreters. Byte-codes. Lexical analysis: interface with input, parser and symbol table, token, lexeme and patterns. Syntax analysis: context-free grammars, ambiguity, precedence, top-down parsing, recursive descent parsing, transformation on the grammars, predictive parsing. Bottom up parsing, operator precedence grammars, LR parsers. Regular expressions and semantics. Error detection, type-checking and run-time environments. Code generation, code optimizations, code improvement techniques.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			4	
Computer Engineering and Software Systems Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CSE441	Software Project Management			2 CH
Prerequisites	Software Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
The course introduces the methodologies and techniques for software project management both traditional and agile, this also includes scope, effort, risk estimation, plus scheduling and communication management of stakeholders. The course also includes several techniques and the student is introduced to different PM tools.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			4	
Computer Engineering and Software Systems Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

E10.5 Computer Networks

<table>
<tr><td colspan="3">CSE351</td><td colspan="4">Computer Networks</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="5"></td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="3">2</td><td colspan="2">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">This course reflects the latest essential networking technologies with emphasis on wireless networking, including 802.11, 802.16, Bluetooth, and 3G/4G cellular, paired with fixed-network coverage of ADSL, Internet over cable, gigabit Ethernet, MLPS, and peer-to-peer networks, Fiber to the Home, RIFD, delay-tolerant networks, in addition to Internet routing, multicasting, congestion control, quality of service, real-time transport, and content distribution.
Typically, a description is provided for the inner facets of Computer Networks, exploring their functionality from underlying hardware up to applications. The course dissects and depicts the principles associated with each layer and then translates them through examples from the networking, Internet, wireless networks, and software defined networks.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="6">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="6">Electrical Engineering Requirement Elective</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Computer Engineering and Software Systems Program</td><td colspan="2">3</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
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<table>
<tr><td colspan="3">CSE352</td><td colspan="4">Parallel and Distributed Systems</td><td>3 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="5">Computer Networks</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="3">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="3">2</td><td colspan="2">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Motivations for parallel programming. Instruction Level Parallelism (ILP). Parallel Random Access Machines(PRAM). Cluster computing and grid computing. Message passing systems and applications. Message PassingInterface (MPI) and configuration of MPI cluster. MPI programming algorithms and implementation of PRAM through MPI. Peer-to-Peer (P2P) systems, mobile agents. GPUs, Multi-Core, Distributed file systems. Distributed coordination systems. Replication and consistency. Fault tolerance. Grid computing paradigm. Cloud computing: properties and characteristics, service models, deployment models.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="6">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="6">Computer and Systems Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
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CSE353	Industrial Networks			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	125	Equivalent ECTS	5	

Course Content

The course is presented through a layered top-down approach starting from the application layer down to the physical layer, focusing on basic networking concepts and typical application layer examples. Focusing on the Internet and the fundamentally important issues of networking, this course provides a foundation for students interested in computer science and electrical engineering, without requiring extensive knowledge of programming or mathematics.
A typical outline of the course goes by the following sequence:

* Application layer (e.g., e-mail, the Web, PHP, wireless Web, MP3, and streaming audio)
* Transport layer essentials and requirements.
* Network layer functions and fundamentals of routing, congestion control, QoS, IPv4, and IPv6.
* Data link layer and MAC Sublayer with emphasis on gigabit Ethernet, 802.11, broadband wireless, and switching.
* Physical layer (e.g., copper, fiber, wireless, satellites, and Internet over cable)

The course dissects and depicts the principles associated with each layer and then focuses on Fieldbus networks, Control Area Networks (CAN, LIN, FLEXRAY) and SCADA systems.

Used in Program / Level

Program Name or requirement	Study Level
Electrical Engineering Requirement Elective	2
Energy & Renewable Energy Program Elective	3
Mechatronics Engineering & Automation Program	4

Assessment Criteria

Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	10%	10%	60%

CSE354	Distributed Computing			3 CH
Prerequisites	Advanced Computer Programming, Computer Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		1
Required SWL	100	Equivalent ECTS	4	

Course Content

Overview of distributed computing. Client-server paradigm: protocols, simple client-server messaging systems, remote procedure calls, remote method invocation, remote object invocation systems. Message-oriented middleware systems. Advanced messaging systems: transient, persistent. Naming: flat, structured, attribute-based. Distributed processes. Distributed synchronization. Peer-to-Peer (P2P) systems, mobile agents. P2P with mobile agents. Distributed file systems. Distributed coordination systems. Distributed document (web) systems. Replication and consistency. Fault tolerance. Web services (WSDL, XML, UDDI). Grid computing: grid computing middleware, resource management and scheduling, grid portals, data management, grid security, grid services, grid-enabled applications.

Used in Program / Level

Program Name or requirement	Study Level
Computer Engineering and Software Systems Program	3

Assessment Criteria

Student Activities	Mid-Term Exam	Practical Exam	Final Exam

20%	20%	20%	40%

CSE355	Parallel and Distributed Algorithms		2 CH
Prerequisites	Design and Analysis of Algorithms		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction. Parallel versus distributed algorithms. Message passing and shared memory. Parallel algorithm design: parallel graph algorithms, parallel searching and sorting algorithms. Parallel computational algorithms. Basic distributed problems and protocols. Synchronous computation: communicators, pipeline, transformers, waiting, guessing, synchronous problems. Algorithms in systems with no failures. Election: election in trees, rings, mesh networks, cube networks, and complete networks, universal election protocols. Message routing: shortest path routing, coping with changes, routing in static systems. Distributed set operations: distributed selection, distributed sorting. Stable properties detection. Continuous computations. Computing in presence of faults: faults and failure, modeling faults, the crushing impact failure, localized entity and link failures, ubiquitous faults. Failure detectors. Parallel and distributed matrix algorithms. Optimization in parallel and distributed algorithms. Complexity analysis of distributed and parallel algorithms. Applications.			
Used in Program / Level			
Program Name or requirement	Study Level		
Computer Engineering and Software Systems Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

CSE356	Internet of Things		2 CH
Prerequisites	Distributed Computing		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	1	
Required SWL	125	Equivalent ECTS	5
Course Content			
Introduction. Concepts and architecture. Connected devices. Managing IoT resources in the cloud. Fog computing. Programming frameworks. Virtualization on Embedded boards. Collecting and managing data. Reliability, privacy, and security. IoT applications.			
Used in Program / Level			
Program Name or requirement	Study Level		
Computer Engineering and Software Systems Program Elective	3		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

CSE357	Network Operation and Management			2 CH
Prerequisites	Computer Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Network management: goals, organization and functions. Basic foundations: standards, models and languages. Simple network management protocol (SNMP). SNMPvA organization and information models. SNMPvA communication and functional models. SNMPv2. SNMPv3. Remote monitoring (RMON). Network management applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CSE358	Pervasive Computing and Internet of Things			2 CH
Prerequisites	Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Ubiquitous data access. Exploiting virtual machines. Resource-driven dynamic adaptation. Sensing and actuation: smart sensors and actuators, smart appliances. Mobile hardware technologies. Information access devices. Smart identification: smart cards, smart labels, smart tokens. Home networking. Entertainment systems. Pervasive computing platforms and software: Java cards, iOS, Android, Windows-based platforms. Client middleware: smart card programming, messaging components. Security and privacy in mobile and pervasive systems. Mobile internet. Web services: service discovery, location and context awareness. Backend server infrastructure: Gateways, application servers, Internet portals, device management, synchronization. Mobile and ubiquitous services: home services, travel and business services, consumer services. Design methodologies and infrastructure. End-to-end application considerations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CSE451	Computer and Network Security			3 CH
Prerequisites	Computer Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Attacks and threats, symmetric key cryptography, public key cryptography, authentication protocols, digital signature, viruses, worms, Trojan horses, malicious programs, computer crimes, web-security, firewalls, intrusion detection, TLS, IPSec, SET, digital homeland security, offensive and defensive tools, security issues in wireless technologies and mobile computing, ethics and hacking in laws.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			4	
Computer Engineering and Software Systems Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	10%		10%	60%

CSE452	Wireless Networks			2 CH
Prerequisites	Computer Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Wireless networking fundamentals. Wireless technologies (GSM, CDMA, GPRS, etc.). Cellular Wireless Networks: 1G, 2G, 3G, 4G, future of cellular wireless networks. Wireless medium access control. Wireless LANs and IEEE 802.11. Bluetooth and WPANs. Zigbee/802.15.4. WiFi/Bluetooth/Zigbee coexistence. Ad hoc networks. Wireless and mobile routing protocols for ad hoc networks. Wireless and mobile routing in the Internet: mobile IP, DHCP, NAT. Wireless sensor and mesh networks. Performance improvements for TCP in wireless networks. Wireless network security.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CSE453	Digital Forensics			2 CH
Prerequisites	Computer and Network Security			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Concepts of digital forensics. Computer investigations using digital evidence controls. Crime and incident scenes. Computer forensic analysis. E-mail investigations. Image file recovery. Incident response. Recovery of digital evidence. Testimony on evidence. Computer forensics tools. Best practices for processing crime and incident scenes. Digital evidence controls. Best practices for data discovery, recovery, and acquisition. Network forensic analysis. Investigative report writing.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE454	Quantum Communication and Security			2 CH
Prerequisites	Computer Networks			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Quantum Computing, QUBITS, Postulates of Quantum Mechanics, Quantum Information, No Cloning, Quantum Algorithms: Basic algorithms, period finding, Quantum FT, Quantum Communication, Quantum Key Distribution, Quantum Secure Communication, Quantum Attacks, Post-Quantum Cryptography, Implementation Issues				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CSE455	High-Performance Computing			2 CH
Prerequisites	Computer Organization or Computer Organization and Architecture			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Overview of existing HPC software and hardware. Basic software design patterns for high performance parallel computing. CUDA for parallel computing on the Graphics Processing Unit (GPU). Message Passing Interface (MPI) parallel programming. OpenMP and POSIX threads solution to enable parallelism across multiple CPU cores. Standard algorithms utilizing parallelism. Matrix and vector operations. Collective communications. The use of Graphics Processing Units (GPUs) for general purpose computations (GPGPU). Multi-GPU and Multi-CPU solutions. Optimizing HPC-based programs. Designing GPU-based systems. Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Computer Engineering and Software Systems Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CSE456	Cloud Computing			3 CH
Prerequisites	Distributed Computing			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
3	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Key cloud computing concepts. Cloud computing properties and characteristics, service models, deployment models. Cloud computing models, techniques, and architectures. Infrastructure as a Service (IaaS): resource virtualization, server, storage, network. Platform as a Service (PaaS): Cloud platform and management: computation, storage, case studies. Software as a Service (SaaS): web services, web OS, Case studies. Cloud-based software systems. Advanced web technologies. Cloud issues: provider lock-in, security. Key cloud service providers and platforms. Creating own cloud services. Cloud deployment and service models, cloud infrastructure, migration to cloud computing environments. Traditional, virtualized, and cloud data center environments. Storage, networking, desktop, and application virtualization. Backup and recovery, security, and management of cloud computing systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE457	Mobile and Wireless Networks				3 CH
Prerequisites	Computer Networks				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Wireless networking fundamentals. Wireless technologies. Global System for Mobile communication (GSM). Code Division Multiple Access (CDMA). Short Message Service (SMS). General Packet Radio Service (GPRS). Wireless Application Protocol (WAP). IP Multimedia Subsystem (IMS). Multimedia Messaging Service (MMS). Geolocation and Global Positioning System (GPS). Cellular Wireless Networks: 1G, 2G, 3G, 4G, future of cellular wireless networks. Wireless medium access control. Wireless LANs and IEEE 802.11. Bluetooth and WPANs. Zigbee/802.15.4. Wi-Fi/Bluetooth/Zigbee coexistence. Ad hoc networks. Wireless and mobile routing protocols for ad hoc networks. Wireless and mobile routing in the Internet: mobile IP, DHCP, NAT. Wireless sensor and mesh networks. Performance improvements for TCP in wireless networks. Wireless network security.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer Engineering and Software Systems Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

CSE458	Computer and Network Forensics				3 CH
Prerequisites	Computer and Network Security				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Concepts of computer and network forensics. Computer investigations using digital evidence controls. Crime and incident scenes. Computer forensic analysis. E-mail investigations. Image file recovery. Incident response. Recovery of digital evidence. Testimony on evidence.Computer forensics tools. Best practices for processing crime and incident scenes. Digital evidence controls. Best practices for data discovery, recovery, and acquisition. Network forensic analysis. Investigative report writing.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer Engineering and Software Systems Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

CSE459	Selected Topics in Networks and Security		2 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	2		0
Required SWL	125	Equivalent ECTS	5
Course Content			
Selected topics in recent developments in computer networks and security will be presented in this course. Course material will reflect the needs of the graduating students			
Used in Program / Level			
Program Name or requirement		Study Level	
Computer and Systems Engineering Program Elective		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

CSE461	Selected Topics in Distributed and Mobile Computing		3 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
3	1		1
Required SWL	125	Equivalent ECTS	5
Course Content			
Selected topics in recent directions in distributed and mobile computing will be presented in this course.			
Used in Program / Level			
Program Name or requirement		Study Level	
Computer Engineering and Software Systems Program Elective		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	20%	40%

E10.7 Systems and Artificial Intelligence

CSE271	System Dynamics and Control Components			4 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		1
Required SWL	150		Equivalent ECTS	6
Course Content				
Modeling principles and simulation; methodology for model building, Modeling of distributed systems, Modeling of process dead-time, Experimental approach to model building, Linearization techniques, Modeling of chemical process plant, Heat exchanger, Binary distillation column, Chemical reactor, Iron making and steel making; models. Turbo-generators in electric power systems, nonlinear mathematical model, Generator, Exciter, And transmission system, Boiler and turbine. Manufacturing systems, Mechanization and automation,Numerical control, Computer-aided manufacture, Illustrative examples. Simulation of physical systems. Measurements and control in closed loop control. Physical quantities and transducers. Static and dynamic specifications of transducers. Displacement, velocity, and acceleration transducers. Strain gauges and Wheatstone bridge. Thermal transducers. Pressure, flow, and level transducers. Analog signal conditioning and transmission. Digitizing analog signals (D/A, A/D). Data acquisition systems in digital control loops. PC interfaces through standard I/O bus cards and parallel and serial interfaces and their drivers. Programmable controllers. Power interfacing (power amplifiers, thyristors). Control valves. Electronic/pneumatic PID controllers.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	10%		10%	60%

CSE371	Control Engineering			3 CH
Prerequisites	Signals and Systems Fundamentals or Signals and Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to feedback control systems. Characteristics of closed loop systems. Advantages and disadvantages of feedback. Obtainment of transfer functions along with illustrative examples. Block diagram reduction. Signal flow graphs. Sensitivity to parameter variation. Performance of control systems. Standard test signals. Time response of first and second order systems and response specs. Identifications of systems from time response. Static error analysis. Classical controllers P, PI, PD, PID. Routh - Method for stability analysis. Root locus. Frequency response. Identifications of systems from frequency response. Design of PID controllers and compensators. State space representation in canonical forms. State feedback gain matrix design method. Observability and controllability analysis.				
Used in Program / Level				
Program Name or requirement			Study Level	
Electrical Engineering Requirement			3	
Computer Engineering and Software Systems Program			2	
Communication Systems Engineering Program			3	
Assessment Criteria				

Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	10%	10%	60%

CSE372	Simulation of Engineering Systems					2 CH
Prerequisites	Probability and Statistics					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Introduction to simulation of engineering systems. Continuous-time and discrete-time systems simulation. Statistical models in simulation. Overview of basic probability and statistics. Selecting input probability distribution. Random number generators. Random variate generation. Simulation of a single server queueing system. Simulation of an Inventory system. Simulation of discrete-event and hybrid systems using Petri nets. Simulation of discrete-event systems using Grafcet. Building valid and credible simulation models. Desirable features of simulation software. Some simulation software examples.						
Used in Program / Level						
Program Name or requirement				Study Level		
Computer and Systems Engineering Program Elective				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20%	10%		10%		60%	

CSE373	Digital Control Systems					2 CH
Prerequisites	Control Engineering					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Z-Transform and pulse transfer function-Representation of digital system using difference equation. The stability of a digital system. Design a digital controller from a continuous controller-Implement a digital filter-Represent a system in digital state space-Design and tune a digital PID controller-Design a digital controller using pole placement and polynomial equations-Simulate a digital system on Matlab. Understand the robustness of a control design-Digital optimal control.						
Used in Program / Level						
Program Name or requirement				Study Level		
Computer and Systems Engineering Program Elective				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20%	10%		10%		60%	

CSE374	Digital Image Processing			2 CH
Prerequisites	Signals and Systems Fundamentals			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the theory and applications of 2D signal and image processing: 2D signals and systems analysis, 2D sampling and quantization, 2D signals and image transforms, 2D FIR filter design. Image formation. Image enhancement. Image restoration. Image coding. Image reconstruction from projections. Image compression. Color image processing. Image segmentation. Morphological operations. Super resolution. Wavelets and image pyramids.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE375	Machine Learning and Pattern Recognition			2 CH
Prerequisites	Probability and Statistics, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to Machine Learning: Concepts, Instances, Attributes, Simple Examples, Application Domains.Machine Learning and Statistics. Data Preprocessing and Exploration: Sampling, Principal ComponentAnalysis, Feature Extraction, Exploratory Data Analysis. Fundamental Classification Strategies. Clustering Techniques. Statistical and structural pattern recognition approaches. Bayesian decision theory. Maximum-Likelihood and Bayesian parameter estimation. Nearest neighbor rule. Non-parametric classifiers. Linear discriminate functions. Non-linear classifiers. Multi-layer neural networks. Features selection. Template matching. Unsupervised learning and Cluster analysis. Supervised learning.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE376	Digital Signals Processing			2 CH
Prerequisites	Signals and Systems Fundamentals			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	5		Equivalent ECTS	125
Course Content				
Z-transform and its properties, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), Circular convolution, block convolution, digital filters, FIR design, IIR design. Multi-Rate processing, Experiments in the field of signal processing supporting the course's theoretical content.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE377	Pattern Recognition			2 CH
Prerequisites	Signals and Systems Fundamentals			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to pattern recognition, Statistical and structural approaches, Bayesian decision theory, Maximum-Likelihood and Bayesian parameters estimation, Nearest neighbor rule, Non-parametric classifiers, Decision trees, Unsupervised classification and clustering, Linear discriminate functions, Non-linear classifiers, Classifiers comparison, Multi-layer neural networks, Back-propagation, Hidden Markov models, Principal component analysis, Features selection, Template matching, Unsupervised learning and cluster analysis.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE378	Computer Graphics			2 CH
Prerequisites	Mathematics (2), Advanced Computer Programming			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to computer graphics hardware, algorithms, and software. Graphics Programming, OpenGL. Displaying images. 3D transformations. Light and shading. Ray tracing. Hidden surface removal. Color technology. Image morphing. Texture mapping. Line drawing. Local illumination models. Curves and Surfaces. Geometric Modeling. Animation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE379	Human Computer Interaction			2 CH
Prerequisites	Advanced Software Engineering			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction. Iterative design processes, interactive prototype construction, discount evaluation techniques. Fundamental methods, principles and tools for designing, programming, and testing interactive systems. Usability, user-centered design, information and interactivity structures, interaction styles, interaction techniques, and user interface software tools with aspecial focus on mobile user interfaces. Mobile interaction, augmented-reality, tangible user interfaces, and ubiquitous computing. Interaction techniques: use of voice, gesture, and eye movements.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE381	Introduction to Machine Learning			2 CH
Prerequisites	Probability and Statistics, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. Naïve Bayes. Decision Trees. Linear regression (single and multivariable). Logistic regression. Artificial Neural Networks. Support Vector Machines. Ensemble Methods. Randomized Optimization. Clustering algorithms. Principal component analysis. Reinforcement Learning. Recommender Systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE382	Data Mining and Business Intelligence			2 CH
Prerequisites	Probability and Statistics, Database Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction: definitions, data mining process, knowledge discovery in databases. Data preprocessing: data cleaning, data integration, data reduction, data transformation, data discretization. Data warehousing. Mining frequent patterns, association rules, correlation. Classification: k-nearest neighbors, multiple linear regression, logistic regression, decision tree, bayes classification, rule-based classification, model evaluation and selection, support vector machine, anomaly detection. Cluster analysis: partition methods, hierarchical methods, density methods. Outlier detection: statistical methods, proximity-based methods. Web mining: text and web-page preprocessing, inverted index, latent semantic indexing web search, web meta-search, social network analysis, web crawling. Business intelligence. Data mining tools. Applications of data mining to various application domains. Data mining case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

<table>
<tr><td>CSE471</td><td colspan="3">Robotic Systems</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Control Engineering</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>1</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction to Homogeneous Transformations, Forward Kinematics: The Denavit-Hartenberg-Convention, Inverse Kinematics, Velocity Kinematics, The Manipulator Jacobian, Dynamics, Independent Joint Control, Feedback Linearization, Robot programming and algorithms.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Computer and Systems Engineering Program Elective</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>10%</td><td>10%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>CSE472</td><td colspan="3">Artificial Intelligence</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Probability and Statistics, Discrete Mathematics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction. Artificial intelligence languages. Problem-solving in artificial intelligence. Problem-solving by searching: uninformed search, informed search, heuristic functions. Adversarial search and game theory. Expert Systems: rule-based systems, inference, probabilistic reasoning. Learning methodologies. Decision theory. Classification. Clustering. Neural Networks. Evolutionary Computation. Genetic Algorithms. Artificial intelligence applications.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Computer and Systems Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="3">Computer Engineering and Software Systems Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

CSE473	Computational Intelligence					2 CH
Prerequisites	Probability and Statistics, Computer Programming					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Definitions, learning theory, soft-computing paradigm. Fuzzy systems: Fuzzy sets and relations, operations on fuzzy sets, fuzzy logic, approximate reasoning, fuzzy control. Neural networks: machine learning using neural networks, supervised learning, unsupervised learning, competitive learning, reinforcement learning, neuro-dynamic programming, neuro-fuzzy systems. Evolutionary computation: genetic algorithms, genetic programming, genetic optimization, machine learning using genetic algorithms. Particle swarm optimization. Bayes networks. Artificial immune systems. Rough theory. Granular computing. Chaos theory. Tools used in developing computational intelligence algorithms. Applications: intelligent control systems, object recognition, applications in mobile robots.						
Used in Program / Level						
Program Name or requirement					Study Level	
Computer and Systems Engineering Program Elective					4	
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20%	10%		10%		60%	

CSE474	Visualization					3 CH
Prerequisites	Computer Graphics					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
3		1		1		
Required SWL	125		Equivalent ECTS		5	
Course Content						
Introduction. Perception and its applications. Graphical perception. Visual encoding principles. Interaction principles. Single-view methods. Multiple-view methods. Item reduction methods. Attribute reduction methods. Tabular data. Visualization toolkits. Graphs and trees. Flow visualization. Geo-spatial visualization. Volume visualization.Vector visualization. High-dimensional Visualization. Visualizing relational data. Design and evaluation. Visualizing structure. Visualizing time. Scaling.						
Used in Program / Level						
Program Name or requirement					Study Level	
Computer Engineering and Software Systems Program Elective					4	
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20%	20%		20%		40%	

CSE475	Biomedical Engineering			2 CH
Prerequisites	Probability and Statistics, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to mathematical modelling of physiological systems, Linear system approximation, Stochastic modelling, Cardiopulmonary system models, Myocardial mechanics, Cardiac energy and power analysis models, Models of gastrointestinal tract motility, Models of respiratory mechanics and chemical control of respiration.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE476	Fundamentals of Big-Data Analytics			2 CH
Prerequisites	Probability and Statistics, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Definition. Fundamentals of Big data technologies and tools. Distributed processing ecosystem. Big Data Storage and Analytics. Big data analytics machine learning algorithms. Graph analytics. Big data visualization.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer and Systems Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	10%	10%	60%	

