Faculty of Engineering

UNDERGRADUATE CURRICULUM PLAN

PART 2: CREDIT HOURS SYSTEM PROGRAMS

June 2013

Ain Shams University - Faculty of Engineering

Undergraduate Curriculum Plan

Part 2: Credit Hours System Programs

Introduction: Vision and Mission

- **Vision**

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

- **Mission**

  The mission of the Faculty of Engineering at 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 the local and regional markets. These graduates are 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 in 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.

I. The following articles included into the current Internal regulations of the Faculty of Engineering Undergraduate Programs are amended:

Chapter 2

Bachelor of Science Degree

Article (5): Awarding the Degrees

Ain Shams University, upon the request of the Faculty of Engineering Council, awards the Bachelor of Science (B.Sc.) Degree in one of the following Majors:

1. **Civil Engineering**
   - Construction
   - Water and Hydraulic Structures
   - Public Works
   - Building Engineering (Credit Hour Program)

2. **Architectural Engineering**
   - Architecture
   - Urban Planning and Design
   - Landscape Architecture (Credit Hours Program)

3. **Electrical Engineering**
   - Electrical Power and Machines
   - Electronics and Electrical Communications
   - Computers and Systems
   - Communication Systems Engineering (Credit Hours Program)
   - Energy and Renewable Energy Engineering (Credit Hours Program)
   - Computer Engineering and Software Systems (Credit Hours Program)

4. **Mechanical Engineering**
   - Production
   - Mechanical Power
   - Automotive
   - Mechatronics
   - Materials Engineering (Credit Hours Program)
   - Manufacturing Engineering (Credit Hours Program)

II. Articles 36, 37, and 38 in the internal regulations of the faculty are re-numbered to become 16, 17, and 18, respectively.

III. Chapter 3 concerning the Undergraduate Credit Hours Engineering Programs is added to the regulations.

Chapter 3

Undergraduate Credit Hours Engineering Programs

Article (19): Credit Hours Engineering Programs' Administration

A Board of Directors is formed for the credit hours engineering programs. Its tasks are the development of policies and the adoption of administrative reports and decisions for the system. In addition, the board of directors plays the role of the scientific council for these programs, and may seek professional opinion when needed.

Article (20): Contributing Departments

The scientific departments of the Faculty of Engineering contribute in teaching and doing the academic research in courses having similar codes to those of these departments.

Article (21): Supervision of the General Courses

The Council of the Faculty of Engineering entrusts to one or more faculty department the supervision of the general and humanity courses, which are the courses that have course codes starting with (HUM).

Article (22): Enrolment Requirements

- Students eligible to get enrolled in the Credit Hours Engineering Programs are those with the general certificate of secondary education (Thanaweya Amma), mathematics section, or equivalent, who have been deployed to the Faculty through the Coordination Office, or transferred from other Faculties, in accordance with the rules and conditions established annually by the Supreme Council of Universities.
- 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.
- When the student applies to the credit hours programs, the Council of the Faculty of Engineering may assign him a maximum of two basic courses as an admission prerequisite. These courses will not be included in the student's GPA and are recommended by the Programs Administration Council and approved by the Council of the Faculty of Engineering.

Article (23): Program System

- The Programs follow the credit hours system: One credit hour is equivalent to a one hour weekly lecture, two hours weekly tutorial, or three hours weekly Lab work.
- The actual hours is determined in accordance with the resolutions of the Supreme Council of Universities, such that one teaching hour equals 50 minutes teaching.
- The study is in English, and the Faculty of Engineering will ascertain the student's proficiency in English.

Article (24): Study Timings and Registration

- The academic year comprises three semesters:
  - **First main semester (Fall)**: Begins early September and lasts for 15 weeks.
  - **Second main semester (Spring)**: Begins early February and lasts for 15 weeks.
  - **Summer semester**: Begins late June and lasts for 7 weeks.
- New students' enrolment in the programs starts two weeks before the starting of the Fall semester, after fulfilling all the programs requirements and paying the enrolment fees, as recommend by the Programs Administration Council and set by the Council of the Faculty of Engineering.
- Registration for any semester takes place within two weeks before the starting day of the semester. Registration is not final until the full tuition fees of the semester are paid.
- Registration in the Summer semester is optional.

Article (25): Program Study Duration

- The minimum allowed study duration is nine main semesters.
- The maximum allowed study duration is ten years, which does not include frozen semesters for reasons acceptable by the faculty, after which the student is expelled from the programs.

Article (26): Tuition Fees

- Tuition fees, set per credit hour, are specified yearly by the University administration based on the recommendation of the Programs Administration Council and the approval of the Council of the Faculty of Engineering. The tuition fees may be increased annually for newly enrolled students, according to the rules set by the Council of the Faculty of Engineering and the University administration based on the associated general regulations.

- The student will sign a pledge to abide by the educational service charges proposed by the Faculty, and approved by the University, with the commitment of constant charges from admission until graduation.
- The tuition fees are paid every semester (the first and the 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 credit hours 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 educational service fees for the Summer semester are determined based on the actual number of credit hours registered by the student.