CSE477	Fundamentals of Deep Learning						2 CH
Prerequisites	Machine Learning and Pattern Recognition						
Number of weekly Contact Hours							
Lecture			Tutorial		Laboratory		
2			1		1		
Required SWL	125		Equivalent ECTS		5		
Course Content							
Introduction to deep learning and its underlying theory, the range of applications to which it has been applied. Architectures commonly associated with deep learning, basic neural networks, convolutional neural networks and recurrent neural networks. Methods to train and optimize the architectures and methods to perform effective inference							
Used in Program / Level							
Program Name or requirement					Study Level		
Computer and Systems Engineering Program Elective					4		
Assessment Criteria							
Student Activities	Mid-Term Exam		Practical Exam		Final Exam		
20%	10%		10%		60%		

CSE478	Selected Topics in Systems and Artificial Intelligence						2 CH
Prerequisites							
Number of weekly Contact Hours							
Lecture			Tutorial		Laboratory		
2			1		1		
Required SWL	125		Equivalent ECTS		5		
Course Content							
Selected topics in recent developments in systems engineering and Artificial Intelligence will be presented in this course. Course material will reflect the needs of the graduating students							
Used in Program / Level							
Program Name or requirement					Study Level		
Computer and Systems Engineering Program					4		
Assessment Criteria							
Student Activities	Mid-Term Exam		Practical Exam		Final Exam		
20%	10%		10%		60%		

CSE479	Multimedia Engineering			3 CH
Prerequisites	Digital Image Processing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to multimedia. Image data representation. Color in image and video. Basics of digital audio. The creation of digital music and audio. Encoding and compression, segmentation, recognition and interpretation, 3D imagery. Speech coders: Speech signal analysis, Waveform coders, Voice coders, Hybrid coders. Voice over IP, Video over IP. Lossless compression algorithms. Lossy compression algorithms. JPEG, JPEG2000. Video compression techniques, MPEG-1, MPEG-2, MPEG-4, MPEG-7, H.261, H.263, H.264, H.265 High Efficiency Video Coding (HEVC). Audio compression techniques, Vocoders. MPEG audio compression. Quality of service. Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE481	Computer Animation			3 CH
Prerequisites	Computer Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction. Key-framing. Storyboarding. Animation software. Spacing and timing. Digital animation techniques. 2D and 3D animatics, special effects design, 3D paint techniques and integration. Sequence planning, non-photorealistic rendering. Kinematics, physically based dynamics modeling. Motion capture. Scene composition, lighting, and sound track generation. Visual effects process. Texture-mapping, rendering and camera tracking techniques. Live action films.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE482	Game Design and Development			3 CH
Prerequisites	Computer Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125	Equivalent ECTS		5
Course Content				
Introduction. The process of game development. The importance of testing, and how developers use the results of testing to improve their games. Advanced principles and practices of computer game design and programming. The different aspects of game development including 2D and 3D asset creation, rendering and animation, AI for games, programming, and testing				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE483	Computer Vision			3 CH
Prerequisites	Digital Image Processing			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125	Equivalent ECTS		5
Course Content				
Introduction. The analysis of the patterns in visual images with the view to understanding the objects and processes in the world that generates them. Image representation and processing. Feature extraction and selection. Object recognition and probabilistic inference. Dynamic and hierarchical processing. Multi-view geometry. Projective reconstruction. Tracking and density propagation. Visual surveillance and activity monitoring. Medical imaging. Applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE484	Big-Data Analytics			3 CH
Prerequisites	Probability and Statistics, Computer Programming			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
3		1	1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Definition and taxonomy. Challenges, trends, and applications. Big data technologies and tools. The Hadoop ecosystem. The Map-reduce paradigm. Big Data Storage and Analytics. Big data analytics machine learning algorithms. Graph analytics. Big data visualization.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE485	Deep Learning			3 CH
Prerequisites	Introduction to Machine Learning			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
3		1	1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Deep Learning algorithms learn multi-level representations of data, with each level explaining the data in a hierarchical manner. Such algorithms have been effective at uncovering underlying structure in data, e.g., features to discriminate between classes. They have been successful in many artificial intelligence problems including image classification, speech recognition and natural language processing. The course, which will be taught through lectures and projects, will cover the underlying theory, the range of applications to which it has been applied, and learning from very large data sets. The course will cover connectionist architectures commonly associated with deep learning, e.g., basic neural networks, convolutional neural networks and recurrent neural networks. Methods to train and optimize the architectures and methods to perform effective inference with them, will be the main focus. Students will be encouraged to use open source software libraries such as Tensorflow, PyTorch, and Keras.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	20%	40%	

CSE486	Bioinformatics			3 CH
Prerequisites	Database Systems			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Fundamental biological, mathematical and algorithmic models underlying bioinformatics. Sequence analysis. Database search. Gene prediction. Molecular structure comparison and prediction. Phylogenetic trees. High throughput biology. Massive datasets. Applications in molecular biology and genetics. Use and extension of common bioinformatics tools.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE487	Selected Topics in Multimedia and Computer Graphics			3 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Selected topics in recent directions in multimedia and computer graphics will be presented in this course.				
Used in Program / Level				
Program Name or requirement			Study Level	
Computer Engineering and Software Systems Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		20%	40%

CSE488	Ontologies and the Semantic Web				3 CH
Prerequisites	Artificial Intelligence				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Logic-based knowledge representation. Basic reasoning tasks. Modelling in description logics: informal examples, ontologies, models and consistency of knowledge bases. Formal syntax and semantics. Reasoning tasks and the associated algorithms. Correctness proofs. Fasic reasoning tasks and their relations: concept satisfiability, subsumption, instance checking. Tableau-like algorithms and their implementation. Knowledge bases. ABoxes, reasoning over ABoxes, algorithms and implementation. Semantic web. Semantic web standards.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer Engineering and Software Systems Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

CSE489	Selected Topics in Data Science				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		1		1	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Selected topics in recent directions in data science will be presented in this course.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer Engineering and Software Systems Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		20%	40%	

E10.9 Graduation Projects

CSE491	Computer & Systems Engineering Graduation Project (1)				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		0		5	
Required SWL	150		Equivalent ECTS	6	
Course Content					
This course represents the first part of the graduation project, where the students work in the graduation projects under the supervision of faculty members.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer and Systems Engineering Program				4	
Computer Engineering and Software Systems Program				4	
Assessment Criteria					
Student Activities		Thesis		Final Exam	
40%		20%		40%	

CSE492	Computer & Systems Engineering Graduation Project (2)				3 CH
Prerequisites	Computer & Systems Engineering Graduation Project (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
0		0		5	
Required SWL	150		Equivalent ECTS	6	
Course Content					
As a continuation of the first part of the graduation project, the students continue work in the graduation projects under the supervision of faculty members.					
Used in Program / Level					
Program Name or requirement				Study Level	
Computer and Systems Engineering Program				4	
Computer Engineering and Software Systems Program				4	
Assessment Criteria					
Student Activities		Thesis		Final Exam	
40%		20%		40%	

E11. Courses offered by Structural Engineering Department (CES)

The Structural Engineering Department is responsible for teaching courses that serve the following programs:

1. Several Basic Civil Engineering courses as a Civil Discipline Requirement.
2. Water Engineering and Hydraulic Structures Program.
3. Structural Engineering Program.
4. Utilities and Infrastructure Program.
5. Building Engineering Program.
6. Civil and Infrastructure Engineering Program

Table 62: List of specializations at the Structural Engineering Department.

#	Specialization
1	Structural Analysis Engineering
2,3	Reinforced Concrete Structures Engineering
4	Steed Structures Engineering
5	Properties and Testing of Materials Engineering
6	Geotechnical Engineering
7,8	Construction Management Engineering
9	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl Level
CH Credit Hour
ECTS European Credit Transfer System
SWL Student Work Load
Lec Lectures
Tut Tutorials
Lab Laboratory
TT Total

UR University Requirement
FR Faculty Requirement
DR Discipline Requirement
PR Program Requirement

SA Student Activities
MT Mid-Term Exam
PE Practical Exam
FE Final Exam

Table 63 List of CES courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Structural Analysis Engineering																				
1	1	111	Structural Mechanics (1)	4	4	100	3	2	0	5			x		20	20	0	60	PHM032	
2		112	Structural Mechanics (2)	4	4	100	3	2	0	5			x		20	20	0	60	CES111	
3		113	Structural Mechanics	3	6	150	2	2	0	4			x		35	25	0	40	PHM012	PHM031
4		114	Strength of Materials	3	5	125	2	2	0	4			x		35	25	0	40	CES113	
5		115	Structural Analysis for Architecture Engineering	2	3	75	1	2	0	3			x		30	30	0	40	PHM031	
6	2	211	Structural Analysis (1)	3	3	75	2	2	0	4			x		20	20	0	60	CES112	
7		212	Structural Analysis (2)	3	3	75	2	2	0	4			x		20	20	0	60	CES211	
8		213	Structural Analysis	3	5	125	2	2	0	4				x	35	25	0	40	CES114	
9	3	311	Structural Analysis (3)	3	3	75	2	2	0	4				x	20	20	0	60	CES212	
10		312	Structural Dynamics	3	3	75	2	2	0	4				x	20	20	0	60	CES311	
11		313	Computer Aided Structural Design	2	4	100	2	1	0	3				x	20	20	0	60	CES222	CES341
12		314	Computer Applications in Structural Design	3	5	125	3	0	2	5				x	25	20	15	40	CES224	CES241
13		315	Introduction to Structural Dynamics	3	6	150	3	1	0	4				x	35	25	0	40	PHM032	CES213
14	4	411	Advanced Structural Analysis	2	3	75	2	1	0	3				x	20	20	0	60	CES312	
15		412	Finite Element Method	2	4	100	2	1	0	3				x	20	20	0	60	CES312	
16		413	Earthquake Engineering	2	4	100	2	1	0	3				x	20	20	0	60	CES312	
17		414	Dynamic Floor Vibrations	2	4	100	2	1	0	3				x	20	20	0	60	CES312	
2. Reinforced Concrete Structures Engineering																				
18	2	221	Concrete Design (1)	2	3	75	2	1	0	3			x		20	20	0	60	CES112	
19		222	Concrete Design (1)	2	3	75	2	1	0	3			x		20	20	0	60	CES221	
20		223	Design Principles	1	2	50	1	1	0	2			x		20	20	0	60	CES221	
21		224	Concrete Structures Design (1)	3	6	150	2	3	0	5			x		35	25	0	40	CES114	CES151
22		225	Concrete & Steel Structures for Arch. Engineering	3	4	100	2	2	0	4			x		20	40	0	40	CES115	
23		226	Concrete Structures for Architectural Engineering	2	4	100	1	2	0	3				x	30	30	0	40	CES115	
24	3	321	Design of Concrete Floors	3	4	100	2	2	0	4			x		20	20	0	60	CES222	
25		322	Design of Concrete Halls	3	4	100	2	2	0	4			x		20	20	0	60	CES321	
26		323	Construction Techniques	2	4	100	2	1	0	3				x	20	20	0	60	CES321	
27		324	Concrete Structures Design (2)	3	6	150	2	3	0	5			x		35	25	0	40	CES213	CES224
28		325	Construction Engineering	3	7	175	2	2	0	4				x	35	25	0	40	CES371	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
29	4	421	Design of Prestressed Concrete and Bridges	3	5	125	2	2	0	4				x	20	20	0	60	CES322	/CES324/
30		422	Special Topics in Concrete Design	3	5	125	2	2	0	4				x	20	20	0	60	CES421	
31		423	Design of Concrete Bridges	2	4	100	2	1	0	3				x	20	20	0	60	CES322	
32		424	Masonry Structures	2	4	100	2	1	0	3				x	20	20	0	60	CES322	
33		425	Design of Civil Structures	3	5	125	2	2	0	4				x	20	20	0	60	CES322	
34		426	Design of Water Concrete Structures	2	4	100	2	1	0	3				x	20	20	0	60	CES322	
35		427	Concrete Structures Design (3)	3	5	125	2	3	0	5				x	35	25	0	40	CES324	CES365
36		428	Masonry	3	5	125	2	2	0	4				x	35	25	0	40	CES224	
37		429	Advanced Design of Reinforced Concrete Structures	3	5	125	2	2	0	4				x	35	25	0	40	CES324	
38		430	Construction Methods and Techniques	2	4	100	2	1	0	3				x	35	25	0	40	CES271	
4. Steel Structures Engineering																				
39	2	241	Steel Structures Design (1)	3	6	150	2	3	0	5			x		35	25	0	40	CES151	CES114
40	3	341	Design and Behavior of steel Structures (1)	3	5	125	2	2	0	4			x		20	20	0	60	CES212	
41		342	Design and Behavior of steel Structures (2)	3	5	125	2	2	0	4			x		20	20	0	60	CES341	
42		343	Behavior of Steel Structures	2	4	100	2	1	0	3				x	20	20	0	60	CES341	
43		344	Steel Structures Design (2)	3	6	150	2	3	0	5			x		35	25	0	40	CES213	CES241
44		345	Steel Structures for Architectural Engineering	2	4	100	1	2	0	3				x	30	30	0	40	CES115	
45	4	441	Design of Steel Bridges (1)	3	5	125	2	2	0	4				x	20	20	0	60	CES342	
46		442	Design of Steel Bridges (2)	2	5	125	2	1	0	3				x	20	20	0	60	CES441	
47		443	Steel Plated Structures	2	4	100	2	1	0	3				x	20	20	0	60	CES342	
48		444	Construction of Steel Structures	2	4	100	2	1	0	3				x	20	20	0	60	CES342	
49		446	Steel Structures Design (3)	3	5	125	2	2	0	4				x	35	25	0	40	CES344	
50		447	Advanced Design of Steel Structures	3	5	125	2	2	0	4				x	35	25	0	40	CES344	
5. Properties and Testing of Materials Engineering																				
51	1	151	Structures and Properties of Construction Materials	2	4	100	2	1	1	4		x			25	15	10	50	PHM032	
52		152	Properties and Testing of Materials	2	4	100	2	1	1	4			x		25	15	10	50	CES151	
53	2	251	Concrete Technology (1)	3	4	100	2	2	2	6			x		25	15	10	50	CES151	
54		252	Concrete Technology (2)	3	4	100	3	1	1	5			x		25	15	10	50	CES251	
55	3	351	Advanced Composite Materials	2	4	100	2	1	0	3				x	20	20	0	60	PHM021	CES252

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
56		451	Repair and Strengthening of Structures	2	3	75	2	1	0	3				x	25	15	0	60	CES222	CES252
57		452	Special Types of Concrete	2	4	100	2	1	0	3				x	20	20	0	60	CES252	
58	4	453	Sustainability of Construction and Building Physics	2	4	100	2	1	0	3				x	20	20	0	60	CES252	
59		454	Modern Building Materials	3	5	125	3	1	0	4				x	35	25	0	40	CES224	CES252
60		455	Materials and Technologies for Sustainable Construction	3	5	125	3	1	0	4				x	35	25	0	40	CES454	
6. Geotechnical Engineering																				
61	1	161	Geology	2	3	75	2	1	0	3			x		35	25	0	40	PHM041	
62		261	Geology and Geotechnical Engineering	2	3	75	2	1	1	4			x		15	15	20	50	CES112	
63	2	262	Geotechnical Engineering (1)	2	3	75	2	1	1	4			x		15	15	20	50	CES261	
64		263	Soil Mechanics (1)	4	6	150	2	3	2	7			x		25	20	15	40	CES151	CES161
65		361	Geotechnical Engineering (2)	2	3	75	2	1	0	3			x		25	15	0	60	CES262	
66		362	Foundation Engineering (1)	3	3	75	2	2	0	4				x	25	15	0	60	CES361	
67	3	363	Geotechnical Site Characterization	2	4	100	2	1	0	3				x	20	20	0	60	CES361	
68		364	Soil Mechanics (2)	3	6	150	2	2	0	4			x		25	20	15	40	CES263	
69		365	Foundation Design (1)	3	5	125	2	2	0	4			x		35	25	0	40	CES324	CES364
70		461	Foundation Engineering (2)	2	3	75	2	1	0	3				x	25	15	0	60	CES362	
71		462	Ground Improvement	2	4	100	2	1	0	3				x	20	20	0	60	CES362	
72		463	Computer Application in Geotechnical Engineering	2	4	100	2	1	0	3				x	20	20	0	60	CES362	
73	4	464	Geotechnical Engineering for Infrastructures	2	4	100	2	1	0	3				x	25	15	0	60	CES362	
74		465	Foundation Engineering of Water Structures (1)	3	5	125	2	2	0	4				x	25	15	0	60	CES361	
75		466	Foundation Engineering of Water Structures (2)	2	4	100	2	1	0	3				x	25	15	0	60	CES466	
76		467	Foundation Design (2)	3	5	125	2	2	0	4				x	35	25	0	40	CES365	
7. Construction Management Engineering																				
77	1	171	Construction Management	2	3	75	2	1	0	3		x			20	20	0	60	PHM032	
78		172	Engineering Economics and Finance	2	3	75	2	1	0	3			x		35	25	0	40	PHM032	
79	2	271	Project Management Essentials	2	3	75	2	1	0	3			x		35	25	0	40	CES172	
80		371	Management of Project Resources	2	4	100	2	1	0	3				x	20	20	0	60	CES171	
81	3	372	Construction Planning and Scheduling	3	5	125	2	2	0	4				x	35	25	0	40	CES172	
82		373	Construction Cost Management	3	5	125	2	2	0	4				x	35	25	0	40	CES371	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
83	4	471	Construction Project Management	3	4	100	2	2	0	4				x	20	20	0	60	CES322	
84		472	Risk and Safety Management	2	4	100	2	1	0	3				x	20	20	0	60	CES471	
85		473	Construction Contracts and Cost Estimation	2	4	100	2	1	0	3				x	20	20	0	60	CES471	
86		474	Resources Management	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
87		475	Risk and Safety Management	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
88		476	Legal Issues in Construction	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
89		477	Computer Applications in Construction Management	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
90		478	Quantity Surveying and Estimating	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
91		479	Planning and Scheduling of Repetitive Projects	2	4	100	2	1	0	3				x	35	25	0	40	CES271	
92		480	Environmental Risk Management	3	5	125	2	2	0	4				x	35	25	0	40	CES371	
9. Graduation Project																				
93	4	491	Structural Engineering Graduation Project (1)	2	5	125	0	4	0	4				x	75	0	0	25	Elect.(1)	
94		492	Structural Engineering Graduation Project (2)	4	9	225	0	8	0	8				x	75	0	0	25	CES491	
95		493	Building Engineering Design Graduation Project (1)	3	8	200	1	4	0	5				x	60	0	0	40		
96		494	Senior Seminar	2	3	75	0	4	0	2				x	60	0	0	40	CES493	
97		495	Building Engineering Design Graduation Project (2)	3	9	225	1	4	0	5				x	60	0	0	40	CES493	

E11.1 Structural Analysis Engineering Courses

CES111	Structural Mechanics (1)			4 CH
Prerequisites	Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction: types of structures, types of supports, types of loads, determinacy, equilibrium and stability of structures. Analysis of statically determinate structures: calculation of reactions, calculation of internal forces (normal force, shearing force and bending moments) for plane structures: beams, trussed beams, inclined beams, frames, closed frames, arches and trusses. Analysis of beams, frames and trusses under moving loads using the influence lines diagrams.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Building Engineering Program			1	
Civil and Infrastructure Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES112	Structural Mechanics (2)			4 CH
Prerequisites	Structural Mechanics (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Normal Stresses: properties of plane areas, straining actions, distribution of normal stresses in homogeneous sections, distribution of normal stresses in heterogeneous sections, core of cross sections. Shear stresses: Shear Stresses in homogeneous section due to shearing force and torsion moments, shear stresses on bolts, riveted (bolted) and welded connections due to shearing force and torsion moments. Combined stresses analytically and graphically using Mohr’s circle.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Building Engineering Program			1	
Civil and Infrastructure Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

<table>
<tr><td colspan="4">CES113</td><td colspan="7">Structural Mechanics</td><td>3 CH</td></tr>
<tr><td colspan="4">Prerequisites</td><td colspan="8">Mathematics (1) & Statics</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">150</td><td colspan="3">Equivalent ECTS</td><td colspan="3">6</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Introduction: types of structures, types of supports, types of loads, determinacy, equilibrium and stability of structures. Analysis of statically determinate structures: calculation of reactions, calculation of internal forces (normal force, shearing force and bending moments) for plane structures: beams, trussed beams, inclined beams, frames, closed frames, arches and trusses. Analysis of beams, frames and trusses under moving loads using the influence lines diagrams.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Building Engineering Program</td><td colspan="4">1</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program</td><td colspan="4">1</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="4">CES114</td><td colspan="7">Strength of Materials</td><td>3 CH</td></tr>
<tr><td colspan="4">Prerequisites</td><td colspan="8">Structural Mechanics</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Properties of homogeneous cross section, straining actions and stresses distribution in these sections, when subjected to axial, flexural, shearing and torsional loadings. Analytical determination of combined and principal stresses.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Building Engineering Program</td><td colspan="4">1</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program</td><td colspan="4">1</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

CES115	Structural Analysis for Architecture Engineering			2 CH
Prerequisites	Statics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
General principles of structural analysis, Loads, Forces and moments, Reactions, Stable and unstable structures, Internal forces in statically determinate structures (beams, frames and trusses), Internal stresses (normal stresses and shear stresses), Deformations of statically determinate beams.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			1	
Housing and Urban Development Program			1	
Environmental Architecture and Urbanism Program			1	
Landscape Architecture Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	30%	0%	40%	

CES211	Structural Analysis (1)			3 CH
Prerequisites	Structural Mechanics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Deflection using double integration, conjugate beam, and virtual work methods. Analysis of statically indeterminate structures: The Force Methods (consistent deformations method and equation of three moments method). Use of the virtual work method for analysis of statically indeterminate structures				
Used in Program / Level one				
Program Name or requirement			Study Level	
Civil Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES212	Structural Analysis (2)		3 CH
Prerequisites	Structural Analysis (1)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
Analysis of statically indeterminate structures using Displacement Methods (slope deflection method and moment distribution method). Introduction to Stability of Structures, Euler load, Stability of Truss elements, Stability of Beams and Columns.			
Used in Program / Level	one		
Program Name or requirement	Study Level		
Civil Engineering Requirement	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

CES213	Structural Analysis		3 CH
Prerequisites	Strength of Materials		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Deflection using virtual work method. Analysis of statically indeterminate structures: general method of deformations (consistent deformations), three moments equation method and moment distribution method. Introduction to matrix methods: stiffness method.			
Used in Program / Level			
Program Name or requirement	Study Level		
Building Engineering Program	2		
Civil and Infrastructure Engineering Program	2		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

CES311	Structural Analysis (3)			3 CH
Prerequisites	Structural Analysis (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Analysis of statically indeterminate structures using stiffness method (matrix approach): bar and spring elements, beams, frames, grids and trusses. Formulation of element stiffness matrices, and global stiffness matrix. External load vectors. Implementation of Restraint and Constraint equations. Computer Applications.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES312	Structural Dynamics			3 CH
Prerequisites	Structural Analysis (3)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Structural dynamics of single degree of freedom systems: Classification of structural systems, damped and undamped free vibration, Forced vibration. Response to harmonic excitation. Support motion. Numerical evaluation of dynamic response, Earthquake response, generalized single degree of freedom analysis. Introduction to multi-degree of freedom systems. Computer applications.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Building Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

<table>
<tr><td>CES313</td><td colspan="4">Computer Aided Structural Design</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Concrete Design (2) and Design and Behavior of Steel Structures (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Introduction: Overview of F.E.M for Beam Element -Plates and Shells-Modeling of 2-D. Structures: (Beams - Frames - Trusses). Modeling of solid slabs-One way, Two way and Hollow Blocks. Modeling of surfaces of revolution. Modeling of 3-D Frames (Steel and concrete). Modeling of foundations on elastic supports. Development of 3-D models for Retaining walls and Water tanks. Interface between F.E. programs and Auto- Cad program. Interface between F.E. programs and Column design programs. Sensitivity of structures to boundary conditions variation. A design project is an integral part of this course.</td></tr>
<tr><td colspan="6">Used in Program / Level one</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Civil Engineering Requirement (Elective (1))</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>CES314</td><td colspan="4">Computer Applications in Structural Design</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Concrete Structures Design (2), Steel Structures Design (2)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">3</td><td colspan="2">0</td><td colspan="2">2</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Building engineering design process: methodology, identification of objectives, Building codes, formulation of design problems. Preliminary building design: synthesis and design of structures using computer-aided design tools. Performance evaluation using modeling, sensitivity analysis and cost estimation. Introduction - Overview of F.E.M for Beam Element -Plates and Shells-Modeling of 2-D structures (Beams-Frames - Trusses). Modeling of solid slabs-One way, Two-way Hollow Blocks. Modeling of surfaces of revolution. Modeling of 3-D Frames (Steel and concrete). Modeling of foundations on elastic supports (isolated footing-combined footing-raft foundation-piles foundations). Lateral load analysis of 3-D Frames using equivalent static load method and response spectrum method. Retaining walls and Water Circular - Rectangular tanks (Elevated tanks – Rested on Ground – Under Ground tanks). Interface between F.E. programs and Auto-Cad program. Interface between F.E. programs and P.C.A. Columns. Sensitivity of structures to boundary conditions variation. A design project is an integral part of this course.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program Elective</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>20%</td><td colspan="2">15%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>CES315</td><td colspan="3">Introduction to Structural Dynamics</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Dynamics, Structural Analysis</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">3</td><td>1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>150</td><td>Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Theory of vibration, types of dynamic loads, dynamic equilibrium of structures, response of a single degree of freedom system to dynamic excitation: free vibration, harmonic loads, pulses and earthquakes, response of multi-degree of freedom systems, response spectra, basic concepts in earthquake resistant design, computer applications.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Building Engineering Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td>0%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>CES411</td><td colspan="3">Advanced Structural Analysis</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Structural Dynamics</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>75</td><td>Equivalent ECTS</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Plastic analysis of beams and frames: Definitions, Material behavior, Assumptions, Theories of plastic analysis, Applications on beams and frames, Effect of normal forces. Lateral load analysis of structures: Structural behavior of lateral load resisting elements. Distribution of lateral load resisting elements in plan: Approximate methods of frame analysis: Portal method, Cantilever method. Concepts of Center of mass, Center of rigidity. Introduction to computer analysis and modeling of buildings subjected to lateral loads. Introduction to Pushover analysis of structures.</td></tr>
<tr><td colspan="5">Used in Program / Level one</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Structural Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

CES412	Finite Element Method			2 CH
Prerequisites	Advanced Structural Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Direct perturbation method in deriving stiffness matrix. Assemblage of stiffness matrices of discrete elements and minimum matrix band width. A-Method in deriving element shape functions. Different stress-strain relationships (3-D, plane stress, and plane strain). Lagrangian method in deriving elements shape functions. Energy approach in deriving stiffness matrix. Application of energy method in deriving stiffness matrix for multi-node truss and beam element. Application of energy method in deriving stiffness matrix for Plane stress and plane strain element. Applications using computer software.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (2))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES413	Earthquake Engineering			2 CH
Prerequisites	Advanced Structural Analysis			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Seismology, and measurements the magnitude and energy of earthquakes. Dynamic response of SDOF to general dynamic loads. Duhamel Integral for un-damped and damped system. Dynamic response of SDOF to ground excitation. Response spectrum curves. Combined response spectrum curve for spectral displacement, Pseudo velocity, and Pseudo acceleration. Construction of the codes design spectral curves. Orthogonality properties of the mode shapes. Normalization of the mode shapes. Modal superposition method. Analysis of shear frames using modal superposition method. Response spectrum analysis for building subjected to earthquakes.				
Used in Program / Level	one			
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (2))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES414	Dynamic Floor vibrations				2 CH
Prerequisites	Advanced Structural Analysis				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Course Contents. Basic vibration terminology. Acceptance criteria for human comfort and its historical development. Walking excitation. Rhythmic excitation. Natural frequency for steel frame system. Natural frequency for different reinforced concrete floor system. Design for walking excitation. Design for rhythmic excitation. Design for sensitive equipment. Evaluation of vibration problems and remedial measures. Along and across wind acceleration for tall building. Steady state analysis and power-spectrum-density analysis for floor system subjected to deterministic and probabilistic equipment vibration.					
Used in Program / Level	one				
Program Name or requirement			Study Level		
Structural Engineering Program (Elective (2))			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

E11.2 Reinforced Concrete Structures Engineering Courses

<table>
<tr><td colspan="2">CES221</td><td colspan="5">Concrete Design (1)</td><td>2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">Structural Mechanics (2)</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="2">1</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">75</td><td colspan="2">Equivalent ECTS</td><td colspan="2">3</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Introduction to building systems. TypesofBuildings.Load distribution on floors.Loads and load combinations. Design philosophies.Flexural behavior of beams. Flexural design of beams using first principles.Flexural design using charts.Design for shear.Design for shear and torsion.BondandDevelopmentLength.Detailing of RC Beams</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="6">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="6">Civil Engineering Requirement</td><td colspan="2">2</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td colspan="2">CES222</td><td colspan="5">Concrete Design (2)</td><td>2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">Concrete Design (1)</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="2">1</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">75</td><td colspan="2">Equivalent ECTS</td><td colspan="2">3</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Design of RC short columns. Design of Ties.Design for combined axial forces and flexure.Design of slender columns. Serviceability Limit States.Calculations of deflection and crack width.Introduction to strut and tie method.Design of statically determinate RC frames.Detailing of RC frames.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="6">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="6">Civil Engineering Requirement</td><td colspan="2">2</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

CES223	Design Principles			1 CH
Prerequisites	Concrete Design (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		1	0	
Required SWL	50	Equivalent ECTS	2	
Course content				
Basics of design. Design methods. Type of loads (direct loads, environmental loads, accidental loads).Design philosophy. Limit state design (LRFD). Performance based concept. Load path. Theory of elasticity for flow of forces. Physical meaning of straining actions on different structural elements. columns. beams. slabs. etc.Design process. Safety concept for different structural materials. Overall view about the design codes and their role. Basics of computer aided design tools needed in design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES224	Concrete Structures Design (1)			3 CH
Prerequisites	Strength of Materials, Structure and Properties of Construction Materials			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		3	0	
Required SWL	150	Equivalent ECTS	6	
Course Content				
Methods of design; Codes; Structural systems, load determination and distribution. Behavior and limit states design of reinforced concrete section subjected to bending moments. Design using limit states method; Section subjected to bending, shear, torsion and axial force; Reinforcement details for beams. Development and curtailment of reinforcement for beams. Serviceability limits states.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CES225	Concrete & Steel Structures for Arch. Engineering			3 CH
Prerequisites	Structural Analysis for Architecture Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Reinforced Concrete systems; students will know about the physical and mechanical properties of concrete and reinforcing steel. They will study the structural systems of slabs (solid, hollow block, ribbed, flat slab and paneled beams), in addition to knowing about the different loads the building may experience and how does the structure system distribute and transfer these loads. Students will study rules of thump to make a primary design of the main structure system elements such as slabs, beams, columns, stairs, and other elements. Steel structures; students will know about the main concepts and considerations of the steel structure system design. They will study: the structural systems, lateral resistance and bracing systems. In addition, they will study: the structural behavior of members, an Introduction to design philosophies, the different threats the steel structure system may experience and how to deal with.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			2	
Housing and Urban Development Program			2	
Landscape Architecture Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	40%	0%	40%	

CES226	Concrete Structures for Architectural Engineering			2 CH
Prerequisites	Structural Analysis for Architecture Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		2	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Structural systems of buildings (wall bearing, skeleton). Physical and mechanical properties of concrete andreinforcing steel. Loads on buildings, Load distribution on beams. Behavior and design of reinforced concretebeams (simple, continuous and cantilever beams). Behavior and design of axially loaded short columns. Studystructural systems of slabs (solid, hollow block, ribbed, flat slab and paneled beams). Behavior and design ofreinforced concrete solid slabs (one or two way). Structural systems of stairs. Structural systems of reinforcedconcrete halls (frames, domes, cones, surfaces of revolution, folded plates, shells, … etc.).				
Used in Program / Level				
Program Name or requirement			Study Level	
Environmental Architecture and Urbanism Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
30%	30%	0%	40%	

CES321	Design of Concrete Floors			3 CH
Prerequisites	Concrete Design (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to floor systems. Design of solid slabs. Design of ribbed slabs. Design of flat and waffle slabs. Design of paneled beams. Design of stairs. Computer modeling of floor systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES322	Design of Concrete Halls			3 CH
Prerequisites	Design of Concrete Floors			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Design of statically indeterminate frames. Design of polygons. Design of arch girders. Design of trusses. Design of Vierendeel's.Design of arch slabs.Design of folded plates. Design of surfaces of revolution.Design of saw-tooth roofs. Calculation of wind loads. Design of end gables.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES323	Construction Techniques (Elective 1)			2 CH
Prerequisites	Design of Concrete Floors			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Presentation of the different construction methods used in construction of concrete structures. Presentation of the different shuttering systems including wooden and metallic shuttering, scaffolding system, tunnel forms, climbing forms and slip forms. Illustration of practical examples for these construction methods.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (1))			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES324	Concrete Structures Design (2)			3 CH
Prerequisites	Structural Analysis, Concrete Structures Design (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Design of reinforced concrete slabs: solid slabs, ribbed slabs, panelled beams slab, flat slabs (beamless slabs), stairs; Design of sections under eccentric forces; Characteristics of interaction curves and their application in design; Design and reinforcement details of concrete slender columns. Design of reinforced concrete frames. Types and details of joints in RC structures.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			3	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CES325	Construction Engineering			3 CH
Prerequisites	Construction Planning and Scheduling			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	175		Equivalent ECTS	7
Course Content				
The nature of construction and the environment in which the industry works, organizational structures for project delivery, construction contracts and documents, introduction to construction processes: excavation and site works, foundation layout, concrete, steel, and masonry construction, prestressed construction, precast construction, horizontal and vertical concrete formworks, special bridge formworks, concrete form design, project planning, scheduling, and control, construction safety.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CES421	Design of Prestressed Concrete and Bridges			3 CH
Prerequisites	Design of Concrete Halls or Concrete Structures Design (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Prestressed concrete concepts. Prestressing losses. Statically determinate prestressed structures. Design of end anchorage zone. Limit state of flexure and shear. Statically indeterminate prestressed structures. Bridge loading and load combinations. Bridge planning and systems. Design of concrete box-girder bridges. Basics of precast concrete.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program			4	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

<table>
<tr><td>CES422</td><td colspan="3">Special Topics in Concrete Design</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Design of Prestressed Concrete and Bridges</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td>2</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Introduction to seismology and earthquake engineering and basic dynamics. Seismic design concepts (Equivalent static, Response spectrum, Time history). Lateral load resisting system design (Shear walls, Frames, Coupled shear walls behavior and detailing and computer modeling).Design of water section and crack control concept.Statics and load distribution for elevated, rested and underground tanks and computer modeling.Structural detailing and reinforcement distribution in water tanks.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Structural Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>CES423</td><td colspan="3">Design of Concrete Bridges</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Design of Concrete Halls</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td>2</td><td colspan="2">1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>75</td><td>Equivalent ECTS</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Conceptual design of concrete bridges and hybrid bridges for which various concrete sections are adopted. Different structural systems will be introduced such as girder type bridges, box-girder bridges, arch bridges and extra dosed bridges. Analysis and design of different structural elements, decks, bearings, piers and footings will be introduced. The influence of the construction techniques and construction details on the design are included.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Structural Engineering Program (Elective (4))</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td>0%</td><td colspan="2">60%</td></tr>
</table>

CES424	Masonry Structures				2 CH
Prerequisites	Design of Concrete Halls				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		75	Equivalent ECTS	3	
Course Content					
History of masonry, masonry elements, types of masonry construction, analysis and design methods.Materials: masonry units, mortar, grout, reinforcement, masonry assemblages, compression, flexural, shear in-plane and tensile strength. Reinforced beams and lintels: flexural behavior and design, shear design, load distribution on lintel beams.Flexural walls: load resisting mechanisms, flexural behavior, analysis and design of reinforced flexural walls. Load bearing walls under axial load and out-of-plane bending.Overview of the effects of bending on the capacity of walls, effect of wall height, interaction between axial loads and bending.Linear elastic analysis of unreinforced and reinforced masonry sections, effects of slenderness, moment magnification.Special provisions for slender reinforced walls.					
Used in Program / Level					
Program Name or requirement				Study Level	
Structural Engineering Program (Elective (4))				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

CES425	Design of Civil Structures				3 CH
Prerequisites	Design of Concrete Halls				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS	5	
Course Content					
Water tanks: Rectangular and circular tanks, Elevated and ground tanks, Design of sections Calculation of internal forces, Design of deep beams, Details of reinforcement. Seismic design of concrete structures: Introduction, Forces induced from earthquakes, Classification of seismic zones, Structural analysis and design of concrete structures subjected to earthquakes. Prestressed concrete: Introduction, Types of prestressing steel, Material properties, Analysis of statically determinate prestressed beams.					
Used in Program / Level					
Program Name or requirement				Study Level	
Utilities and Infrastructure Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

<table>
<tr><td colspan="2">CES426</td><td colspan="3">Design of Water Concrete Structures</td><td>2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="4">Design of Concrete Halls</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Water tanks: Rectangular and circular tanks, Elevated and ground tanks, Design of sections. Calculation of internal forces, Design of deep beams, Details of reinforcement.
Seismic design of concrete structures: Introduction, Forces induced from earthquakes, Classification of seismic zones, Structural analysis and design of concrete structures subjected to earthquakes.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Water Engineering and Hydraulic Structures Program (Elective (4))</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td>60%</td></tr>
</table>

<table>
<tr><td colspan="2">CES427</td><td colspan="3">Concrete Structures Design (3)</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="4">Concrete Structures Design (2) & Foundation Design (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">3</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Cracking limit state; Design of Water tanks: design of sections, elevated, ground and underground tanks, circular and rectangular tanks, calculation of internal forces. Design and reinforcement details of corbels and deep beams. Lateral resistance of buildings: earthquake and wind. Design and detailing of shear walls and RC cores. Introduction of Prestressed concrete structures.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="4">Civil and Infrastructure Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>35%</td><td colspan="2">25%</td><td colspan="2">0%</td><td>40%</td></tr>
</table>

CES428	Masonry				3 CH
Prerequisites	Concrete Structures Design (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to masonry structures, Masonry materials, Behavior of masonry assemblages, Design of reinforced beams and lintels, Design of unreinforced and reinforced flexural walls, and Design of unreinforced and reinforced load bearing walls under axial load and out-of-plane bending.					
Used in Program / Level					
Program Name or requirement				Study Level	
Building Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
35%	25%		0%		40%

CES429	Advanced Design of Reinforced Concrete Structures				3 CH
Prerequisites	Concrete Structures Design (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Design of reinforced concrete systems: polygons, sheds, arch slabs, arch girders, trusses, Vierendeel girders. Design of saw tooth slab types, Surface of revolution (SOR): Different types of SOR (domes, cones), Internal stresses, Design of sections and reinforcement details. Folded plats and shells. Introduction to strut and tie design method.					
Used in Program / Level					
Program Name or requirement				Study Level	
Building Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam		Final Exam
35%	25%		0%		40%

CES430	Construction Methods and Techniques			2 CH
Prerequisites	Project Management Essentials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL		100	Equivalent ECTS	4
Course Content				
A study of current construction methods and techniques. The subjects include site preparation and earth-work, wood framing, masonry, concrete forming, slip forming, precast construction, industrialized building, deep excavation shoring and underpinning. Design, erection, and removal of temporary construction work. Current field practice and safety considerations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E11.4 Steel Structures Engineering Courses

CES241	Steel Structures Design (1)					3 CH
Prerequisites	Strength of Materials, Structure and Properties of Construction Materials					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		3		0		
Required SWL	150		Equivalent ECTS	6		
Course Content						
Loads on steel structures, analysis and design concepts, steel grades and types, structural systems and general layout for multipurpose halls, local buckling and steel cross sections classifications, Design of steel elements: Tension members, struts and compression members, flexural Members, lateral torsion buckling of beams, floor beams, Purlins, Crane track girders, and beam-columns. Design of bolted connections subjected to shear, tension and shear and tension, Design of welded connections subjected to shear and tension, wind bracing systems and design of column bases, Details. Construction: Tolerances, Fabrication, Erection.						
Used in Program / Level						
Program Name or requirement				Study Level		
Building Engineering Program				2		
Civil and Infrastructure Engineering Program				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

CES341	Design and Behavior of steel Structures (1)					3 CH
Prerequisites	Structural Analysis (2)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWLs	125		Equivalent ECTS	5		
Course Content						
Steel constructions technology: steel making process – steel grades and types – structural behavior of steel members – Design philosophies of steel structures and different codes. Structural Systems: single story buildings – gravity loads resisting systems – lateral loads resisting systems and bracing systems. Design of structural steel members: introduction to steel members design - structural behavior of steel members – local buckling and classification of cross-sections – design of axially loaded tension members – design of axially loaded compression members - design of beams- Application on laterally supported beams- Design of thin-walled Members.						
Used in Program / Level						
Program Name or requirement				Study Level		
Civil Engineering Requirement				3		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20 %	20 %		0%		60%	

CES342	Design and Behavior of steel Structures (2)			3 CH
Prerequisites	Design and Behavior of steel Structures (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Design of structural steel members: design of beams (laterally unsupported beams and crane girders) – design of beam-columns – design of portal frames. Design of slender sections. Design of connections: Bolts – types of bolts – design and analysis of bolted joints – Welds – types of welded joints – structural analysis of welded joints. Details Steel Fabrication and erection: tolerances and allowable tolerances – fabrication – erection – fire resistance – corrosion resistance.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20 %	20 %		0%	60%

CES343	Behavior of Steel Structures			2 CH
Prerequisites	Design and Behavior of Steel Structure (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		-
Required SWL	100		Equivalent ECTS	4
Course Content				
-Design consideration in the different steel structure elements: Principle mathematical equations for elastic and inelastic design of columns and beams and their cooperation in the design codes and specifications Basics of different methods in the design of beam-columns. -Design of beams subjected to Torsion. -Structure analysis and design of steel elements subjected to raised temperature (fire). -Parameters affecting steel structure subjected to fatigue and recommendation for details as well as effect of stress range and crack initiation and propagation of such behavior. -Design of flexible and rigid connections.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (1))			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
15%	15%		0%	70%

CES344	Steel Structures Design (2)					3 CH
Prerequisites	Structural Analysis, Steel Structures Design (1)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		3		0		
Required SWL	150		Equivalent ECTS		6	
Course Content						
Design of Eccentric bolted and welded connections, Design of slender cross section and cold formed sections, Types of bridges, Structural system for steel roadway bridges, loads on roadway bridges, fatigue considerations, design of bridge floor beam systems: stringer and cross girders, Design of plate girders: flexure strength and flange curtailment, buckling of webs, web stiffeners, and design of splices, Design of Bridge Bearings, Details, Analysis of beam grid in bridges, design of composite plate girders, composite columns.						
Used in Program / Level						
Program Name or requirement				Study Level		
Building Engineering Program				3		
Civil and Infrastructure Engineering Program				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

CES345	Steel Structures for Architectural Engineering					2 CH
Prerequisites	Structural Analysis for Architecture Engineering					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
1		2		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Structural steel technology: Metallurgy of steel, Steel fracture, Steel grades, Fatigue. Design synthesis: Structural systems, Lateral resistance and bracing systems, Codes and specifications. Elements design: Structural behaviour of members, Introduction to design philosophies, Local buckling and cross section classification, Tension members, Struts and columns, Bending of beams, Torsion of beams, Beam-columns and frame structures, Light gauge steel members. Connection design: Bolts: types of bolts, Analysis and design of bolt groups, Welds: Types of welds, Analysis and design of welded connections. Composite structures: composite beams and composite columns. Construction: tolerances, fabrication, erection, fire protection, corrosion resistance.						
Used in Program / Level						
Program Name or requirement				Study Level		
Environmental Architecture and Urbanism Program				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
30%	30%		0%		40%	

CES441	Design of Steel Bridges (1)			3 CH
Prerequisites	Design and Behavior of Steel Structures (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Structural Systems of Railway and Roadway Bridges: Types of bridges, structural systems in longitudinal and transverse direction –material of construction – design philosophy. Design loads: Roadway loading –other loads on bridges. Design of Plate Girder (Rail- and Roadway Bridges): General design considerations – fatigue considerations – buckling of plates - actual strength of plate girder elements – flange to web weld - Stiffeners – splices –curtailment of flange plates – details. Design of Composite Bridges: General design considerations – Composite design considerations – Shear connectors design – effect of shrinkage and creep – Details. Design of Beam Grids: General design considerations – Effect of gird interaction – Effect of relative rigidity. Design of Bridge Wind Bracings.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		--	60%

CES442	Design of Steel Bridges (2)			2 CH
Prerequisites	Design of Steel Bridges (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Structural Systems in longitudinal and transverse direction of Railway Bridges. Design loads: Railway loading, other loads on bridges. Design of Truss Members: General design considerations – fatigue considerations –actual strength of truss members – Design of joints – Details. Design of Bridge Bracings: Wind and Breaking force bracings- Stringer Bracing. Design of Bridge Bearings and Expansion Joints. Design of Box Girder Bridges: General layouts- General design considerations – Design for torsion - Box girder design considerations – Details. Design of orthotropic bridges.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES443	Steel Plated Structures			2 CH
Prerequisites	Design and Behavior of Steel Structures (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	100		Equivalent ECTS	4
Course Content				
Design of Circular and Rectangular tanks. Introduction to Connections of Hollow Sections and Modes of Failure. Design of Connections of Hollow Sections Subjected to pure Normal Force using AISC 2010.Design of Connections of Hollow sections Subjected to Moment and Normal Forces using AISC 2010.Yield Line Analysis of Head Plate Connections. Design of Head Plate Thickness in Rigid Connections using AISC 2010. Introduction to Box Girder Bridges. Design of Box Girder Bridges. Orthotropic bridges				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (4))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES444	Construction of Steel Structures			2 CH
Prerequisites	Design and Behavior of Steel Structures (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	100		Equivalent ECTS	4
Course Content				
Different considerations and methods for steel elements preparation from receiving raw materials and the methods of drilling and punching in addition to their quality control procedures, welding types and processes as well as inspection methods in addition to their quality control, Types of painting and methods of application, methods and equipment used in erection, inspection of steel structures and maintenance procedures, safety rules and applications to be followed during all stages.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (4))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES445	Steel Structures Design (3)			3 CH
Prerequisites	Steel Structures Design (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS		5
Course Content				
Structural system of railway bridges Loads on railway bridges, Design of steel trussed bridge, Connection of steel trussed bridge, Design of Bridge bracing, Design of Bridge Bearings, Design and Details of Orthotropic floor and decks, Design of Steel Box Girders, Steel hollow section structures: different applications in trusses, arches and Vierendeels, and connection design, Details of connections.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CES446	Advanced Design of Steel Structures			3 CH
Prerequisites	Steel Structures Design (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125	Equivalent ECTS		5
Course Content				
Design of space structures roofs, Loads and Design of communications towers, Methods of strengthening of existing communications towers, Design of steel tanks and silos, Design of steel plates by yield line theory. Fire resistance of protected and unprotected structural steel columns and beams, Analysis and design of steel elements at elevated temperature, Behavior of steel structural joints, Pretensioned bolts and Non-pretensioned bolts, Rigid and semi rigid Joints.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E11.5 Properties and Testing of Materials Engineering Courses

CES151	Structure and Properties of Construction Materials			2 CH
Prerequisites	Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to engineering materials. The internal structure of material: atomic structure, atomic arrangement, microstructure, and macrostructure. Metals: Structure, Types, Properties, and applications. Material properties: physical, chemical, corrosion, electrical, thermal, and optical properties. Relationship between material properties and its internal structure. Basic properties of non-metal materials. Building stones, Bricks, Tiles, Timber, Isolation materials for moisture and heat, glass, Ceramics, Polymers and advanced composite materials, Mineral binders, Aggregates, Admixtures, Concrete				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Building Engineering Program			1	
Civil and Infrastructure Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	10%	50%	

CES152	Properties and Testing of Materials			2 CH
Prerequisites	Structure and Properties of Construction Materials			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Testing machines and Strain measurements. Main properties of engineering materials (physical, chemical, mechanical …). Behavior of metals under static loads (Tension, Compression, Flexure, and Shear). Surface hardness of metals. Behavior of metals under dynamic loads (Impact) and repeated loads (Fatigue). Creep of metals.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Building Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	10%	50%	

CES251	Concrete Technology (1)					3 CH
Prerequisites	Structure and Properties of Construction Materials					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		2		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Concrete materials: Cement (Manufacture, Chemical composition, Hydration of cement, Physical and mechanical properties, Testing of cement, Common types of cement), Aggregates (Types, Physical, chemical and mechanical properties), Mixing water, Reinforcing steel (Types, Properties, Standard specifications), Admixtures (Chemical admixtures, Mineral admixtures, Air entrained admixtures). Properties of fresh concrete: Consistency, Workability, Cohesion, Segregation, Bleeding, air entraining. Properties of hardened concrete: (compressive, tensile, flexural, shear, and bond strengths). Concrete mix design methods						
Used in Program / Level						
Program Name or requirement				Study Level		
Civil Engineering Requirement				2		
Building Engineering Program				2		
Civil and Infrastructure Engineering Program				1		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
25%	15%		10%		50%	

CES252	Concrete Technology (2)					3 CH
Prerequisites	Concrete Technology (1)					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
3		1		1		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Concrete manufacturing: (Approval of materials source, Storage, Batching and mixing, Transportation, Pouring, Compacting, Curing, Construction joints, Formwork). Ready mixed concrete: (Production methods, Inspection, Quality control measures). Statistical analysis to judge the concrete quality. Hot weather concreting: (Definition, Problems, Precautions). Concrete flooring: (Floor types, Materials properties, Construction joints, Surface finish and preparation). Volumetric changes of concrete: (Elasticity, Creep). Durability of concrete: (Carbonation, Corrosion process, Permeability. Non-destructive testing: (Rebound hammer, Ultrasonic, Pulse velocity, Core, Steel detection, Radiation). Special types of concrete: (High performance, Polymer, Fiber and Lightweight concrete).						
Used in Program / Level						
Program Name or requirement				Study Level		
Civil Engineering Requirement				2		
Building Engineering Program				3		
Civil and Infrastructure Engineering Program				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
15 %	10 %		5 %		70 %	

CES351	Advanced Composite Materials		2 CH
Prerequisites	Vibration and Waves, Concrete Technology (2)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
Types of Fibers and Polymers – Advanced Composite Materials (ACM): Advantages, Disadvantages, Applications of ACM in the construction field – Stiffness and strength characteristics of ACM – Failure modes of ACM in different directions – Strengthening of concrete elements using ACM: (flexural strengthening, shear strengthening, axial strengthening) according to the Egyptian code of practice.			
Used in Program / Level			
Program Name or requirement		Study Level	
Structural Engineering Program (Elective (3))		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0	60%

CES451	Repair and Strengthening of Structures		2 CH
Prerequisites	Concrete Technology (2), Concrete Design (2)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	75	Equivalent ECTS	3
Course Content			
Causes of deterioration of concrete structures – Evaluation of concrete structures – Repair and strengthening materials (types, selection and testing) – Bond between repair and strengthening materials and substrate concrete – Different repair and strengthening techniques – Protection and maintenance of concrete structures – Repair and strengthening of different concrete elements (footing – column – beam – slab …. etc.) – Structural analysis of repair and strengthening – Design of repair and strengthening – Case studies.			
Used in Program / Level			
Program Name or requirement		Study Level	
Structural Engineering Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
25%	15%	0	60%

CES452	Special Types of Concrete			2 CH
Prerequisites	Concrete Technology (2)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
The course of special types of concrete is a comprehensive review of all special concrete types: High strength concrete, Light weight concrete, Heavy weight concrete. Fiber reinforced concrete, High performance concrete, Polymer concrete, Mass concrete, etc. It includes fundamental principles. Glossary of terms and description of types and manufacturing methods, Practices, Physical properties, Durability, Design considerations, Applications and research needs. Each special type course includes: Introduction and historical background, Definition and composition, Discussion of special components, Comparison with conventional concrete, Production aspects and fabrication technologies, Testing, Standard specifications and codes, Properties, Practical applications, Research need and related references.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (3))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0	60%	

CES453	Sustainability of Construction and Building Physics			2 CH
Prerequisites	Concrete Technology (2)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
The basic concepts of sustainability and sustainable construction, Development of international and local regulations in the area of sustainability, The different rating systems of construction sustainability. Causes and defects of climate change, The different techniques to approach energy-efficient and energy-saving constructions applying the concepts of building physics.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (3))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0	60%	

<table>
<tr><td>CES454</td><td colspan="4">Modern Building Materials</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Concrete Structures Design (1), Concrete Technology (2)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">3</td><td colspan="2">1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Introduction - different types of modern building materials - Advanced composite materials - Fibers and Polymer properties - Fabrication technology - Advantages and disadvantages of modern building materials compared with conventional construction materials - Structural applications – Testing - Stiffness and Strength characteristics of modern building materials - Flexural, shear and axial strengthening of concrete elements using Advanced composite materials.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>CES455</td><td colspan="4">Materials and Technologies for Sustainable Construction</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Modern Building Materials</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">The basic concepts of sustainability and sustainable construction, Development of international and local regulations in the area of sustainability, The different rating systems of construction sustainability. Causes and defects of climate change, The different techniques to approach energy-efficient and energy-saving constructions applying the concepts of building physics.Assessment and analysis techniques and the use of specifications as well as service life models for building materials, components and assemblies.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program – Elective</td><td colspan="2">Fourth Level</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>35%</td><td>25%</td><td colspan="2">0</td><td colspan="2">40%</td></tr>
</table>

E11.6 Geotechnical Engineering Courses

CES161	Geology				2 CH
Prerequisites	Engineering Chemistry				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	75		Equivalent ECTS	3	
Course Content					
Earth composition. Major types of rocks and deposits. Soil and rock cycle. Minerals identification and classification. Clay minerals. Principles of structural geology: joints, faults, folds and landforms. Subsurface exploration: techniques and tests. Influence of geological origin on composition and structure of soils. Substance and mass properties of rock: compressibility, shear strength and permeability. Rock as a construction material. Weathering and engineering aspects of transported soils: alluvial, colluvial, glacial, coastal, aeolian, lacustrine and residual soils. Soil description and engineering classification.					
Used in Program / Level					
Program Name or requirement				Study Level	
Building Engineering Program				2	
Civil and Infrastructure Engineering Program				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CES261	Geology and Geotechnical Engineering				2 CH
Prerequisites	Structural Mechanics (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL	75		Equivalent ECTS	3	
Course Content					
Engineering Geology: Definition, the role of geological engineering in Civil Engineering. Types of rock: igneous rock, sedimentary rock, and metamorphic rocks. Soil formation: Soil origin and weathering process, and basic definitions. Physical properties of soil: Definitions, laboratory tests, basic relationships, and soil classification. Hydraulic soil properties: Soil water, laboratory and field soil permeability. Stress distribution within the soil mass: Stresses under point, line loads, and distributed load.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil Engineering Requirement				2	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
15%	15%		20%	50%	

CES262	Geotechnical Engineering (1)			2 CH
Prerequisites	Geology and Geotechnical Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	75	Equivalent ECTS	3	
Course Content				
Compressibility and consolidation: Soil compression, theory of consolidation, and estimation of elastic settlement and consolidation settlement. Shear strength of soil: Definitions, Mohr's Coulomb's shear strength criteria, types of shear strength tests. Lateral earth pressure: Active and passive earth pressures, and water pressure. Subsurface exploration and sampling: Methods of boring and basic field tests.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	15%	20%	50%	

CES263	Soil Mechanics (1)			4 CH
Prerequisites	Structures and Properties of Construction Materials, Geology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		2
Required SWL	150	Equivalent ECTS	6	
Course Content				
Introduction to geotechnical engineering, earth crust, soil and rock, minerals, soil formation. Index properties and classification of soils. Weight-volume relation- ships. Soil structures. Moisture-density relation- ships. Hydraulic soil properties and permeability. Principle of total and effective stresses. Stress distribution due to external loads and analysis of total settlements. Outline of theory of consolidation. Shear strength of soil.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

CES361	Geotechnical Engineering (2)			2 CH
Prerequisites	Geotechnical Engineering (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
Soil compaction, Relative Density, Laboratory Compaction tests, Field compaction, Compaction equipment, and Site control of compaction. Seepage: Flow net diagram, Uplift pressure, and Critical hydraulic gradient. Slope stability: Infinite slope, Finite slope, Mass Methods, Method of slices, and Design charts. Gravity retaining structures: Action forces, Rotational siding, Block stability, and Foundation stresses. Bearing capacity: Modes of failure, Shear strength parameters, Bearing capacity loads equation, Eccentric loads, and Inclined loads. Bearing Capacity based on Settlement Criteria.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	0%	60%	

CES362	Foundation Engineering (1)			3 CH
Prerequisites	Geotechnical Engineering (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
Analysis and Design of Shallow Foundation: isolated and combined footings, Strip foundation, and Strap beams. Interaction of shallow foundations with elastic soil: Subgrade reaction model, Half-space model, Contact pressure distribution, and Settlement; Raft and Slab on grade. Deep foundations: Types, Classification of piles, bearing capacity of a single pile, settlement of a single pile, Pile load tests, design of pile caps, and laterally loaded piles.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	0%	60%	

CES363	Geotechnical Site Characterization			2 CH
Prerequisites	Foundation Engineering (2)			
Number of weekly Contact Hours				
2	1	0		
Required SWL	100	Equivalent ECTS	4	
Course Content				
Planning of geotechnical investigations: desk studies, utilization of geological, geomorphological and topographic maps, types and phasing of investigations, spacing and depths of investigations, off-shore and on-shore investigations. Boring: Auger boring, wash boring, percussion drilling, air rotary drilling, and mud rotary drilling. Soil Sampling: disturbance, disturbed sampling, undisturbed sampling of cohesive soils, undisturbed sampling of non-cohesive soils. Rock sampling: single barrel core, double core barrels, triple core barrels. Descriptions and classifications of geomaterials. Insitu testing procedure and their interpretations: Standard Penetration Testing (SPT), Field vane shear testing (FVST), Dynamic cone penetration testing (DCP), Static cone penetration testing (CPT), Pressuremeter testing (PMT), borehole permeability tests, pumping tests. Groundwater monitoring. Non-intrusive and intrusive geophysical surveys. Laboratory testing of geomatrerials: shear strength, deformability and water flow parameters. Geotechnical Correlations. Data reduction and determination of characteristic geotechnical parameters. Some case studies.				
Used in Program / Level				
Program Name or requirement	Study Level			
Structural Engineering Program (Elective (3))	4			
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES364	Soil Mechanics (2)			3 CH
Prerequisites	Soil Mechanics (1)			
Number of weekly Contact Hours				
Lecture	Tutorial	Laboratory		
2	2	0		
Required SWL	150	Equivalent ECTS	6	
Course Content				
The principles and methods of performing laboratory and field soil compaction. Steady stage seepage through isotropic soil media. Methods of design and analysis of soil slopes. Lateral earth pressures. Stability of retaining walls. Loads, bearing capacity and settlement. Subsurface exploration (planning, boreholes, open and test pits, soil sampling, rock coring, visual inspection, SPT, CPT, vane shear test, plate load test, field permeability test, geophysical test methods, exploration report).				
Used in Program / Level				
Program Name or requirement	Study Level			
Building Engineering Program	3			
Civil and Infrastructure Engineering Program	3			
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

CES365	Foundation Design (1)			3 CH
Prerequisites	Concrete Structures Design (2), Soil Mechanics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Shallow foundations. Spread footings. Strip footings. Combined footings. Strap beam footings. Raft foundations. Deep foundations. Pile foundations. Caissons. Retaining structures. Sheet-piling walls. Supported deep excavations. Free and fixed earth support types. Anchors. Struts. Waling beams. Braced cofferdams.				
Used in Program / Level				
Program Name or requirement		Study Level		
Building Engineering Program		3		
Civil and Infrastructure Engineering Program		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CES461	Foundation Engineering (2)			2 CH
Prerequisites	Foundation Engineering (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
<u>Pile Group:</u> bearing Capacity analysis, and settlement analysis. Micro-piles design for historical buildings. <u>Supported Deep Excavation:</u> Types of in-situ walls, Analysis and design of in-situ walls, Struts and tiebacks, Waling beams, and Braced supported excavation. <u>Tunneling:</u> Construction of tunnels, Analysis of lining, and Calculation of settlement. <u>Earth embankments:</u> Classification, Empirical dimensioning, Analysis and Design, Construction control and Insitu measurements.				
Used in Program / Level				
Program Name or requirement		Study Level		
Structural Engineering Program		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	0%	60%	

CES462	Ground Improvement			2 CH
Prerequisites	Foundation Engineering (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Geotechnical problems with soft and loose soils, Soil improvement techniques. Mechanical stabilization densification: Deep and shallow compaction, Techniques, Compaction equipment, In-situ soil parameters after densification. Preloading: Consolidation analysis, Preloading with and without drains. Design and construction of soil reinforcement: History of soil reinforcement, Reinforcing materials , Physical and mechanical properties , Utilization methods , Advantages and limitations, and construction techniques, Analysis and design of reinforced embankments constructed on soft soils, Analysis and design of reinforced earth walls. Grouting: types, properties, and techniques. Criterion for choosing suitable technique for soil improvement.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (3))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES463	Computer Application in Geotechnical Engineering			2 CH
Prerequisites	Foundation Engineering (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Theory of Finite Difference and its application in geotechnical problems: Seepage, Consolidation, and Beam on Elastic Foundation. Analysis of Geotechnical parameters based on factual site investigation report using excel spread sheet. Preparation of Geotechnical applications using Excel spread sheet: Seepage, Bearing capacity of shallow foundations, Settlement of shallow foundations, Capacity of axially loaded piles. Student – edition Software applications in Slope stability, and Seepage analysis. The main items of final Design Report issued for different geotechnical structures.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (3))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

<table>
<tr><td>CES464</td><td colspan="4">Geotechnical Engineering for Infrastructures</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Foundation Engineering (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6"><u>Analysis and Design of Shallow Foundation:</u> isolated and combined footings, Strip foundation, and Strap beams.
<u>Soil stabilization</u>: applying additives to improve soil performance, compaction of different soils; quality control;
<u>Mechanically Stabilized Earth Walls (MSEW)</u>: description of MSEW, construction sequence, design method of MSEW;
<u>Deep foundations</u>: Types, Classification of piles, bearing capacity of a single pile, settlement of a single pile, Pile load tests, design of pile caps, and laterally loaded piles. Pile group bearing Capacity analysis under different load conditions, settlement analysis. Micro-piles.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Utilities and Infrastructure Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>15%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td>CES465</td><td colspan="4">Foundation Engineering of Water Structures (1)</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Geotechnical Engineering (2)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Analysis and Design of Shallow Foundation: Isolated and combined footings, Strip foundation, Strap beams, and Raft foundation. Interaction of shallow foundations with elastic soil: Subgrade reaction model, Half-space model, Contact pressure distribution, and Settlement. Deep foundations: Types, Classification of piles, bearing capacity of a single pile, settlement of single pile, Pile load tests, design of pile caps, and laterally loaded piles.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Water Engineering and Hydraulic Structures Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>15%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

CES466	Foundation Engineering of Water Structures (2)			2 CH
Prerequisites	Foundation Engineering of Water Structures (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Pile Group: bearing Capacity analysis, and settlement analysis. Micro-piles design for historical buildings.Supported Deep Excavation: Types of in-situ walls, Analysis and design of in-situ walls, Struts and tiebacks,Waling beams, and Braced supported excavation. Soft ground tunneling: Construction of tunnels, Analysis oflining, and Calculation of settlement. Soil improvement techniques.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program (Elective (4))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	15%	0%	60%	

CES467	Foundation Design (2)			3 CH
Prerequisites	Foundation Design (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Beams on elastic media. Subgrade reaction modulus. Earth dams and earth embankments. Characteristics of problematic soils. Swelling soil. Collapsible soil. Soil improvement methods. Surface and deep compaction. Pre-loading. Stability and design of reinforced-earth walls. Grouting techniques. Computer applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E11.7 Construction Management Engineering Courses

CES171	Construction Management			2 CH
Prerequisites	Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Aspects of construction industry, definitions used in construction management, The project life cycle, Project stages, Relationships and responsibilities of the different project parties, Execution phase responsibilities, Productivity, Quality management.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES172	Engineering Economics and Finance			2 CH
Prerequisites	Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	75	Equivalent ECTS	3	
Course Content				
Concepts and Principles of Engineering Economics. Time Value of Money. Economic Evaluation of Alternatives. Financial Accounting. Depreciation Accounting. After-tax Economic Analysis. Effects of Inflation on Economic Evaluation. Replacement Analysis. Sources of Finance. Decision Making under Uncertainties.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			1	
Civil and Infrastructure Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

<table>
<tr><td colspan="3">CES271</td><td colspan="7">Project Management Essentials</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Engineering Economics and Finance</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">75</td><td colspan="3">Equivalent ECTS</td><td colspan="3">3</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Project management definition and areas, basic management functions, Construction project life cycle, project delivery methods, contracting strategies, construction contracts. Construction planning and scheduling, WBS bar charts, AOA and AON networks, critical path method, project control. Construction resources, material management, Organization charts, construction equipment. Construction method statement, constructability, Construction cost estimating, direct and indirect costs, cash flow calculations, introduction to management information systems.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Building Engineering Program</td><td colspan="4">2</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program</td><td colspan="4">1</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="3">CES371</td><td colspan="7">Management of Project Resources</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Construction Project Management</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Introduction to project procurement management, project resources management; critical project resources, material management: planning& control; Procurement&acquisition costs; resources management information systems; inventory analysis, inventory factors. Resources allocation and leveling.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Structural Engineering Program (Elective (2))</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="3">60%</td></tr>
</table>

CES372	Construction Planning and Scheduling				3 CH
Prerequisites	Project Management Essentials				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Construction planning, importance of scheduling, scheduling techniques, project scope management, work breakdown structure, project time plan, Program Evaluation and Review Technique (PERT), line of balance, scheduling control, schedule updating, project crashing, time cost trade-off, resource scheduling, resource allocation and leveling techniques, project planning and control using commercial software.					
Used in Program / Level					
Program Name or requirement			Study Level		
Building Engineering Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CES373	Construction Cost Management				3 CH
Prerequisites	Construction Planning and Scheduling				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Fundamentals of cost management: cost estimate, cost budgeting and cost control. Types of estimates; project budgets, concepts of pricing and mark up; direct cost, indirect cost, contingency, overhead. Construction cost/price analysis and bidding cost estimate. Cost control tools. Cash flow analysis, analysis of project profitability. Least cost scheduling. Life cycle costing and alternatives study. Principles of construction accounting, percentage of completion. Basic financial accounting concepts: accounting terms, assets, liabilities, debit, credit, balance sheet and income statement, depreciation methods.					
Used in Program / Level					
Program Name or requirement			Study Level		
Building Engineering Program Elective			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CES471	Construction Project Management			3 CH
Prerequisites	Design of Concrete Halls			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to project time management, planning in the different project stages, construction planning, importance of scheduling, scheduling/network techniques; program evaluation and review technique (PERT), critical path methods (CPM), line of balance (LOB), Bar charts, schedule updating/ Progress monitoring, Progress curves, project crashing/time reduction, time cost trade-off, resource scheduling, resource allocation and leveling techniques. Project cost and time integrated control systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Requirement			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES472	Risk and Safety Management			2 CH
Prerequisites	Construction Project Management			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to project risk management, Introduction to advanced concept of the systematic process of identifying, analyzing, and responding to risk and safety management of construction projects. Risk management during construction project life, risk analysis, risk evaluation, risk assessment, risk prevention in construction projects, Safety and health considerations on construction project, safety regulations and safety management. Environmental Risk Assessment Methodology, Environmental Impact Assessment EnvironmentalHealth Risk Assessment. National and International regulations				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (2))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CES473	Construction Contracts and Cost Estimation			2 CH
Prerequisites	Construction Project Management			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
-Methods of contractors’ selection, tender types. Construction contracts basics and definitions. Types of construction contracts; cost-based contracts and Price given in advance contracts. Legal Aspects of Construction Projects “Egyptian Law”, Legal Aspects of Construction Projects “FIDIC”. Construction Claims; Definition & Classification, Generation and Procedure of Claims, Claim categories. Dispute resolution techniques; Mediation, Conciliation, Adjudication, Arbitration, Litigation … etc. -Cost estimating methods, types of estimates; feasibility estimate, budget estimate, detailed estimate, direct cost estimating, Early cost estimating methods -Detailed cost estimating methods The estimating process - Method statement - Materials cost estimating - Equipment cost estimating - Labor cost estimating - Estimating inaccuracy. Concept of cost monitoring and control (meaning and definition), cost breakdown structure, earned value concept, performance indices, cost prediction at completion.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program (Elective (2))			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CES474	Resources Management			3 CH
Prerequisites	Construction Planning and Scheduling			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to advanced concept of construction resources management, including planning, productivity, utilization, and costing. Resources management during construction project life, material management, labor management, and equipment management.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CES475	Risk and Safety Management					3 CH
Prerequisites	Construction Planning and Scheduling					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Introduction to advanced concept of the systematic process of identifying, analyzing, and responding to risk and safety management of construction projects. Risk management during construction project life, risk analysis, risk evaluation, risk assessment, risk prevention in construction projects, safety and health considerations on construction project, safety regulations and safety management.						
Used in Program / Level						
Program Name or requirement				Study Level		
Building Engineering Program Elective				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

CES476	Legal Issues in Construction					3 CH
Prerequisites	Construction Planning and Scheduling					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		2		0		
Required SWL	125		Equivalent ECTS	5		
Course Content						
Legal concepts and processes applicable to the development of constructed facilities and to the operation of the construction firm. Including types of construction contract; fixed price, cost plus contracts, project delivery methods, Design-Bid-Build and other methods, common clauses in contract, risk management in contracts, standard forms of contract, dispute resolution methods; mediation, arbitration, adjudication. Emphasis on Egyptian law and institutions.						
Used in Program / Level						
Program Name or requirement				Study Level		
Building Engineering Program Elective				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

CES477	Computer Applications in Construction Management			3 CH
Prerequisites	Construction Planning and Scheduling			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		0		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to the use of automated programs for planning, scheduling, and controlling construction projects. Focuses on the use of Primavera Project Planner software. OBS, EPS, Create Project, Project Code, WBS, Calendar, Create Activities, Activity Code, Relationships, Activity Network, Time Scale, Bars Format, Column Format, Group and Sort, Filter, Baseline, Progress Update, Constraints, Activity Cost, Resource Dictionary, Resource Codes, Resource Roles, Resource Assignment, Expenses, Resource Profile, Resource Allocation, Claim Digger, risks, print.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CES478	Quantity Surveying and Estimating			3 CH
Prerequisites	Construction Planning and Scheduling			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Importance of quantity surveying and pricing for engineering projects; measurement units. methods of measurement. Bidding process strategy: tender types, bid documents, calculations, bill of quantities, balanced and unbalanced bids. Estimating principles: quantity survey, technical specifications for construction works, priced BOQ, recap sheet, unit cost estimate; Contract forms and administration. Construction project payments, change orders, purchasing orders.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CES479	Planning and Scheduling of Repetitive Projects				2 CH
Prerequisites	Project Management Essentials				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Repetitive projects planning and scheduling, Principals of Work Break Down Structure (WBS), Project scheduling, Bar Chart technique, Critical Path Method, AOA and AON networks, Program Evaluation and Review Technique (PERT), line of balance technique, project updating, project crashing, time cost trade-off, resource allocation and scheduling, resource leveling techniques, project control using commercial software.					
Used in Program / Level					
Program Name or requirement			Study Level		
Civil and Infrastructure Engineering Program			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CES480	Environmental Risk Management				3 CH
Prerequisites	Construction Planning and Scheduling				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Life Cycle Assessment, Main pollution parameters. Target setting for LCA. Steps of life cycle assessment: target setting, inventory analysis, impact analysis and interpretation of results. Environmental declarations and other data sources. Calculation tools for LCA. LCA reporting, building products as an example: Environmental Risk Management, Environmental Impacts of Building Materials, Air pollution: particulates, Smog, Ozone Depletion, Climate Change, Water pollution: Toxic chemicals, Eutrophication, Heat, Habitat destruction, Natural resource depletion, Human Impacts: Social, Health, Costs, Material Life Cycle Assessment. Environmental Management System, Construction Environnemental Management Plan, Management of the Environmental Risks in Construction Projects, Waste Management in construction, Multi-Criteria Decision Making Methods, Safety Management (OSHA)					
Used in Program / Level					
Program Name or requirement			Study Level		
Building Engineering Program Elective			4		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

E11.9 Graduation Projects

<table>
<tr><td colspan="2">CES491</td><td colspan="9">Structural Engineering Graduation Project (1)</td><td>2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Structural Engineering Elective (1)</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">0</td><td colspan="4">4</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">125</td><td colspan="3">Equivalent ECTS</td><td colspan="3">5</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Students will research and report on technical issues, research references, and will emphasize innovation and integration in buildings design with respect to building engineering. The problems are identified, and solutions are found to improve the performance of the building in areas such as: energy efficiency, negative solar engineering, lighting, acoustics, indoor air quality, building management, ventilation, air conditioning, advanced building materials, construction envelopes, earthquake and wind resistance and effects on buildings and computer aided design. A technical report is written, presented, and discussed.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Structural Engineering Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">60%</td><td colspan="3">0%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="2">CES492</td><td colspan="9">Structural Engineering Graduation Project (2)</td><td>4 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Structural Engineering Graduation Project (1)</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">0</td><td colspan="4">8</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">225</td><td colspan="3">Equivalent ECTS</td><td colspan="3">9</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">The project of each team will encompass the conceptual and preliminary design of a new medium-size building. Students learn building engineering design process, methodology, identification of objectives, building codes, formulation of design problems. Development and evaluation of sustainable building design alternatives. Conceptual building design: spatial requirements, design of space layout. Preliminary building design: synthesis and design of structures, enclosure systems, using computer-aided design tools. Performance evaluation using modelling, sensitivity analysis and cost estimation.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Structural Engineering Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">60%</td><td colspan="3">0%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td>CES493</td><td colspan="3">Building Engineering Design Graduation Project (1)</td><td colspan="2">3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Building Engineering Elective (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">1</td><td colspan="2">4</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>200</td><td colspan="2">Equivalent ECTS</td><td colspan="2">8</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">The project of each team will encompass the conceptual and preliminary design of a new medium-size building. Students learn building engineering design process, methodology, identification of objectives, building codes, formulation of design problems. Development and evaluation of sustainable building design alternatives. Conceptual building design: spatial requirements, design of space layout. Preliminary building design: synthesis and design of structures, enclosure systems, and services (HVAC, lighting, electrical distribution) using computer-aided design tools. Performance evaluation using modelling, sensitivity analysis and cost estimation.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>60%</td><td>0%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

<table>
<tr><td>CES494</td><td colspan="3">Senior Seminar</td><td colspan="2">2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="5">Building Engineering Design Graduation Project (1)</td></tr>
<tr><td colspan="6">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">0</td><td colspan="2">4</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>75</td><td colspan="2">Equivalent ECTS</td><td colspan="2">3</td></tr>
<tr><td colspan="6">Course Content</td></tr>
<tr><td colspan="6">Students will research and report on technical issues, research references, and will emphasize innovation and integration in buildings design with respect to building engineering. The problems are identified, and solutions are found to improve the performance of the building in areas such as: energy efficiency, negative solar engineering, lighting, acoustics, indoor air quality, building management, ventilation, air conditioning, advanced building materials, construction envelopes, earthquake and wind resistance and effects on buildings and computer aided design. A technical report is written, presented, and discussed.</td></tr>
<tr><td colspan="6">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="4">Building Engineering Program</td><td colspan="2">4</td></tr>
<tr><td colspan="6">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>60%</td><td>0%</td><td colspan="2">0%</td><td colspan="2">40%</td></tr>
</table>

CES495	Building Engineering Design Graduation Project (2)			3 CH
Prerequisites	Building Engineering Design Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	225		Equivalent ECTS	9
Course Content				
The project of each team encompasses the integrated design of at least three sub-systems of a new or retro-fitted building to achieve high performance and efficiency at reasonable cost; sustainable design and environmental impact issues are addressed in all projects. In the process, students learn, through case studies and literature survey, the information gathering and decision/design process, problem-resolution as well as aspects related to management, teamwork and communication. Students registering for this course must contact the course coordinator for the detailed procedure.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

E12. Courses offered by Irrigation and Hydraulics Engineering Department (CEI)

The Irrigation and Hydraulics Department is responsible for teaching courses that serve the following programs:

1. Several Basic Civil Engineering courses as a Civil Discipline Requirement.
2. Water Engineering and Hydraulic Structures Program.
3. Structural Engineering Program.
4. Utilities and Infrastructure Program.
5. Building Engineering Program.
6. Civil and Infrastructure Engineering Program.
7. Landscape Architecture program

Table 64 List of specializations at the Irrigation and Hydraulics Department.

#	Specialization
1	Hydraulics
2	Irrigation and Drainage
3	Design of Irrigation Works
4	Coastal and Port Engineering
5	Hydrology
6	Water Resources
9	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total
UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement
SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 65 List of CEI courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Hydraulics																				
1	1	111	Fluid Mechanics	2	4	100	2	1	1	4			x		20	20	10	50	PHM013	PHM032
2		112	Hydraulics (1)	2	4	100	2	1	1	4			x		20	20	10	50	CEI111	
3		113	Fluid Mechanics for Civil Engineers	3	5	125	2	2	2	6				x	25	20	15	40	PHM112	
4	2	211	Hydraulics (2)	2	4	100	2	1	1	4			x		20	20	10	50	CEI112	
5		212	Hydraulics	3	5	125	2	2	2	6				x	25	20	15	40	CEI113	
6	3	311	Infrastructure Planning and Landscape Irrigation	2	4	100	1	2	0	3				x	25	25	0	50	PHM022	PHM032
7	4	411	Hydraulic Networks	3	5	125	2	1	2	5				x	20	15	15	50	CEI361	
8		412	Pump Stations Engineering	2	4	100	2	1	0	3				x	50	0	0	50	CEI211	/ CEI212/
9		413	Environmental Hydraulics	2	4	100	2	1	0	3				x	30	20	0	50	CEI262	/ CEI361/
10		414	River Engineering	2	4	100	2	1	0	3				x	50	0	0	50	CEI351	/ CEI352/
11		415	Lab and Field Measurements in Water Resources field	2	4	100	2	1	0	3				x	40	10	0	50	CEI351	
12		416	Hydraulic Modeling	2	4	100	2	1	0	3				x	35	25	0	40	CEI341	CEI352
13		417	Sustainable Urban Water Systems	2	4	100	2	1	0	3				x	35	25	0	40	CEI212	CEI352
2. Irrigation and Drainage																				
14	2	221	Irrigation and Drainage Engineering	4	5	125	3	2	0	5			x		20	20	0	60	CEI211	
15		222	Irrigation and Drainage	3	5	125	2	2	0	4				x	35	25	0	40	CEI212	CEI262
16	3	321	Modern Irrigation Systems	2	4	100	2	1	0	3				x	35	25	0	40	CEI222	
17	4	421	Sustainable Drainage Systems	2	4	100	2	1	0	3				x	35	15	0	50	CEI351	
18		422	Advanced Irrigation Engineering	2	4	100	2	1	0	3				x	40	0	0	60	CEI331	
3. Design of Irrigation Works																				
19	1	131	Civil Drawing	2	5	125	1	3	0	4			x		25	25	0	50	CEP011	
20		132	Civil Engineering Drawing	2	4	100	1	3	1	5					25	20	15	40	CEP011	
21	3	331	Design of Irrigation Works	2	5	125	2	1	0	3				x	25	25	0	50	CEI221	CES212
22		332	Hydraulic Structures (1)	2	5	125	2	1	0	3				x	25	25	0	50	CEI331	CES222
23		333	Design of Irrigation Structures	2	4	100	2	1	0	3				x	25	25	0	50	CEI221 /CEI222/	CES222 /CES224/

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
24	4	431	Hydraulic Structures (2)	2	5	125	2	1	0	3				x	35	15	0	50	CEI332	CES361
25		432	Hydraulic Structures (3)	2	5	125	2	1	0	3				x	35	15	0	50	CEI431	CES341
26		433	Dams Engineering	2	4	100	2	1	0	3				x	50	0	0	50	CEI262 /CEI361/	CES361 /CES364/
27		434	Advanced Hydraulic Structures	2	4	100	2	1	0	3				x	50	0	0	50	CEI431	
28		435	Hydraulic Structures	2	4	100	2	1	0	3				x	35	25	0	40	CEI333	CES361
29		436	Topics in Hydraulic Structures	2	4	100	1	1	0	3				x	35	25	0	40	CEI333	
4. Coastal and Port Engineering																				
30	3	341	Coastal Engineering	2	4	100	2	1	0	3				x	25	25	0	50	CEI211 /CEI212/	CES361 /CES364/
31	4	441	Port Engineering and navigation	2	4	100	2	1	0	3				x	25	25	0	50	CEI341	
32		442	Coastal Environment Engineering	2	4	100	2	1	1	4				x	25	25	0	50	CEI341	
33		443	Inland Navigation	2	4	100	2	1	0	3				x	25	25	0	50	CEI441	
34		444	Port Engineering and Shore Protection	2	4	100	2	1	0	3				x	50	0	0	50	CEI211	
5. Hydrology																				
35	3	351	Environmental Hydrology	2	5	125	2	1	0	3				x	25	25	0	50	CEI221	
36		352	Applied Hydrology	2	4	100	2	1	0	3				x	35	25	0	40	CEI333	
37	4	451	Ground Water Hydrology	2	5	125	2	1	0	3				x	50	0	0	50	CEI211 /CEI212/	CES361 /CES364/
38		452	Engineering Hydrology	2	4	100	2	1	0	3				x	50	0	0	50	CEI111	CES361
6. Water Resources																				
39	2	261	Engineering Economics and Management	2	4	100	2	1	0	3				x	25	25	0	50		
40		262	Principles of Water Resources Engineering	2	4	100	2	1	0	3				x	35	25	0	40	CEI113	
41	3	361	Water Resources Engineering	2	5	125	2	1	0	3				x	25	25	0	50	CEI351	
42	4	461	Geographic Information Systems in water Engineering	2	5	125	2	0	2	4				x	40	0	10	50	CEP211	
43		462	Water Quality	2	4	100	2	1	0	3				x	50	0	0	50	CEI361	
44		463	Environmental Impact Assessment in water Engineering Projects	2	4	100	2	1	0	3				x	25	25	0	50	CEI262 /CEI361/	CEI341
45		464	Climate Change Adaptation in Water Resources field	2	4	100	2	1	0	3				x	50	0	0	50	CEI361	
46		465	Non-Conventional Water Resources	2	4	100	2	1	0	3				x	50	0	0	50	CEI361	
47		466	Water Security and Governance	2	4	100	2	1	0	3				x	35	25	0	40	CEI262	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
9. Graduation Project																				
48	4	491	Water Engineering Graduation Project	6	12	300	0	12	0	12				x	50	0	0	50	Elect.(1) /Elect.(2)	
49	4	492	Civil Engineering Design Graduation Project (1)	3	6	150	1	4	0	5				x	60	0	0	40	Elect.(1)	
50	4	493	Civil Engineering Senior Seminar	2	3	75	0	4	0	2				x	60	0	0	40	CEI492	
51	4	494	Civil Engineering Design Graduation Project (2)	3	6	150	1	4	0	5				x	60	0	0	40	CEI492	

E12.1 Hydraulics Courses

CEI111	Fluid Mechanics			2 CH
Prerequisites	Mathematics (2), Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Review of fluid properties: Definition, Characteristics of mass and weight, Viscosity, Vapor pressure, Surface tension, Compressibility. Fluid statics: Pressure, Pressure at a point, Pressure variation, Pressure transmission in fluids, Pressure measurements, Forces on plane and curved surfaces, Fluid masses subject to acceleration, Forced vortex, Buoyancy and floatation. Fluid Dynamics: Fundamentals of fluid flow, Classification of fluid flow, Continuity equation, Flow of ideal fluids, Euler's equation, Bernoulli's equation, flow of real fluids, Energy equation, T.E.L. and H.G.L. Applications of Bernoulli's equation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		10%	50%

CEI112	Hydraulics (1)			2 CH
Prerequisites	Fluid Mechanics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
Review of Bernoulli’s equation and Energy equation, Applications of Bernoulli's equation. The Momentum equation: Development of the equation, Applications of the momentum equation. Pipe flow: Laminar and turbulent flow, Reynolds number, Shear stress distribution, Velocity distribution, Main losses, Secondary losses, Single pipe, Pipe connections (series and parallel), Pipe branching, Three tank problems. Pipe networks: Analysis of pipe networks, Hardy Cross method. Water hammer in pipes: Unsteady flow equations, Rigid water hammer theory, Elastic water hammer theory, Wave celerity, Water hammer effects and control. Dimensional analysis and Similitude.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		10%	50%

<table>
<tr><td>CEI113</td><td colspan="3">Fluid Mechanics for Civil Engineers</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Differential Equations and Numerical Analysis</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td>2</td><td colspan="2">2</td><td colspan="2">2</td></tr>
<tr><td>Required SWL</td><td>150</td><td>Equivalent ECTS</td><td colspan="2">6</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Review of fluid properties and hydrostatics: Manometry, Forces on plane and curved surfaces, Buoyancy, Fluid masses subjected to acceleration (forced vortex). Kinematics of fluid motion: Fluid flow, Types of flow, Classification of flow, Continuity equation. Flow of Incompressible fluid: One-dimensional flow, Euler's Equation in three dimensions, Bernoulli's, Energy equation, Applications of Bernoulli's equation (flow through free and submerged orifices, flow over notches and weirs flow measuring devices, time of filling and emptying tanks under variable and constant heads, free vortex). Pipe flow: Laminar and turbulent flow, Reynolds’ number, Shear stress distribution, Velocity distribution, Main losses, Secondary losses, Single pipe, Pipe connections (parallel and series), Pipe branching, Three tank problems. The Impulse-Momentum principle: Development of the principle, Pipe bends, Enlargements and contractions, Hydraulic structures in open channels.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Building Engineering Program</td><td colspan="2">1</td></tr>
<tr><td colspan="3">Civil and Infrastructure Engineering Program</td><td colspan="2">1</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>25%</td><td>20%</td><td colspan="2">15%</td><td>40%</td></tr>
</table>

<table>
<tr><td>CEI211</td><td colspan="3">Hydraulics (2)</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Hydraulics (1)</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td>2</td><td colspan="2">1</td><td colspan="2">1</td></tr>
<tr><td>Required SWL</td><td>100</td><td>Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Hydraulic machines: Introduction, Types of pumps, System characteristics, Pump characteristics and performance, Operation of pumps, Pump selection, Multiple pump system, Cavitation phenomena. Open channel flow: Introduction, Types of open channel flow, States of open channel flow, Geometric elements of channel sections, Velocity distribution in open channels, Equations for uniform steady flow in open channels, Factors affecting Roughness coefficient, Design of open channels sections, Energy equation in open channels, Specific energy, Specific discharge, Applications of the specific energy, Specific force, Specific force diagram, Rapidly varied flow, Gradually varied flow, Methods of computation for gradually varied flow.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Civil Engineering Requirement</td><td colspan="2">1</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td>Final Exam</td></tr>
<tr><td>20%</td><td>20%</td><td colspan="2">10%</td><td>50%</td></tr>
</table>

CEI212	Hydraulics			3 CH
Prerequisites	Fluid Mechanics for Civil Engineers			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		2
Required SWL	150	Equivalent ECTS	6	
Course Content				
Pipe networks: Analysis, Design and optimal design. Water hammer in pipes: Unsteady flow equations, Rigid water hammer theory, Elastic water hammer theory, Wave celerity, Water hammer effects and control. Dimensional analysis and Similitude. Hydraulic machines: Introduction, Types of pumps, System characteristics, Pump characteristics and performance, Operation of pumps, Pump selection, Multiple pump system, Cavitation phenomena. Open channel flow: Introduction, Types of open channel flow, States of open channel flow, Geometric elements of channel sections, Velocity distribution in open channels, Equations for uniform steady flow in open channels, Factors affecting Roughness coefficient, Design of open channels sections, Energy equation in open channels, Specific energy, Specific discharge, Applications of the specific energy, Specific force, Specific force diagram, Rapidly varied flow, Gradually varied flow, Methods of computation for gradually varied flow.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

CEI311	Infrastructure Planning and Landscape Irrigation			2 CH
Prerequisites	Electricity and Magnetism, Dynamics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		2		0
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to Urban Water Systems, Water distribution network design and operation, Potable water demand, Wastewater collection networks, Gray Water concept, Storm Water drainage systems, Combined sewerage networks. Soil-plant-water relationships. Irrigation water requirements, irrigation efficiency and calculating periods between irrigations, flow rates and irrigation time. sprinkler and drip irrigation, subsurface irrigation. Geometric Road design, signing and marking, Street and landscape lighting, power supply networks, CCTV, Gas, and telecommunication. Infrastructure planning, Infrastructures Impact on the environment, public health and safety.				
Used in Program / Level				
Program Name or requirement			Study Level	
Landscape Architecture program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0	50%	

CEI411	Hydraulics of Networks			3 CH
Prerequisites	Water Resources Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		2
Required SWL	125		Equivalent ECTS	5
Course Content				
Pressurized networks: Graph theory, Branched network, System reliability, Governing equations, Analysis techniques, Unsteady flow boundaries, Extended period simulation, Case Studies. Pumping stations, Transmission lines, Practical consideration (control valves, water hammer protection devices, field testing, and leakage control), Commercial software, Case Studies. Gravity networks; understanding of the basic principles and knowledge for the planning, design of urban drainage and sewerage systems, inputs and outputs and functioning of urban drainage/sewerage systems, hydraulic analysis for the steady and unsteady state. Commercial software. Case Studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	15%		15%	50%

CEI412	Pump Stations Engineering			2 CH
Prerequisites	Hydraulics (2) or Hydraulics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Pump performance curves: Speed effect, Impeller changes effect, Type of pump effect, Viscosity effect, Cavitation effect, Net positive suction head effect, Available suction head effect, and Required suction head effect. Pump definition: General- service pumps, Booster pumps, Non-clogging pumps, Sump pumps, Dredge pumps, Slurry pumps, Deep-well pumps, Water-works irrigation and drainage pumps, Circulating pumps. Pump-pipeline system: pump characteristic curves, system curves, operation point and Total head, Total dynamic head, System friction-head curve, Approximated operating head, Pumps operating in series, Pumps operating in parallel. Pump application: Pumping arrangement, Economic consideration. Pump selection, Pump Installation, Location of pump units, Suction line inlet, Size of suction line, Long-radius elbows, Suction header, Eccentric reducers, Screens, Check valves, Expansion joints, Vent valves, Realigned in field, Pump leveling. Operation: gate valve, Priming, Foot valve, Priming chamber, Ejectors, Dry-vacuum pump, Wet-vacuum pump, Automatically priming pump, Time of priming, Sump-pump design.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		0%	50%

CEI413	Environmental Hydraulics			2 CH
Prerequisites	Principles of Water Resources Engineering or Water Resources Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL		100	Equivalent ECTS	4
Course Content				
Water flow in the environment – phenomena and processes related to such flow. Transport processes and spreading of pollutants. Material Balance equations for water and pollutants in surface water systems with instantaneous mixing. Piston flow and nominal retention time. Basic mechanisms for mixing: diffusion (laminar and turbulent), dispersion, and advection. The general transport (advection-diffusion) equation – formulation and special cases. Mixing in rivers, lakes, and coastal areas. Jets and plumes (free shear flows). Near- and far field mixing. Diffusers and other technical solutions for pollution discharge. Steady and unsteady flow conditions. Case studies concerning pollution discharge and environmental impact. Density-driven flows including stratification and horizontal spreading of pollutants. Temperature and oxygen conditions in natural waters together with governing equations.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		0%	50%

CEI414	River Engineering			2 CH
Prerequisites	Environmental Hydrology or Applied Hydrology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL		100	Equivalent ECTS	4
Course Content				
Basic properties and principle equations: properties of water and sediments, river flow kinematics, mass conservation, equation of motion. Steady and unsteady flow in rivers, sediment transport in rivers. –River equilibrium: particle stability, channel stability, river bends, river meander. Stage discharge predictors - Sediment discharge formulas – Sediment measurements techniques. River stabilization: river bank protection, river bank riprap revetment; navigation waterways; River training; River restoration principles: Case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
30%	20%		0%	50%

CEI415	Lab and Field Measurements in Water Resources field			2 CH
Prerequisites	Environmental Hydrology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Build level of competence with instruments, field techniques, sampling basis, data analysis techniques. Measuring climatic parameters, surface hydrological parameters, ground water parameters, stream flow, channel cross-section, rating curves. Measuring devices for special water structures.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
40%	10%		0%	50%

CEI416	Hydraulic Modeling			2 CH
Prerequisites	Coastal Engineering, Applied Hydrology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Models-reality approximations, Different types of Models (Lumped, distributed models). 1D, 2D, and 3D Models. Limitations and constrains, Boundary conditions, Water Networks modeling, Hydrologic Modeling, Open channel/River flow modeling, groundwater modeling. Case studies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEI417	Sustainable Urban Water Systems			2 CH
Prerequisites	Hydraulics, Applied Hydrology			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to Urban Water Systems, Water quality and quantity objectives/risks, Water distribution network design and operation, Leakage control, Potable water demand management, Wastewater collection and reuse networks, Gray Water concept, Storm water drainage systems, Combined sewerage networks, Urban Storm management, The qualitative characteristics of a sustainable system (including social, environmental and economic factors),Tackling water shortages through controlling water demand, investments in increasing water distribution efficiency and utilization of reclaimed water and rainwater.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

E12.2 Irrigation and Drainage Courses

CEI221	Irrigation and Drainage Engineering				4 CH
Prerequisites	Hydraulics (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
3		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Getting down to Engineering Hydrology and Water Resources Engineering (Hydrologic cycle. Hydrometrology – Surface runoff – Hydrographs – Storage and demand curves). Getting Down to Irrigation and Drainage Engineering. Soil-Plant-Water relationships. Irrigation water requirements. Irrigation efficiency. Irrigation period. Irrigation interval. Planning, Design, Management and Operation for field Irrigation (Surface irrigation - Sprinkler Irrigation - Local irrigation). Irrigation system in Egypt (Irrigation schedules - Cropping pattern – Turn system - Field and canal water duties). Introduction to groundwater (Sources - Characteristics and movement - Well design and selection of pumps). Drainage Engineering (Types of drainage systems - Factors affecting type selection - Design of open, tile and vertical drains - Disposal of drainage water and drainage water reuse and precautions). Water Strategy with application to the Egyptian case.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil Engineering Requirement				2	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam		Final Exam
20%		20%	0%		60%

CEI222	Irrigation and Drainage				3 CH
Prerequisites	Hydraulics, Principles of Water Resources Engineering				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		2		0	
Required SWL		125	Equivalent ECTS		5
Course Content					
Soil-plant-water relationships. Determination of plant water consumption. Fundamentals of irrigation and drainage engineering. Planning and design of farm irrigation systems: Surface irrigation system, Pipe irrigation system, Sprinkler irrigation system, Trickle irrigation system. Flow measurements and pump selection and operation. Subsurface flow of free drainage water. Planning and design of drainage systems: Open drainage system, Tile drainage system. Functions of Irrigation and Drainage structures.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil and Infrastructure Engineering Program				2	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam		Final Exam
35%		25%	0%		40%

CEI321	Modern Irrigation Systems			2 CH
Prerequisites	Irrigation and Drainage			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Revision of on-farm irrigation systems. Planning and design of new trends in on-farm irrigation systems: Surge surface irrigation, Subsurface irrigation, Subsurface trickle irrigation. Irrigation system control: Concentration control (injection and mixing), Hydraulic control (discharge and pressure measurements, use of control valves: close, air, wash, pressure relief, constant pressure, constant discharge, non-return, sustaining pressure). Design and construction of lined irrigation canals. Managements and administrative aspects: Stages of irrigation projects, Economics of irrigation systems and feasibility study.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEI421	Sustainable Drainage Systems			2 CH
Prerequisites	Environmental Hydrology			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Concepts of agriculture drainage systems; drainage as an important means to sustain irrigated agriculture, Water balance, Subsurface flow to drains (steady and unsteady state equations - application - comparison – special drainage situations), drainage and salinity (soil salinity - salt balance in root zone - salinization due to capillary rise - fallow period), Drainage water quality and relation with irrigation water and practices - methods of improving and re-using agriculture drainage water quality, drains' gravity outlet structures. Urban Storm water drainage; methods of improving urban water quality, Sustainable Urban Drainage Systems (SUDS), the role of drainage in protecting human health, Strategies for achieving sustainability through drainage, re-use of drainage water (constraints and opportunities).				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	15%		0%	50%

<table>
<tr><td colspan="3">CEI422</td><td colspan="7">Advanced Irrigation Engineering</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Design of Irrigation Works</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Part (1): On-Farm Advanced Irrigation: Review (surface irrigation - sprinkler irrigation - drip irrigation and evaluation of performance). Planning, design, and management, Operation and Maintenance of modern on-farm irrigation systems (surge irrigation - subsurface irrigation – micro sprinklers - trickle subsurface irrigation …), practical considerations when selecting different irrigation methods. Applications of irrigation systems in landscape of urban zones. Hydraulic control of irrigation systems.
Part (2): Delivery Systems: Operation and control concepts in irrigation networks, Review (planning, design, construction, Operation and Maintenance of canals with application under the Egyptian case). Lining of irrigation canals (infiltration - economics – types and materials - practical examples). Maintenance of branch and main canals (objectives - types - responsibilities - planning and scheduling - financial management - practical examples).</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Water Engineering and Hydraulic Structures Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">40%</td><td colspan="3">0%</td><td colspan="3">0%</td><td colspan="3">60%</td></tr>
</table>

E12.3 Design of Irrigation Works Courses

CEI131	Civil Drawings			2 CH
Prerequisites	Projection and Engineering Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		3		0
Required SWL	125	Equivalent ECTS		5
Course Content				
Irrigation Works: Introduction to Irrigation works, Earthworks (Open Channels cross sections and projections/ changes in Bed, Berm, and Bank levels / Rotation and ends of canals), Retaining walls and abutments (types and its relation with earth), Water structures (Crossing works, Heading up works, Canal ends works) Steel structures: Introduction to steel structures, Steel sections, Bases and columns, Beams and Girders, steel bridge connections				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

CEI132	Civil Engineering Drawing			2 CH
Prerequisites	Projection and Engineering Graphics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		3		1
Required SWL	100	Equivalent ECTS		4
Course Content				
Fundamentals of technical drawing, orthographic projections, sectional views. Computer-aided drawing; Concrete structures; slabs, beams, and columns, Steel structures; building trusses and bridges. Irrigation Works; introduction to Irrigation works; Earthworks (Open Channels cross sections and projections/ changes in Bed, Berm, and Bank levels / Rotation and ends of canals), Retaining walls and abutments (types and its relationship with earth). Irrigation structures (Crossing works, heading up works, Canal ends works). Introduction to the design process.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	20%	15%	40%	

<table>
<tr><td>CEI331</td><td colspan="3">Design of Irrigation Works</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Irrigation and Drainage Engineering, Structural Analysis (2)</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Planning and design of Irrigation projects: Alignment of canals and drains, Synoptic diagrams for canals and drains, Design of cross sections for earth channels, Seepage through earth channels, Calculation of expropriation widths, Longitudinal sections and typical cross sections for canals and drains, Canal lining. Retaining walls: Types, Stability, Cases of loading, Hydraulic and structural design, Drawings. Classification of irrigation structures.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Water Engineering and Hydraulic Structures Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>25%</td><td>0%</td><td colspan="2">50%</td></tr>
</table>

<table>
<tr><td>CEI332</td><td colspan="3">Hydraulic Structures (1)</td><td>2 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="4">Design of Irrigation Works, Concrete Design (2)</td></tr>
<tr><td colspan="5">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Laboratory</td></tr>
<tr><td colspan="2">2</td><td>1</td><td colspan="2">0</td></tr>
<tr><td>Required SWL</td><td>125</td><td>Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="5">Course Content</td></tr>
<tr><td colspan="5">Classification of crossing structures – Bridges on waterways: types, hydraulic design, heading-up calculations, bridge scour calculations and scour countermeasures, empirical dimensions, drawings. Culverts: types, culvert hydraulics, hydraulic design of culverts, scour calculations, empirical dimensions, drawings, loads calculations for the different cases of loading. Syphons and Aqueducts: hydraulic design, drawings, calculation of loads for the determined cases of loading.</td></tr>
<tr><td colspan="5">Used in Program / Level</td></tr>
<tr><td colspan="3">Program Name or requirement</td><td colspan="2">Study Level</td></tr>
<tr><td colspan="3">Water Engineering and Hydraulic Structures Program</td><td colspan="2">3</td></tr>
<tr><td colspan="5">Assessment Criteria</td></tr>
<tr><td>Student Activities</td><td>Mid-Term Exam</td><td>Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td>25%</td><td>25%</td><td>0%</td><td colspan="2">50%</td></tr>
</table>

CEI333	Design of Irrigation Structures			2 CH
Prerequisites	Irrigation and Drainage Engineering or Irrigation and Drainage, Concrete Design (2) or Concrete Structure Design (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Planning and design of Irrigation projects: Alignment of canals and drains, Synoptic diagrams, Design of cross sections, Longitudinal sections and typical cross sections - Retaining walls – Crossing Structures: Hydraulic design, Scour calculations and Drawings of Bridges on waterways, Culverts, Syphons and Aqueducts.				
Used in Program / Level				
Program Name or requirement			Study Level	
Structural Engineering Program			3	
Utilities and Infrastructure Program			3	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

CEI431	Hydraulics Structures (2)			2 CH
Prerequisites	Hydraulic Structures (1), Geotechnical Engineering (2)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Water Control System: Introduction – Main irrigation system – Flow control methods. Types of Hydraulic Structures: Non-regulating structures – Regulating structures. Percolation and Seepage: Piping below the floor – Uplift of the floor. Local Scour: Scouring mechanism – Scour protection. Weirs, Spillways and Escapes: Types and functions – Structural elements – Hydraulic design – Empirical dimensions – Principle design of the main elements – Calculations of hydraulic forces – Structural design of the floor – Design of scour protection – Engineering drawings.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	15%	0%	50%	

CEI432	Hydraulic Structures (3)				2 CH
Prerequisites	Hydraulic Structures (2), Design and Behavior of Steel Structures (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Regulators and Intakes: Types and Functions – Classes of gates – Regulation by the gates – Hydraulic design – Structural elements – Empirical dimensions – Principle design of the main elements – Calculations of hydraulic forces – Structural design of the floor – Structural design of the gates – Design of Scour protection – Engineering drawings. Navigation Locks: Types and Functions – Filling and Emptying Process – Hydraulics of Locks – Structural elements – Empirical Dimensions – Principle design of the main elements – Calculations of hydraulic forces – Structural design of the thrust wall – Structural design of the floor – Engineering Drawings.					
Used in Program / Level					
Program Name or requirement				Study Level	
Water Engineering and Hydraulic Structures Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	15%		0%	50%	

CEI433	Dams Engineering				2 CH
Prerequisites	Principles of Water Resources Engineering or Water Resources Engineering, Geotechnical Engineering (2) or Soil Mechanics (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Reservoir planning: Investigation for reservoir planning, Selection of dam site, Zones of storage in Reservoirs, Storage Capacity and Yield, Sedimentation and Sediment Flow, Multipurpose Reservoirs. Dams: Different types of dams, Advantages and disadvantages of dams, Physical factors governing the selection of dams, Selection of site of a dam and its foundation, Gravity dams: Forces acting on gravity dams, Stability requirements, Elementary and practical profile of gravity dam, Height of gravity dam and its limitation, Methods of design, Dam Foundation treatment, Galleries and joints, Control of cracks in dams. Earth dams: Classification, Design considerations, Seepage in earth dams, design of filters, slope stability, critical cases of loading, failure of earth dams. Spillways: Types, Methods of design. Operation and Maintenance of Dams.					
Used in Program / Level					
Program Name or requirement				Study Level	
Water Engineering and Hydraulic Structures Program				4	
Civil and Infrastructure Engineering Program-elective				3	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	25%		0%	50%	

CEI434	Advanced Hydraulic Structures (Elective 3)			2 CH
Prerequisites	Hydraulic Structures (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Modern Barrages: Aims and functionality – Main components (embankment dam, gated spillway, river hydropower plant and navigation lock) – Preliminary studies and investigations – Principle design of the main components – Engineering drawings – Physical modelling – Construction procedure. Operation and Maintenance: Operation guidelines – Common problems – Failure and emergency actions – Regular maintenance.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	0%		0%	50%

CEI435	Hydraulic Structures			2 CH
Prerequisites	Design of Irrigation Structures, Soil Mechanics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Weirs: Weirs function, types of weirs, hydraulic of weirs, stability of gravity weirs, static design of the floor for percolation, uplift and scour. Regulators: Types of regulators and component parts of the regulator, hydraulic design of the waterway, hydraulic and static design of piers under different cases of loading, static design of floor for percolation and scour, static design of vertical gates and winch structure. Radial Gates: Aims, functionality, components, type of radial gates, relations between gate opening and discharge, forces acting on gate and design aspect of gates.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEI436	Topics in Hydraulic Structures				2CH
Prerequisites	Design of Irrigation Structures				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		100	Equivalent ECTS		4
Course Content					
Spillways: Aims, functionality, classification, location, determination of the crest length and discharge capacity of the spillway, types of stilling basins, hydraulic jump and energy dissipation. Navigation Structures: Types of locks, main elements of locks, dimensioning of lock chamber, methods of emptying and filling the lock chamber, hydraulic design of side culverts, static design of: landing wall, guide pier, thrust wall and floor.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil and Infrastructure Engineering Program – (elective)				4	
Assessment Criteria					
Student Activities		Mid-Term Exam	Practical Exam	Final Exam	
35%		25%	0%	40%	

E12.4 Coastal and Port Engineering Courses

CEI341	Coastal Engineering		2 CH
Prerequisites	Hydraulics (2) or Hydraulics, Geotechnical Engineering (2) or Soil Mechanics (2)		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		0
Required SWL	100	Equivalent ECTS	4
Course Content			
Introduction to Coastal Engineering and Shore Protection, Natural phenomenon (winds, waves, tide, sea currents), Wave action and propagation (wave breaking, wave refraction, wave diffraction), Wave Impact on coastal structures, Effect of waves on the shoreline, Sediment transport and Shoreline changes, Shore Protection measures.			
Used in Program / Level			
Program Name or requirement		Study Level	
Water Engineering and Hydraulic Structures Program		3	
Civil and Infrastructure Engineering Program		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
25%	25%	0%	50%

CEI441	Port Engineering and Navigation		2 CH
Prerequisites	Coastal Engineering		
Number of weekly Contact Hours			
Lecture	Tutorial		Laboratory
2	1		0
Required SWL	100	Equivalent ECTS	4
Course Content			
Introduction to Port Engineering, Port master planning, Design of Navigation Channels, Types of breakwaters, Design of breakwaters, Berthing facilities (quay walls types and their design), Vessels Mooring, Fenders, Repair Facilities, sheds, Introduction to Inland (river), Effect of ship movement in ports and navigation channels, Navigation Aids, Dredging, Planning and design of marinas.			
Used in Program / Level			
Program Name or requirement		Study Level	
Water Engineering and Hydraulic Structures Program		4	
Civil and Infrastructure Engineering Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
25%	25%	0%	50%

CEI442	Coastal Environment Engineering			2 CH
Prerequisites	Coastal Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to coastal environment, problems facing coastal zone, human made shore protection structures and their impacts (bulkheads, seawalls, revetments, jetties, breakwaters, groins and geotextile sand containers), case studies and lessons learnt from Egypt coastal projects, environmental impact assessment of coastal projects, effect of global warming and sea level rise on coastal zones.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	25%		0%	50%

CEI443	Inland Navigation			2 CH
Prerequisites	Port Engineering and Navigation			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Types of navigation waterways, Importance of Inland Navigation, Hydraulic and morphodynamic phenomena in navigation channels, Specifications of vessels, Ship movements, Effect of ship movement on water motion, Design of navigable waterway cross section, Dikes and Revetments, Channel dredging and maintenance, inland ports master plan, berthing facilities, environmental aspects of inland waterways, Inland navigation in Egypt.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25 %	25%		0%	50 %

CEI444	Port Engineering and Shore Protection	2 CH
Prerequisites	Hydraulics (2)	

Number of weekly Contact Hours		
Lecture	Tutorial	Laboratory
2	1	0

Required SWL	100	Equivalent ECTS	4

Course Content
Natural phenomenon (winds, waves, tide, sea currents), Wave action and propagation (wave breaking, wave refraction), Wave Impact on Walls, Port master planning, Design of Navigation Channels, Design of breakwaters, Berthing facilities (quay walls types and their design), Vessels Mooring, Sediment transport, Shore Protection measures.

Used in Program / Level	
Program Name or requirement	Study Level
Utilities and Infrastructure Program Elective (1)	4

Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
50%	0%	0%	50%

E12.5 Hydrology Courses

CEI351	Environmental Hydrology				2 CH
Prerequisites	Irrigation and Drainage Engineering				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	125		Equivalent ECTS	5	
Course Content					
Introduction to Environmental Hydrology - Hydrometeorology: Temperature, Climate Change and its impact - Humidity and Evaporation – Precipitation: Types and Measurements, Rainfall analysis, intensity-duration-frequency (IDF) Curves - Hydromorphology: Watershed Characteristics and Morphological Analysis – Rainfall Runoff Relationship – Runoff Hydrograph Components – Unit Hydrograph: Theory and Applications – Flash Floods: Estimation of Peak Runoff – Negative and Positive Impacts of flash floods - Methods of Flash Flood Control - Flood Routing – Sediment Transport by Flash Floods: Volume Estimation and Control – Surface Water Pollution: Sources and Control - Eutrophication of Lakes.					
Used in Program / Level					
Program Name or requirement			Study Level		
Water Engineering and Hydraulic Structures Program			3		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
25%	25%		0%	50%	

CEI352	Applied Hydrology				2 CH
Prerequisites	Design of Irrigation Structures				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Different Applications of Hydrology in Civil Engineering. Design storm, Rainfall statistical analysis. Hydromorphology: Watershed characteristics, Morphological parameters, Time parameters. Surface runoff: Losses estimates (SCS method) Peak flow estimate (Rational Method), Storm hydrograph, Unit hydrograph, Mass curves. Soil loss estimation and Sediment yield. Protection works against flash floods: Storage and detention works, Roads crossing works, Direction change works, Sediment traps, Storm water drainage systems. Subsurface hydrology: Soil-water relations, Characteristics and types of aquifers, groundwater control systems.					
Used in Program / Level					
Program Name or requirement			Study Level		
Civil and Infrastructure Engineering Program			Third Level		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CEI451	Ground Water Hydrology			2 CH
Prerequisites	Hydraulics (2) or Hydraulics, Geotechnical Engineering (2) or Soil Mechanics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction: Groundwater and hydrologic cycle, Importance of groundwater, the relation of groundwater to geologic structure, Types and physical properties of aquifers, Aquifer systems in Egypt. Groundwater exploration methods. Groundwater hydraulics: Infiltration, Seepage, Percolation, Darcy’s law, Hydraulic conductivity measurements, Flow governing equations. Well hydraulics: Flow towards wells, Safe yield, Well construction, well development and pumping tests. Well evaluation Introduction to Groundwater quality and pollution: Pollution sources, Mechanisms of pollutant transfer in porous media, saltwater intrusion in coastal aquifers, Pollution control and remedy measures. Introduction to Groundwater modelling: Mathematical, Physical and numerical models, Modelling of flow in porous media, Modelling of pollutant transfer in porous media. Introduction to management of groundwater systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program – (elective)			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

CEI452	Engineering Hydrology			2 CH
Prerequisites	Fluid Mechanics, Geotechnical Engineering (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction: Engineering Hydrology Applications - Hydrologic Cycle - Hydrologic Data and Measurements – Evaporation - Precipitation - Rainfall Data Analysis – Infiltration – Surface Runoff – Introduction to Groundwater – Darcy’s Law and Flow Equations – Applications of Hydrology in Road Engineering – Flood Protection Works.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (1)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

E12.6 Water Resources Courses

CEI261	Engineering Economics and Management					2 CH
Prerequisites						
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Part (1): Engineering Economics: Introduction, Glossary of terms, Technical studies and engineering Costs estimate, Benefits and cost model, Financial cash flow diagrams, Time value of money and modern equivalent value, Economic based Multi Criteria Analysis (MCA). Part (2): Engineering Management of new projects: Stage (1) (Pre-project studies, submittal of the preliminary report), Stage (2) (Project design, submittal of the project TOR), Stage (3) (Bidding for contractors, shop drawings, project construction), Stage (4): (Project handling, preliminary project operation). Part (3): Engineering Management of Assets: Glossary of terms, Engineering assets, Asset extent, Asset serviceability, Asset Management Plan (AMP), Definition and origin, Features of AMP, Statistics in AMP, Producing AMP, System definition, Stratified random sampling, Environmental and legal aspects, Performance assessment, Asset survey, Cost model, Application of AMP, Implementation and further considerations.						
Used in Program / Level						
Program Name or requirement				Study Level		
Faculty Requirement Elective				2		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
25%	25%		0%		50%	

CEI262	Principles of Water Resources Engineering					2 CH
Prerequisites	Fluid Mechanics for Civil Engineers					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		0		
Required SWL	100		Equivalent ECTS		4	
Course Content						
Water-Resources Engineering provides comprehensive coverage of the principles of hydrology (Precipitation, Infiltration, Runoff, Evaporation), principles of hydraulics (flow in closed conduits, open channel flow, flow in rivers, lakes and estuaries, and groundwater flow), and principles of water-resources planning and management estimation of water demands and quality for different purposes, water supply from different sources, and feasibility of water resources projects)). Presented from first principles relevant to the practice of water resources engineering and reinforced by some design applications. Laboratory and field work on selected topics.						
Used in Program / Level						
Program Name or requirement				Study Level		
Civil and Infrastructure Engineering Program				Second Level		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

CEI361	Water Resources Engineering			2 CH
Prerequisites	Environmental Hydrology			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Water Resources in Egypt, Arab countries and Africa. Conventional and non- conventional water resources (reuse and recycling of domestic, industrial and agriculture wastewater, brackish groundwater, seawater, and water harvesting). Principal elements of water resources. Statistics on Water Availability and Future Needs, Water Requirements for Public Supplies and Other Usages; Factors influencing water availability and supply; hazards associated with water (droughts and flooding and pollution); the role of water in sustaining healthy ecosystems, Water Resources Planning and Management, Water Quality management, Introduction to Economic Feasibility of Water resources Projects, Water Rights, Hydro-politics and Trans-boundary Issues.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

CEI461	Geographical Information Systems in Water Engineering			2 CH
Prerequisites	Topographic Surveying (1) or Surveying (2)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		0	2	
Required SWL	125		Equivalent ECTS	5
Course Content				
The application of GIS technology to create solutions for water and environmental engineering problems is the main goal of this course. The course focuses generally on enhancing the spatial and spatiotemporal thinking of the students and their abilities to analyze and break down the spatial problem into GIS solutions. The contents of the course cover the concepts of GIS, data types, data sources, geo-referencing, coordinate systems and map projections, raster analysis and calculations, modelling in GIS environment, GIS applications in hydrology, GIS applications in infrastructure, GIS applications in irrigation and water resources management, general GIS applications in the planning/design and management of civil and environmental projects. The course tutorials provide students with technical skills and hands-on contact with GIS software via selected exercises and projects (both paper based and computer based).				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
40%	0%	10%	50%	

CEI462	Water Quality			2 CH
Prerequisites	Water Resources Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to water quality issues; Characteristics of surface waters and groundwater; Natural processes affecting water quality; Water use and water quality deterioration; Water and human health ; Basic concepts of surface and ground water quality modeling; Models of pollution transport; concepts of sediment quality in rivers and lakes; Solute transport; Nutrients and eutrophication; Toxic substances and sediments; Catchment water quality management ; Environmental impact of water pollution; design protocol and implementation of monitoring surface and groundwater; sampling and analytical methods; guidance on data analysis and presentation, water quality parameters and standard permissible limits.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program Elective (1)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

CEI463	Environmental Impact Assessment for WaterEngineering Projects			2 CH
Prerequisites	Principles of Water Resources Engineering or Water Resources Engineering, Coastal Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction: Availability of natural resources, Natural cycles for some basic elements (carbon, oxygen, nitrogen, sulfur, phosphorous…). Conflicts between developments, Economics and environments. Defining emissions sources, Impacts, Standards and precautions. Water, Air and soil pollution and measurements. Historical development for recognizing the need for environmental impact assessment. Assessing the impacts on health, Social, Cultural and economic activities. Procedures of the environmental impact assessment: Screening, Scoping, Defining impacts, Comparing alternatives, Plans for mitigation and alleviation, Environmental auditing. Public participation. Environmental impact statement and reporting, Contents and forms. Impact assessment methods, check list, simple matrix, stepped matrix, loops and networks. Environmental management plan. Environmental law. Examples for assessing the impacts of water resources projects on the environment and impacts of different activities on the water environment.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			4	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
25%	25%	0%	50%	

CEI464	Climate Change Adaptation in Water Resources Field			2 CH
Prerequisites	Water Resources Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to Hydrology and Water Resources, Introduction to climate change science and impacts in general, the factors responsible for climate change and the possible engineering solutions to avoid more extreme perturbations. Impacts of climate change on the hydrologic variations (floods, droughts, and sea level rise), Impacts of climate change on Water resources management (quantity and quality), Understanding Risk and vulnerability assessment of water resources due to climate changes, Identify and discuss water resources adaptation and strategies, Risk management and Risk reduction, Dealing with uncertainty, Protecting coasts, Adaptation to scarcity and changes in water availability, Examples for adaptation strategies.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program Elective (1)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

CEI465	Non-Conventional Water Resources			2 CH
Prerequisites	Water Resources Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
This course will focus on potential non-conventional water-resource applications such as; re-use and recycling of (urban waste water and agricultural drainage water) brackish groundwater and seawater desalination (types, reverse osmosis plant configuration, intakes and outfalls, energy requirements, operation and maintenance), cloud seeding, and rain water harvesting (valley tanks, rock catchment, tanks and cisterns), and flood harvesting (sand dams, spate irrigation, and dams).				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program Elective (2)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
50%	0%	0%	50%	

<table>
<tr><td colspan="2">CEI466</td><td colspan="8">Water Security and Governance</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Principles of Water Resources Engineering</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">The issue of water security, national security, human health, and ecosystem services is currently receiving considerable attention. Water security index can be calculated based on include five main dimensions: households, socio-economy, urban cities, environment, and resilience to natural disasters. Water security usually can be achieved through the concept of Integrated water management, which demands a new framework within which there may be a need for significant changes in existing interactions between politics, laws, regulations, institutions, civil society, and the consumer-voter. The capacity to make these changes depends therefore on changes in governance. The course covers the topics related to water security and governance with applications and case studies from Egypt and other countries.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

E12.9 Graduation Project

CEI491	Graduation Project			6 CH
Prerequisites	Water Engineering Elective (1), Water Engineering Elective (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		12		0
Required SWL	300		Equivalent ECTS	12
Course Content				
The student analyses and designs an integrated engineering system using the principles, foundations, and engineering skills that he acquired during the years of study. The project report submitted by the student should include the detailed steps of analysis and design realizing the requirements of the work and including the computer applications used in mathematical simulation for the designed system, and the laboratory tests if necessary. It also includes engineering drawings and maps needed to implement the designed system. The student must demonstrate in the body of his project, and during the project defense, his full understanding of the principles and foundations on which his project is based. He must also demonstrate ability to apply these principles in the field of his future engineering work.				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
50%	0%		0%	50%

CEI492	Civil Engineering Design Graduation Project (1)			3 CH
Prerequisites	Civil and Infrastructure Elective (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	150		Equivalent ECTS	6
Course Content				
The project of each team will encompass the conceptual and preliminary design of a medium-size civil engineering project. Students learn civil engineering design process, methodology, identification of objectives, codes, formulation of design problems. Development and evaluation of sustainable design alternatives. Computer-aided design tools. Performance evaluation using modelling, sensitivity analysis, and cost estimation.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
60%	0%		0%	40%

CEI493	Civil Engineering Senior Seminar			2 CH
Prerequisites	Civil Engineering Design Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		4		0
Required SWL	75	Equivalent ECTS	3	
Course Content				
Students will research and report on technical issues, research references, and will emphasize innovation and integration in civil engineering. The problems are identified and solutions are found to improve the performance of the civil in areas such as: Infrastructure Engineering and technologies, and a broad introduction into structures, engineering materials, transport systems, soil engineering, environment protection, Water Resources, water engineering and computer aided design. A technical report is written, presented, and discussed.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

CEI494	Civil Engineering Design Graduation Project (2)			3 CH
Prerequisites	Civil Engineering Design Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	150	Equivalent ECTS	6	
Course Content				
The project of each team will encompass the integrated design of at least two subdisciplines of civil engineering to achieve high performance at reasonable cost. Through case studies and literature survey, students learn the information gathering and decision/design process, problem resolution, and aspects related to management, teamwork, and communication. Students registering for this course must contact the course coordinator for the detailed procedure.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

E13. Courses offered by Public Works Engineering Department (CEP)

The Public Works Engineering Department is responsible for teaching courses that serve the following programs:

1. One course in Faculty Requirement.
2. Several Basic Civil Engineering courses as a Civil Discipline Requirement.
3. Water Engineering and Hydraulic Structures Program.
4. Structural Engineering Program.
5. Utilities and Infrastructure Program.
6. Building Engineering Program.
7. Civil and Infrastructure Engineering Program.
8. Architectural Engineering Program

Table 66 List of specializations at the Public Works Engineering Department.

#	Specialization
1	Surveying & Remote Sensing
2	Transportation Planning and Traffic Engineering
3	Highways and Airport Engineering
4	Railway Engineering
5	Sanitary and Environmental Engineering
6	Graduation Project

The following abbreviations are the legend for the courses table.

Lvl	Level
CH	Credit Hour
ECTS	European Credit Transfer System
SWL	Student Work Load
Lec	Lectures
Tut	Tutorials
Lab	Laboratory
TT	Total
UR	University Requirement
FR	Faculty Requirement
DR	Discipline Requirement
PR	Program Requirement
SA	Student Activities
MT	Mid-Term Exam
PE	Practical Exam
FE	Final Exam

Table 67 List of CEP courses.

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
1. Surveying & Remote Sensing																				
1	0	011	Projection and Engineering Graphics	3	6	150	1	3	2	6		x			40	20	0	40		
2	1	111	Plane Surveying (1)	2	4	100	2	1	1	4			x		15	10	15	60		
3		112	Plane Surveying (2)	3	5	125	2	1	2	5			x		15	10	15	60	CEP111	
4		113	Surveying	1	3	75	1	0	2	3				x	20	0	20	60		
5	2	211	Topographic Surveying (1)	2	5	125	2	1	1	4			x		15	10	15	60	CEP112	
6		212	Engineering Surveying	3	5	125	2	2	0	4			x		20	20	0	60	CEP211	
7		213	Surveying (1)	4	6	150	3	2	2	7				x	25	20	15	40	PHM013	
8		214	Surveying (2)	4	6	150	2	3	2	7				x	25	20	15	40	CEP213	
9	3	311	Topographic Surveying (2)	2	4	100	2	1	1	4				x	20	20	0	60	CEP211	
10		312	Surveying (3)	2	4	100	2	1	0	3				x	35	25	0	40	CEP214	
11		313	Photogrammetric Surveying	2	4	100	2	1	0	4				x	35	25	0	40	CEP312	
12		314	Infrastructure Network Planning	2	5	125	2	1	1	4				x	35	25	0	40	CEP312	
13	4	411	Geodetic Surveying	3	4	100	2	2	0	4				x	20	20	0	60	CEP212	CEP311
14		412	Hydrographic Surveying	2	4	100	2	1	0	3				x	20	20	0	60	CEP311	
15		413	Geographic Information Systems GIS	2	4	100	2	1	0	3				x	20	20	0	60	CEP311	
16		414	Surveying using Satellite	2	4	100	2	1	0	3				x	20	20	0	60	CEP411	
17		415	Geodetic and GPS Surveying	2	4	100	2	1	0	4				x	35	25	0	40	CEP312	
18		416	Hydrographic Surveying and Harbor Engineering	2	4	100	2	1	0	4				x	35	25	0	40	CEP312	
19		417	GIS Applications in Civil infrastructure Projects	2	4	100	2	1	0	4				x	35	25	0	40	CEP312	
2. Transportation Planning and Traffic Engineering																				
20	2	221	Introduction to Transportation & Traffic Engineering	3	5	125	2	2	0	4				x	35	25	0	40	PHM111	
21	3	321	Transportation Planning	3	5	125	2	2	0	4				x	20	20	0	60	PHM111	
22		322	Transportation and Roads Engineering	2	5	125	2	1	0	3				x	20	20	0	60	PHM111	
23		323	Principles of Traffic Engineering	2	4	100	2	1	0	4				x	35	25	0	40	CEP221	
24	4	421	Traffic Engineering	3	4	100	2	2	0	4				x	20	20	0	60	CEP321	
25		422	Traffic Management Systems	2	4	100	2	1	0	3				x	20	20	0	60	CEP321	CEP421
26		423	Traffic Studies and Analysis	2	4	100	2	1	0	3				x	20	20	0	60	CEP421	
27		424	Transportation Economics	2	4	100	2	1	0	4				x	35	25	0	40	CEP221	
28		425	Urban Transportation Planning	2	4	100	2	1	0	4				x	35	25	0	40	CEP221	
29		426	Intelligent Transportation Systems	2	4	100	2	1	0	4				x	35	25	0	40	CEP221	

#	Lvl	Code	Course Title	Credits and SWL			Contact Hours				Classification				Assessment (%)				Prerequisites	
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	SA	MT	PE	FE		
3. Highways and Airport Engineering																				
30	3	331	Roads and Airport Engineering	3	5	125	2	2	0	4				x	20	20	0	60		
31		332	Highway Geometric and Structural Design	3	5	125	2	2	0	4				x	35	25	0	40	CEP221	
32		333	Road Construction Material	2	4	100	2	1	0	4				x	35	25	0	40	CEP332	
33	4	431	Highway Construction Technology	3	4	100	2	2	0	4				x	20	20	0	60	CEP331	
34		432	Maintenance of Roads and Airport	2	4	100	2	1	0	3				x	20	20	0	60	CEP331	
35		433	Airport Planning and Design	2	4	100	2	1	0	3				x	20	20	0	60	CEP331	
36		434	Road Maintenance	2	4	100	2	1	0	4				x	35	25	0	40	CEP332	
37		435	Road Construction	2	4	100	2	1	0	4				x	35	25	0	40	CEP332	
38		436	Airport Engineering	2	4	100	2	1	0	4				x	35	25	0	40	CEP332	
4. Railway Engineering																				
39	3	341	Railway Engineering (1)	3	5	125	2	2	0	4				x	20	20	0	60		
40		342	Railway Engineering Principles	2	5	125	2	1	0	3				x	35	25	0	40	CEP221	
41	4	441	Railway Engineering (2)	2	4	100	2	1	0	3				x	20	20	0	60	CEP341	
42		442	Railway Signaling and Control System	2	4	100	2	1	0	3				x	20	20	0	60	CEP441	
5. Sanitary and Environmental Engineering																				
43	1	151	Introduction to Environmental Engineering	2	3	75	2	1	0	3				x	35	25	0	40		
44	2	251	Green Building Systems and Infrastructure	2	4	100	1	2	0	3				x	35	25	0	40		
45	3	351	Water and wastewater Networks	3	5	125	2	2	0	4				x	20	20	0	60	CEI211	
46		352	Sanitary Engineering	3	5	125	2	2	0	4				x	20	20	0	60	CEI211	
47		353	Principles of Water and Wastewater Treatment	3	6	150	2	2	0	4				x	35	25	0	40	CEI111	
48		354	Computer Applications in Sanitary Engineering	2	4	100	2	1	0	4				x	35	25	0	40	CEP353	
49	4	451	Water and Wastewater Treatment	3	5	125	2	2	0	4				x	20	20	0	60	CEP351	
50		452	Environmental Engineering	2	4	100	2	1	0	3				x	20	20	0	60	CEP351	
51		453	Sludge Management	2	4	100	2	1	0	3				x	20	20	0	60	CEP451	
52		454	Solid Waste Management	2	4	100	2	1	0	3				x	20	20	0	60		
53		455	Design of Water and Wastewater Networks	2	4	100	2	1	0	4				x	35	25	0	40	CEP353	
54		456	Water and Wastewater Supply	2	4	100	2	1	0	4				x	35	25	0	40	CEP353	
55		457	Reuse of Treated Wastewater	2	4	100	2	1	0	4				x	35	25	0	40	CEP353	
9. Graduation Project																				
56	4	491	Utilities and Infrastructure Graduation Project	6	12	300	1	10	0	11				x	50	0	0	50	Elect.(1)	/Elect.(2)/
57		492	Civil Engineering Design Graduation Project (1)	3	6	150	1	4	0	5				x	60	0	0	40		
58		493	Senior Seminar	2	3	75	0	4	0	2				x	60	0	0	40		
59		494	Civil Engineering Design Graduation Project (2)	3	6	150	1	4	0	5				x	60	0	0	40		

E13.1 Surveying & Remote Sensing Courses

CEP011	Projection and Engineering Graphics				3 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		3		2	
Required SWL	150		Equivalent ECTS	6	
Course Content					
Introduction to descriptive geometry, projection of points, lines, surfaces. Intersection of bodies and surfaces. Development of surfaces. The principles of steel drawing and construction. Derivation of views and sections from given views of steel constructions. Fundamentals of architectural drawings: Plans, sections, elevations, and paraline drawings. Computer aided drafting (CAD).					
Used in Program / Level					
Program Name or requirement			Study Level		
Faculty Requirement			0		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
40%	20%		0%	40%	

CEP111	Plane Surveying (1)				2 CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		1	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Introduction to mapping and surveying science - Different surveying instruments and their uses - The surveying maps and their types - Reconnaissance and surveying sketches drawing - Scales- International coordinate systems - Different coordinate systems used in Egypt - The Theodolite - Methods of observing angles and directions - Methods of observing distances - Theory of errors - Errors in surveying measurements, sources, types and treatment.					
Used in Program / Level					
Program Name or requirement			Study Level		
Civil Engineering Requirement			1		
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
15%	10%		15%	60%	

CEP112	Plane Surveying (2)			3 CH
Prerequisites	Plane Surveying (1)			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		1	2	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Different horizontal control networks (triangulation, trilateration, hybrid) - Traverses and their specification and standards of accuracy for different projects - Control points and their fixation - Traverse observations and calculations - Detailing using traverses - Point positioning techniques - Two dimensional coordinates transformation - Surveying maps production(hard copy and Digital Maps).				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	10%	15%	60%	

CEP113	Surveying			2 CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
1		1	1	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Introduction to mapping and surveying science - Definitions and branches of surveying science and its applications - Different surveying instruments and their uses - The surveying maps and their types – Point positioning techniques - Setting out techniques - Interior and exterior survey of buildings for architectural projects and production of maps - Introduction to vertical control in surveying - Determination of the mean sea level in Egypt - Different surveying instruments used for height difference measurement - Different types of bench marks - Ordinary and precise leveling - Calculation of leveling - Applications of leveling - Grid leveling and generation of contour lines - Longitudinal profiles and cross sections.				
Used in Program / Level				
Program Name or requirement			Study Level	
Architectural Engineering Requirement			1	
Landscape Architectural Program			1	
Environmental Architecture and Urbanism Program			1	
Housing and Urban Development Program			1	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	25%	15%	40%	

CEP211	Topographic Surveying (1)			2 CH
Prerequisites	Plane Surveying (2)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		1	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to vertical control in surveying - Determination of the mean sea level in Egypt - Different surveying instruments used for height difference measurement - Different types of bench marks - Ordinary and precise leveling - Calculation of leveling –Indirect methods for height differences determination-Applications of leveling - Grid leveling and generation of contour lines - Longitudinal profiles and cross sections - Computation of volumes of earth works.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil Engineering Requirement			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
15%	10%	15%	60%	

CEP212	Engineering Surveying			3 CH
Prerequisites	Topographic Surveying (1)			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
The use of total stations in surveying mapping- The role of surveying in construction of different projects such as (Roads, Tunnels- pipeline, ...) - Surveying setting out using different surveying instruments - Deformation monitoring techniques - Surveying reports for different engineering projects - Introduction to GPS.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program			2	
Water Engineering and Hydraulic Structures Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP213	Surveying (1)			4 CH
Prerequisites	Mathematics (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
3		2		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Introduction to surveying science: Historical background, definitions and branches of surveying science. Introduction to national and international mapping system, linear measurements, electronic distance measurements, angular measurements, computation of coordinates, traverse (measurements, calculations, adjustments and drawing), coordinate calculations, two dimensional coordinate transformation, area calculations (regular and irregular parcel shapes) by using analytical, mechanical and graphical methods, parcel division techniques, kinds and types of errors in surveying measurement, introduction to theory of errors.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	20%		15%	40%

CEP214	Surveying (2)			4 CH
Prerequisites	Surveying (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		3		2
Required SWL	150		Equivalent ECTS	6
Course Content				
Introduction to vertical control, different methods for height difference determination, ordinary levelling, survey level and survey staff, Calculation of ordinary levelling, Precise level, Calculations of precise levelling, Indirect methods for height difference determination, Tachometry, Trigonometric levelling, Earth curvature and refraction and their effects on height differences, applications of levelling, longitudinal levelling, cross section levelling, grid levelling, contour lines, topographic maps, volume computations and earth work.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			2	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
25%	20%		15%	40%

CEP311	Topographic Surveying (2)			2 CH
Prerequisites	Topographic Surveying (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	100		Equivalent ECTS	4
Course Content				
The use of total stations in surveying mapping- The role of surveying in construction of different projects such as (Roads, Tunnels- pipeline, ...) - Surveying setting out using different surveying instruments - Deformation monitoring techniques - Surveying reports for different engineering projects - Introduction to GPS.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CEP312	Surveying (3)			2 CH
Prerequisites	Surveying (2)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Role of Surveying in engineering projects, Total station instrument and its applications in setting out of coordinates, deformation monitoring. Methods of setting out of sewer and infrastructure networks, Roads (Hz and Vl curves), Tunnel Surveying, Introduction to geometric geodesy, map projection, coordinate transformation, Introduction to GPS and GIS.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP313	Photogrammetric Surveying			2 CH
Prerequisites	Surveying (3)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to photogrammetry, Types of analog and digital cameras, Aerial surveying, type of aerial photo, geometry of overlapping aerial photos, Determination of 3D coordinates from planning of aerial surveying projects, modern techniques in photogrammetry, types of terrestrial cameras, calibration of cameras, determination of three dimensional coordinates from terrestrial photos, application of photogrammetry in mobile mapping systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CEP314	Infrastructure Network Planning			2 CH
Prerequisites	Surveying (3)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		1
Required SWL	125		Equivalent ECTS	5
Course Content				
Role of GIS in engineering projects, holistic view of integrated infrastructure networks for public works, effective planning methods, build-up of integrated GIS/data base for infrastructure networks, indicators for monitoring and decision-making of infrastructure networks.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

<table>
<tr><td colspan="3">CEP411</td><td colspan="7">Geodetic Surveying</td><td colspan="2">3CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Engineering Surveying, Topographic Surveying (2)</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">2</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Astronomic coordinates and its relation to geodetic coordinates - The geoid - Different geodetic computational surfaces - Properties of ellipsoid - Reduction of surveying observations - Determination of coordinates of points on the computational surface - Transformations between coordinate systems - Errors in GPS observations - Coordinates determinations using different GPS techniques - GPS operation planning - Applications of GPS in engineering projects.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Utilities and Infrastructure Program</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="3">60%</td></tr>
</table>

<table>
<tr><td colspan="3">CEP412</td><td colspan="7">Hydrographic Surveying</td><td colspan="2">2CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Geodetic Surveying</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Introduction to natural phenomena and their effect on mean sea level - Different kinds of hydrographic survey - Engineering projects that need the application of hydrographic surveying applications - Instruments used in hydrographic surveying, kinds and accuracies - Navigation tools used marine scanning - Topographic maps production of sea bed - Different methods for volumes computations of sea bed for different hydrographic projects.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Utilities and Infrastructure Program Elective (1)</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="3">60%</td></tr>
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CEP413	Geographic Information System GIS			2CH
Prerequisites	Geodetic Surveying			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to geographic information system (GIS), kinds of used information, transforming the analog drawings to digital maps and study of the errors resulting from the process of transforming and merging, building attribute date base and linking it with the analog data. Methods of data input, store and output. Applications of GIS in the field of roads, transportations and sanitary engineering. Applications of GIS in water resources harbors, marine contraction and hydraulic contraction like regulators, dams and other projects. Decision making support by GIS in non-engineering fields.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (2)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CEP414	Surveying using Satellite			2CH
Prerequisites	Geodetic Surveying			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introductions to Global Navigation Satellite System (GNSS): Conventional navigation, background, concepts and evolutions of global navigation satellite systems (GPS, GLONASS, Galileo, BeiDou/ COMPASS). GNNS Observables. GNSS Mathematics and Position determination techniques. Absolute and relative positioning, principles, observations. Post-processing and real time applications. Coordinate transformations, 3D, and 2D Cartesian and ellipsoidal coordinates. Satellite images overview. Basics of Remote Sensing. Microwave and LiDAR Remote Sensing. Thermal Remote Sensing. Hyper spectral Remote Sensing. Maps from satellite images.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (4)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CEP415	Geodetic and GPS Surveying				2 CH
Prerequisites	Surveying (3)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Astronomic coordinates and their relation to geographic coordinates, Astronomic latitude and azimuth determination from astronomic triangle, Least squares principles and its applications, Different reference ellipsoids and geodetic datums, Reduction of observation, 3D coordinates computations and transformation, Coordinates determinations using different GPS techniques, GPS operation planning, Applications of GPS in infrastructure civil engineering s projects.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil and Infrastructure Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CEP416	Hydrographic Surveying and Harbor Engineering				2 CH
Prerequisites	Surveying (3)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
Introduction to natural phenomena and their effect on coasts and harbors. Planning factors which affect the design of harbors and their protection. Design of dry basins and navigation channels: Open and determined. Surveying procedure of marine survey and the associated instruments. Methods of horizontal and vertical control in marine survey. Methods of depth determinations and contour mapping. Position determination and setting out of off sure engineering projects.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil and Infrastructure Engineering Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CEP417	GIS Applications in Civil infrastructure Projects			2 CH
Prerequisites	Surveying (3)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction, GIS components, Data models: coordinates, attribute data and types, vector data models, Raster Data models, Data and file structure. Map projection and coordinate systems. Building a GIS data base, digitizing, coordinate transformation. Digital Data. Attribute data and tables. Basic spatial analysis in infrastructure projects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

E13.2 Transportation Planning and Traffic Engineering Courses

CEP221	Introduction to Transportation and Traffic Engineering			3 CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Transportation planning: Introduction to transportation planning. Stages of the urban and regional transportation plans, Data collection process required for the transportation plans, Stages of the travel demand forecasting process using the traditional sequential approach, Trip generation - trip distribution; Modal choice; Network assignments; Network equilibrium; Traffic studies (volume, speed, and density); Traffic flow characteristics; Intersection control; Conflict point at intersection; Traffic signal design, Weaving for intersection.				
Used in Program / Level				
Program Name or requirement			Study Level	
Building Engineering Program			3	
Civil and Infrastructure Engineering Program			2	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP321	Transportation Planning			3CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture		Tutorial	Laboratory	
2		2	0	
Required SWL	125		Equivalent ECTS	5
Course Content				
Introduction to transportation planning, stages of urban and regional transportation plans, Data collection process required for the transportation plans, Stages of the travel demand forecasting process using the traditional sequential approach, (trip generation, trip distribution, modal split, and trip assignment), evaluation of the transportation projects.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
20%	20%		0%	60%

CEP322	Transportation and Roads Engineering			2CH
Prerequisites	Probability and Statistics			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Introduction to transportation planning, stages of urban and regional transportation plans, travel demand forecasting process, Applications of Intelligent Transportation Systems, Classification of roads, Traffic characteristics, Geometric design criteria, Sight distances, Horizontal alignment, Vertical alignment, Elements of cross section, At grade intersection design, traffic flow characteristics (traffic volume, traffic speed, traffic density), Characterization and evaluation of pavement materials, Design of asphalt mixes, Load and truck considerations, Stresses in flexible pavement, stresses in Rigid pavement, Flexible pavement design, Rigid pavement design				
Used in Program / Level				
Program Name or requirement			Study Level	
Water Engineering and Hydraulic Structures Program			3	
Structural Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP323	Principles of Traffic Engineering			2 CH
Prerequisites	Introduction to Transportation and Traffic Engineering			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Traffic Flow Theory; Vehicle, roadway and driver characteristics, Traffic signal timing, Parking studies; Traffic safety studies, Capacity analysis of basic freeway segments, multilane, and two-lane highways, Computer applications.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

<table>
<tr><td colspan="2">CEP421</td><td colspan="5">Traffic Engineering</td><td>3 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">Transportation Planning</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="2">2</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Traffic engineering elements (driver, pedestrians, vehicle, road), traffic flow characteristics (volume, speed, and density), travel time, and delay, Traffic volume studies, traffic speed studies, alignment and design of intersections, traffic signal design.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="5">Utilities and Infrastructure Program</td><td colspan="3">4</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td colspan="2">CEP422</td><td colspan="5">Traffic Management Systems</td><td>2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="6">Transportation Planning</td></tr>
<tr><td colspan="8">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="2">1</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">100</td><td colspan="2">Equivalent ECTS</td><td colspan="2">4</td></tr>
<tr><td colspan="8">Course Content</td></tr>
<tr><td colspan="8">Traffic problems impact, difference between traffic and transportation management, objectives of traffic management, traffic management measures for traffic operation improvement (one-way street, coordinating signal timing, restricting turning movements, tidal and reversible flow), Management measures for public transport, definition and applications of Intelligent transport systems, traffic impact studies.</td></tr>
<tr><td colspan="8">Used in Program / Level</td></tr>
<tr><td colspan="5">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="5">Utilities and Infrastructure Program Elective (2)</td><td colspan="3">4</td></tr>
<tr><td colspan="8">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="2">Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="2">20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

CEP423	Traffic Studies and Analysis (Elective 3)					2CH
Prerequisites	Traffic Engineering, Transportation Planning					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		0		
Required SWL		100	Equivalent ECTS		4	
Course Content						
Traffic control devices, intersection design software applications, traffic weaving, pedestrians and bikes movement characteristics, accidents studies, parking studies						
Used in Program / Level						
Program Name or requirement				Study Level		
Utilities and Infrastructure Program Elective (3)				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
20%	20%		0%		60%	

CEP424	Transportation Economics					2 CH
Prerequisites	Introduction to Transportation and Traffic Engineering					
Number of weekly Contact Hours						
Lecture		Tutorial		Laboratory		
2		1		0		
Required SWL		100	Equivalent ECTS		4	
Course Content						
Application of micro- and macro-economic theories to transportation system analysis; interaction between transportation system, land use, and regional economics; mobility, accessibility, and system reliability; market equilibrium; pricing, willingness to pay, and welfare analysis; cost benefit analysis; project finance.						
Used in Program / Level						
Program Name or requirement				Study Level		
Civil and Infrastructure Engineering Program Elective				4		
Assessment Criteria						
Student Activities	Mid-Term Exam		Practical Exam		Final Exam	
35%	25%		0%		40%	

<table>
<tr><td colspan="3">CEP425</td><td colspan="8">Urban Transportation Planning</td><td>2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Introduction to Transportation and Traffic Engineering</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; transportation modeling--trip generation, trip distribution, modal choice, traffic assignment, technological characteristics and operation of modern transit and other movement systems. Site development and traffic impact analysis, financial and economic assessment of transport projects.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

<table>
<tr><td colspan="3">CEP426</td><td colspan="8">Intelligent Transportation Systems</td><td>2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="9">Introduction to Transportation and Traffic Engineering</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Introduction: what is ITS, Why ITS-Requirements and needs of ITS Services, ITS Technologies, ITS User Services and Taxonomy, ITS Enabling Technologies, ITS Deployments and Benefits, Introduction to ITS Architecture, Transportation Planning and ITS, ITS Evaluation, Types of Risks and Mitigation Strategies, ITS Challenges and Opportunities in Developing Countries, Applicability to local and regional context, Case Studies.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

E13.3 Highways and Airport Engineering Courses

CEP331	Roads and Airports Engineering		3 CH
Prerequisites			
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	125	Equivalent ECTS	5
Course Content			
Classification of roads, Traffic characteristics, Geometric design criteria, Sight distances, Horizontal alignment, Vertical alignment, Elements of cross section. Pavement construction materials: Design and characteristics of asphalt mixes, Characterization of pavement materials, testing and specifications, Load and truck considerations, Soil stabilization, Stresses in flexible pavements, Stresses in rigid pavements. Flexible pavement design, Rigid pavement design, Airports pavement design. Technology of roads construction, Quality control. Surface drainage design for roads and airports, Road maintenance, Recycling of road pavement materials, Pavement management systems, Computer application in highways design.			
Used in Program / Level			
Program Name or requirement		Study Level	
Utilities and Infrastructure Program		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
20%	20%	0%	60%

CEP332	Highway Geometric and Structural Design		3 CH
Prerequisites	Introduction to Transportation and Traffic Engineering		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	2	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
Highway classification, highway hierarchy, design control and criteria, road cross section elements, sight distances, applications of sight distances horizontal alignment, vertical alignment, consistency of alignment, types of intersections, intersection planning, traffic control devices. Soil classification, evaluation of soil strength, types of pavements, pavement layers and properties stresses in flexible pavement, design of flexible pavement, overlay design for flexible pavement, stresses in rigid pavement, design of rigid pavement			
Used in Program / Level			
Program Name or requirement		Study Level	
Civil and Infrastructure Engineering Program		3	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

CEP333	Road Construction Material			2 CH
Prerequisites	Highway Geometric and Structural Design			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Soil classification, evaluation of soil strength, road embankment material, sub- grade material, sub-base material, base course material, asphalt mix types, design of asphalt mixes, quality control tests.				
Used in Program / Level				
Program Name or requirement		Study Level		
Civil and Infrastructure Engineering Program Elective		3		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CEP431	Highway Construction Technology			3 CH
Prerequisites	Roads and Airport Engineering			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	2		0	
Required SWL	125	Equivalent ECTS	5	
Course Content				
Technology of embankment construction, technology of pavement construction. Lay down of asphalt mixes: compaction of asphalt mixes. Operation and supervision of asphalt mixing plants, equipment, inspection, quality control, surface treated pavements, methods of soil stabilization. Rigid pavements: technology of construction, quality control. construction requirements for modified binders: polymers, Sulphur, mineral filler and other additives. Use of asphalt in hydraulic structures: reservoirs, tanks design, dams, canal lining, embankment protection, coastal structures.				
Used in Program / Level				
Program Name or requirement		Study Level		
Utilities and Infrastructure Program		4		
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

<table>
<tr><td colspan="3">CEP432</td><td colspan="6">Maintenance of Roads and Airports</td><td>2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="7">Roads and Airport Engineering</td></tr>
<tr><td colspan="10">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="4">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="4">1</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="10">Course Content</td></tr>
<tr><td colspan="10">Assessment of pavement distresses: Assessment of flexible pavement distresses and assessment of rigid pavement distresses, "Tests of pavement evaluation, methods of pavement evaluation, Road maintenance, Maintenance of flexible pavement. Maintenance of rigid pavement, Maintenance of pedestrian crossing routes, Road cubs and pitching, Maintenance of unpaved roads, Maintenance of drainage system, Maintenance of opened and covered ditches, Maintenance of surface water drainage system, Recycling of road pavement materials, Reconstruction works, Pavement management system.</td></tr>
<tr><td colspan="10">Used in Program / Level</td></tr>
<tr><td colspan="7">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="7">Utilities and Infrastructure Program Elective</td><td colspan="3">4</td></tr>
<tr><td colspan="10">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="2">60%</td></tr>
</table>

<table>
<tr><td colspan="3">CEP433</td><td colspan="6">Airport Planning and Design</td><td>2 CH</td></tr>
<tr><td colspan="3">Prerequisites</td><td colspan="7">Roads and Airport Engineering</td></tr>
<tr><td colspan="10">Number of weekly Contact Hours</td></tr>
<tr><td colspan="3">Lecture</td><td colspan="4">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="3">2</td><td colspan="4">1</td><td colspan="3">0</td></tr>
<tr><td colspan="2">Required SWL</td><td colspan="2">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="10">Course Content</td></tr>
<tr><td colspan="10">Airport site location selection, Airport components, planning of both airside and landside, Airport capacity, Airport geometric design, Airport structure design, Airport Utilities and infrastructures.</td></tr>
<tr><td colspan="10">Used in Program / Level</td></tr>
<tr><td colspan="7">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="7">Utilities and Infrastructure Program Elective</td><td colspan="3">4</td></tr>
<tr><td colspan="10">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td colspan="3">20%</td><td colspan="3">0%</td><td colspan="2">60%</td></tr>
</table>

CEP434	Road Maintenance			2 CH
Prerequisites	Highway Geometric and Structural Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Pavement types, Pavement materials; sub-grade stabilization methods; Principles of mix design using SUPERPAVE; Analysis of stresses in flexible and rigid pavement, Design methods of highway flexible and rigid pavements; Overlay design, Computer applications. Pavement Maintenance and Quality Control - Routine, Periodic Maintenance, Special Repairs, Responsive Maintenance Programs, Rehabilitation and Reconstruction, Components of Pavement Maintenance Management System (PMMS).				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP435	Road Construction			2 CH
Prerequisites	Highway Geometric and Structural Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Road construction equipment, equipment productivity and efficiency, new trends in road construction, soil stabilization and soil reinforcement, full depth reclamations of deteriorated pavement, quality control and quality assurance				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP436	Airport Engineering			2 CH
Prerequisites	Highway Geometric and Structural Design			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Civil airport location selection, Airport planning, airside planning, landside planning, airport capacity, airport geometric design; runway, taxiway, aprons, parking facilities airport pavement design for critical and non-critical airfield elements, noise control.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

E13.4 Railway Engineering Courses

CEP341	Railway Engineering (1)			3CH
Prerequisites				
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Railway dynamics: Tractive effort and resistance, Acceleration and braking, Line capacity. Railway alignment: Longitudinal and cross sections, Railway path, Vertical and horizontal curve design, Gaparite, cumulative curve. Structural design of track: Wheel – rail interaction, forces acting on the rail, joined and welded rail design, sleeper and ballast design, Unballasted track and magnetic levitation train, turnouts, stations and signals, Renewal and maintenance.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP342	Railway Engineering Principles			2 CH
Prerequisites	Introduction to Transportation and Traffic Engineering			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Railway dynamics, Tractive effort and resistances, Acceleration and braking; Railway Alignment, Longitudinal and cross sections, Vertical and horizontal curve design; Structural design of track, Jointed and welded rail design, Sleeper and ballast design; Turnouts and switches, Switch, Crossover, Diamond crossing, Scissor crossover, slip, Double junction; Stations and yards, Passenger and freight stations, Locomotive and stabling yard, Sorting and marshalling yards; Signaling; Train traffic management, Automatic block system (ABS), Centralized traffic control (CTC), Automatic control system (ATC),Railway capacity, Railway cost, Railway renewal and maintenance management.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
35%	25%	0%	40%	

CEP441	Railway Engineering (2) (Elective 1)				2 CH
Prerequisites	Railway Engineering (1)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		100	Equivalent ECTS		4
Course Content					
Turnouts and switches: Switch, Diamond crossing, Crossover, Scissor crossover, Slip, Double junction. Stations and yards: Passenger and freight stations, Locomotive and stabling yards, sorting and marshalling yard. Railway cost: Price and subsidy. Signals: Classification and types, Mechanical devices of interlocking, train traffic control, Automatic Block System (ABS), Centralized Traffic Control system (CTC), Automatic Train Control (ATC) system.					
Used in Program / Level					
Program Name or requirement				Study Level	
Utilities and Infrastructure Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

CEP443	Railway signaling and control systems (Elective 4)				2 CH
Prerequisites	Railway Engineering (2)				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL		100	Equivalent ECTS		4
Course Content					
Functions of signaling, Semaphore signaling, Operating principles of light signaling, Equipment and parts of a light signaling system, Train running procedure in a light signaling system, Speed control, Centralized traffic control (CTC) Systems, Automatic Train Control (ATC), Positive Train Control (PTC).					
Used in Program / Level					
Program Name or requirement				Study Level	
Utilities and Infrastructure Program				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
20%	20%		0%	60%	

E13.5 Sanitary and Environmental Engineering Courses

CEP151	Introduction to Environmental Engineering				2 CH
Prerequisites	Statics & Microbiology				
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
2		1		0	
Required SWL	75		Equivalent ECTS	3	
Course Content					
Introduction to environmental sciences: Water resources, Water supply, Wastewater systems, Solid waste management, Air pollution. Solid waste management: Collection, Handling, Separation and treatment, Disposal, Recycling and reuse. Monitoring and control, Noise, Environmental laws and its applications. Ground water pollution, Surface water pollution, Engineering projects to fight natural water pollution. Air: Quality, Environmental impact of Air pollution, Engineering projects to fight natural Air pollution. Soil: Quality, Environmental impact of Soil pollution, Engineering projects to fight natural Soil pollution.					
Used in Program / Level					
Program Name or requirement				Study Level	
Civil and Infrastructure Engineering Program				First Level	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0%	40%	

CEP251	Green Building Systems and Infrastructure				2CH
Prerequisites					
Number of weekly Contact Hours					
Lecture		Tutorial		Laboratory	
1		2		0	
Required SWL	100		Equivalent ECTS	4	
Course Content					
The fundamentals of water supply works. Water supply systems and distribution networks. Introduction to waste water systems, Plumbing equipment and sanitation, water collection and treatment, waste water treatment, firefighting and protection systems. These fundamentals are in compliance with environmental basics and considerations					
Used in Program / Level					
Program Name or requirement				Study Level	
Environmental Architecture and Urbanism Program				2	
Landscape Architecture Program Elective				4	
Assessment Criteria					
Student Activities	Mid-Term Exam		Practical Exam	Final Exam	
35%	25%		0 %	40%	

<table>
<tr><td>CEP351</td><td colspan="5">Water and Wastewater Networks</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Hydraulics (2)</td></tr>
<tr><td colspan="7">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="3">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td colspan="7">Preliminary studies for water supply and sewerage projects, sources of water, design flow rates, water collection, water pumping and transportation, water storage, water distribution networks, wastewater collection systems, hydraulic design, pipe material, network accessories, pump stations, force main, water hammer.</td></tr>
<tr><td colspan="7">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="4">Utilities and Infrastructure Program</td><td colspan="3">3</td></tr>
<tr><td colspan="7">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td>20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
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<table>
<tr><td>CEP352</td><td colspan="5">Sanitary Engineering</td><td>3 CH</td></tr>
<tr><td>Prerequisites</td><td colspan="6">Hydraulics (2)</td></tr>
<tr><td colspan="7">Number of weekly Contact Hours</td></tr>
<tr><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Laboratory</td></tr>
<tr><td colspan="2">2</td><td colspan="2">2</td><td colspan="3">0</td></tr>
<tr><td>Required SWL</td><td colspan="2">125</td><td colspan="2">Equivalent ECTS</td><td colspan="2">5</td></tr>
<tr><td colspan="7">Course Content</td></tr>
<tr><td colspan="7">Preliminary studies for water supply and sewerage projects, sources of water, water quality and standards, design flow rates, water collection, water pumping and transportation works, water storage, water distribution networks, wastewater collection networks, hydraulic design, pump stations, force mains, pipe materials, network accessories. Design of water treatment plants using conventional processes. Design of wastewater treatment plants using conventional processes, sludge treatment.</td></tr>
<tr><td colspan="7">Used in Program / Level</td></tr>
<tr><td colspan="4">Program Name or requirement</td><td colspan="3">Study Level</td></tr>
<tr><td colspan="4">Structural Engineering Program</td><td colspan="3">3</td></tr>
<tr><td colspan="4">Water Engineering and Hydraulic Structures Program</td><td colspan="3">3</td></tr>
<tr><td colspan="7">Assessment Criteria</td></tr>
<tr><td colspan="2">Student Activities</td><td>Mid-Term Exam</td><td colspan="2">Practical Exam</td><td colspan="2">Final Exam</td></tr>
<tr><td colspan="2">20%</td><td>20%</td><td colspan="2">0%</td><td colspan="2">60%</td></tr>
</table>

CEP353	Principles of Water and Wastewater Treatment			3 CH
Prerequisites	Fluid Mechanics			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	150		Equivalent ECTS	6
Course Content				
Principles of public health engineering, Water Treatment: Water Quality (raw and Treated), Types of water intakes and their locations, low lift pump, flash mixing tanks, Coagulation and Flocculation, Sedimentation process with different types of sedimentation basins, Filtration (slow sand filters/ rapid sand filters/ pressure filters),ground storage, Disinfection, iron and manganese removal, Wastewater treatment: Wastewater quality, Preliminary treatment, Primary treatment, secondary treatment (activated sludge and its modification, oxidation ditches, trickling filters, stabilization ponds), Tertiary treatment, sludge treatment, disinfection and disposal.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP354	Computer Applications in Sanitary Engineering			2 CH
Prerequisites	Principles of Water and Wastewater Treatment			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to WaterCad software: Training to feed the software with the input data such as: water demand, flow pattern, peak flow factors, elevated tanks data, pumps data, and junction ground levels, and fire hydrants data. Introduction to SewerCad: Training to feed the software with the input data such as flow at each manhole, conduit catalogues design constrains in SewerCad (such as minimum and maximum slopes minimum and maximum covers, velocity of flow, partially full and manhole). Laboratory training on using WaterCad and SewerCad (data entry and output data).				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			3	
Assessment Criteria				
Student Activities	Mid-Term Exam		Practical Exam	Final Exam
35%	25%		0%	40%

CEP451	Water and Wastewater Treatment			3 CH
Prerequisites	Water and Wastewater Networks, Engineering Chemistry			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		2		0
Required SWL	125		Equivalent ECTS	5
Course Content				
Water quality and standards, Physical, chemical and biological processes for water and wastewater treatment. Design of water treatment plants using conventional and advanced processes. Design of wastewater treatment plants using conventional and advanced processes. Sludge treatment. Disposal and reuse of wastewater and sludge.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP452	Environmental Engineering			2 CH
Prerequisites	Water and Wastewater Networks			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
2		1		0
Required SWL	100		Equivalent ECTS	4
Course Content				
Introduction to environmental sciences, water quality and standards, water pollution sources and impacts, water quality modeling, air pollution and control, solid waste management: collection, handling, separation and treatment, disposal, recycling and reuse.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (1)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP453	Sludge Management			2 CH
Prerequisites	Water and Wastewater Treatment			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Characteristics and volume of sludge, sludge handling, sludge thickening, sludge stabilization, sludge digestion, sludge composting, sludge dewatering, sludge disposal and reuse, environmental impact.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (3)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP454	Solid Waste Management			2 CH
Prerequisites	None			
Number of weekly Contact Hours				
Lecture	Tutorial		Laboratory	
2	1		0	
Required SWL	100	Equivalent ECTS	4	
Course Content				
Source, composition, properties and quantities of solid wastes, handling and storage at the source, solid wastes collection, solid wastes disposal, separation and processing technologies, recycling of solid wastes, planning and operation of solid wastes management systems.				
Used in Program / Level				
Program Name or requirement			Study Level	
Utilities and Infrastructure Program Elective (2)			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
20%	20%	0%	60%	

CEP455	Design of Water and Wastewater Networks		2 CH
Prerequisites	Principles of Water and Wastewater Treatment		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
Water distribution networks: Types of distribution systems, Hydraulic design, water demand (hourly, daily and monthly flow), fire requirements, pipes in series, pipes in parallel, planning consideration of pipe network, Types of water pipes, Fittings, Types of Valves and its locations. Location and volume of elevated storage tanks, Water hammer, Pipes testing, Wastewater collection systems: Sources and planning consideration, per capita wastewater flow, minimum and maximum flow, Hydraulic design. Types of sewer pipes, fittings, design of pump stations, design of force mains, Water hammer. Pipe testing.			
Used in Program / Level			
Program Name or requirement	Study Level		
Civil and Infrastructure Engineering Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

CEP456	Water and Wastewater Supply		2 CH
Prerequisites	Principles of Water and Wastewater Treatment		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
2	1	0	
Required SWL	100	Equivalent ECTS	4
Course Content			
Sources of water, requirements for water supply projects, population's studies, rates of water consumption for domestic and other purposes, variation in water demand, Fire requirements, design period, Sources of wastewater, quantities and quality, per capita wastewater flow, average wastewater flow, dry and wet weather flow (minimum/maximum), infiltration flow, rainfall flow, separate sewage network, combined sewage network.			
Used in Program / Level			
Program Name or requirement	Study Level		
Civil and Infrastructure Engineering Program Elective	4		
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
35%	25%	0%	40%

<table>
<tr><td colspan="2">CEP457</td><td colspan="8">Reuse of Treated Wastewater</td><td colspan="2">2 CH</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="10">Principles of Water and Wastewater Treatment</td></tr>
<tr><td colspan="12">Number of weekly Contact Hours</td></tr>
<tr><td colspan="4">Lecture</td><td colspan="4">Tutorial</td><td colspan="4">Laboratory</td></tr>
<tr><td colspan="4">2</td><td colspan="4">1</td><td colspan="4">0</td></tr>
<tr><td colspan="3">Required SWL</td><td colspan="3">100</td><td colspan="3">Equivalent ECTS</td><td colspan="3">4</td></tr>
<tr><td colspan="12">Course Content</td></tr>
<tr><td colspan="12">Treated effluent for reuse: Quality, Legislation and regulation of reuse of treated wastewater, Health aspects of using reclaimed wastewater, reuse treatment technology, Risk assessment in wastewater reclamation and reuse, economics of wastewater reclamation and reuse projects, Monitoring, sampling and analysis of reuse water.</td></tr>
<tr><td colspan="12">Used in Program / Level</td></tr>
<tr><td colspan="8">Program Name or requirement</td><td colspan="4">Study Level</td></tr>
<tr><td colspan="8">Civil and Infrastructure Engineering Program Elective</td><td colspan="4">4</td></tr>
<tr><td colspan="12">Assessment Criteria</td></tr>
<tr><td colspan="3">Student Activities</td><td colspan="3">Mid-Term Exam</td><td colspan="3">Practical Exam</td><td colspan="3">Final Exam</td></tr>
<tr><td colspan="3">35%</td><td colspan="3">25%</td><td colspan="3">0%</td><td colspan="3">40%</td></tr>
</table>

E13.9 Graduation Projects

CEP491	Utilities and Infrastructure Graduation Project		6 CH
Prerequisites	Utilities and Infrastructure Elective (1) or Utilities and Infrastructure Elective (2)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	10	0	
Required SWL	300	Equivalent ECTS	12
Course Content			
The student analyses and designs an integrated engineering system using the principles, foundations, and engineering skills that he acquired during the years of study. The project report submitted by the student should include the detailed steps of analysis and design realizing the requirements of the work and including the computer applications used in mathematical simulation for the designed system, and the laboratory tests if necessary. It also includes engineering drawings and maps needed to implement the designed system. The student must demonstrate in the body of his project, and during the project defense, his full understanding of the principles and foundations on which his project is based. He must also demonstrate ability to apply these principles in the field of his future engineering work.			
Used in Program / Level			
Program Name or requirement		Study Level	
Utilities and Infrastructure Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
50%	0%	0%	50%

CEP492	Civil Engineering Design Graduation Project (1)		3 CH
Prerequisites	Civil and Infrastructure Elective (1)		
Number of weekly Contact Hours			
Lecture	Tutorial	Laboratory	
1	4	0	
Required SWL	150	Equivalent ECTS	6
Course Content			
The project of each team will encompass the conceptual and preliminary design of a medium-size civil engineering project. Students learn civil engineering design process, methodology, identification of objectives, codes, formulation of design problems. Development and evaluation of sustainable design alternatives. Computer-aided design tools. Performance evaluation using modelling, sensitivity analysis, and cost estimation.			
Used in Program / Level			
Program Name or requirement		Study Level	
Civil and Infrastructure Engineering Program		4	
Assessment Criteria			
Student Activities	Mid-Term Exam	Practical Exam	Final Exam
60%	0%	0%	40%

CEP493	Civil Engineering Senior Seminar			2 CH
Prerequisites	Civil Engineering Design Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
0		4		0
Required SWL	75		Equivalent ECTS	3
Course Content				
Students will research and report on technical issues, research references, and will emphasize innovation and integration in civil engineering. The problems are identified, and solutions are found to improve the performance of the civil in areas such as: Infrastructure Engineering and technologies, and a broad introduction into structures, engineering materials, transport systems, soil engineering, environment protection, Water Resources, water engineering and computer aided design. A technical report is written, presented, and discussed.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

CEP494	Civil Engineering Design Graduation Project (2)			3 CH
Prerequisites	Civil Engineering Design Graduation Project (1)			
Number of weekly Contact Hours				
Lecture		Tutorial		Laboratory
1		4		0
Required SWL	150		Equivalent ECTS	6
Course Content				
The project of each team will encompass the integrated design of at least two subdisciplines of civil engineering to achieve high performance at reasonable cost. Through case studies and literature survey, students learn the information gathering and decision/design process, problem resolution, and aspects related to management, teamwork, and communication. Students registering for this course must contact the course coordinator for the detailed procedure.				
Used in Program / Level				
Program Name or requirement			Study Level	
Civil and Infrastructure Engineering Program Elective			4	
Assessment Criteria				
Student Activities	Mid-Term Exam	Practical Exam	Final Exam	
60%	0%	0%	40%	

Acknowledgment to the Participants in Preparing these Bylaws

The following list shows the staff members of the Faculty of Engineering, Ain Shams University who have effectively participated in the preparation of the 2018 Bylaws for the Undergraduate Studies.

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	54	Shaimaa Mohamed Kamel
	55	Mostafa Refaat Ismail
	56	Sabah Elsayed Soliman
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	106	Hassan Abdelzaher Hassan
	107	Mohammed Sobhi Abdelrahman