Article (27): Registration Terms

- The student may register for a maximum of 18 credit hours or six courses, whichever is greater in the first or the second main semester, after consulting the academic advisor, at the time of registration and according to the yearly rules issued by the Faculty and published in the student's guide. Registration is not final until the student pays the educational service fees for the semester.
- The student may register in the Summer semester in a maximum of two courses with a maximum of 8 credit hours, unless it results in graduating the student conditional the approval of the academic advisor.
- The student with a GPA of 3.0 or higher can register in the main semesters in up to 21 credit hours or 7 courses, whichever is greater.
- The student with a GPA less than 2.0 (under probation) can register in the main semesters in only 12 credit hours or 4 courses, whichever is greater.
- Late registration is not final unless there is a vacancy in the courses, and the student should pay late registration fees besides the prescribed academic service fees, in accordance with the recommendations of the Programs Administration Council and approval of the Council of the Faculty of Engineering regarding this issue.
- The student may not register in any course without fulfilling all its prerequisites.
- If the student's graduation depends on only one additional course than what is permitted according to his condition in the last semester, he is allowed to register that course in terms of studying and examination; and if the course is not offered, he will be allowed to register it as self-study according to the following rules:
  1. The grade is based on a final exam, which is held during the final examination period for the semester.
  2. The student pays the final examination fees according to the recommendation of the Programs Administration Council in this issue and the approval of the Council of the Faculty of Engineering.

- The students may register as audit in some courses provided that there is a vacancy in these courses, and after paying the academic service fees based on the recommendation of the Programs Administration Council and the approval of the Council of the Faculty of Engineering in this regard. Audit students are not eligible to enter the course final exam.

Article (28): Minimum Limit for Course Opening

- The minimum number of students required to open a course in a main semester is 10 students.
- The minimum number of students required to open a course in the Summer semester is 5 students.
- The minimum number of students required to open a course in a technical elective course is 5 students or 25% of the number of students in this program level, whichever is less. The Programs Administration Council may provide exceptions to these limits if there is a necessity.

Article (29): Bachelor Degree Requirements

- To obtain the Bachelor of Science Degree in Engineering, the student must successfully complete 180 credit hours in one of the programs according to the requirements stipulated in Article (30), with a GPA at graduation of at least 2.0.
- 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’s curriculum, and the student does not graduate unless he fulfills the project's pass requirements.
- The student must perform summer training for 12 weeks during his study duration. Training must be performed in an industrial/service facility related to the student's program, and must be under the full supervision of the faculty according to the requirements stipulated in Article (37).
- An English language placement test is held for all students at their first enrolment in the credit hours programs. Not passing the English language placement test will necessitate that the student register in the English Language course (HUM 011), after paying the prescribed fees. The evaluation of the student in this course will be based on success/fail and is not included in the calculation of the GPA. Passing the English language course is a prerequisite for completing the graduation requirements.
- The student is allowed to register during the final semester in a number of credit hours according to his condition, even if the total number of credit hours during the student's study duration exceeds 180. The student who already accomplished his 180 credit hours is not allowed to register in a new semester, since he has already fulfilled the Bachelor Degree requirements.

- In the case of a cooperative agreement between the credit hours engineering programs of the Faculty of Engineering and a foreign university, the student can study a number of courses in the foreign university, pending prior approval of the Faculty of Engineering. The credit hours of these courses are included in the student's graduation requirements, on condition that the total credit hours of these courses do not exceed 36 credit hours.

Article (30): Study Requirements

The study requirements are divided into:

1. **University Requirements**

   The student must pass the University requirements, which consist of humanities, social sciences, general culture courses. These courses represent 18 credit hours selected from a list of courses.

2. **College Requirements**

   The student must pass the College requirements, which consist of basic sciences and engineering sciences courses. These courses must be studied by all students and they represent 46 credit hours.

3. **Program Major and Specialization Requirements**

   The student must pass a total of 116 credit hours.

- The distribution of the credit hours allocated to the study requirements for the Landscape Architecture Program can be different from above, due to the special features of this program.

Article (31): Academic Advisor

- Every student is assigned an Academic Advisor who is one of the faculty members and may continue with the student for the whole study duration.
- The Academic Advisor should follow-up with the student, assist him in selecting courses each semester, and request to place the student under probation for one semester, hence, limiting the number of registered credit hours for this student to a minimum of 12 credit hours in this semester.
- The Academic Advisor may ask the student to repeat courses which he already passed or ask him to register in additional courses to raise his accumulative GPA to that required for graduation.

Article (32): Drop/Add and Withdraw

- The student may add, drop, or exchange courses with other courses in the first two weeks from the beginning of the main semesters, with refundable fees (in case of drop). Add/Drop course(s) should not violate the minimum and maximum number of credit hours registered per semester as defined in

Article (27). Add/Drop course(s) can be done during the first week of the Summer semester.

- The student may withdraw from any course within the first 8 weeks of the main semesters or the first four weeks for the Summer semester. Tuition fees will not be refunded in all cases.
- 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, provided that the full course fees are paid.
- The student, who withdraws from a whole semester and gets a grade (W) because of an illness condition or with an excuse acceptable by the faculty, should submit a request to and get an approval from the Programs Administration Council. The student should then repeat all the courses from which he withdrew in a following semester after re-paying the academic service fees.
- The student withdrawing from a whole semester should pay the minimum tuition fees which is equivalent to 12 credit hours.

Article (33): Passing Courses

- The student must get a minimum D Grade in order to pass a course.

Article (34): Incomplete Courses

- If a student does not attend the final exam of the course in a semester with an excuse that is accepted by the Programs Administration Council and approved by the Council of the Faculty of Engineering, another final exam is held after the semester final exams. The marks of the latter final exam should be added to the semester-work marks to calculate the overall grade of this course, after paying a re-examination fees equivalent to one credit hour.

Article (35): Courses Improvement and Repetition

1. 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 grade of the course after improvement, and this grade is the one that will be accounted for in the accumulative GPA, on condition that the improvement should be shown in the student's transcript.
    - The student can improve up to five courses during his study duration, except for improving courses with the purpose of getting out of the academic warning or satisfying the graduation requirements.
    - The student should pay the credit hours fees for the course.

2. 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 repetition, and this grade is the one that will be accounted for in the accumulative GPA, on condition that the repetition should be shown in the student's transcript.
    - The student should pay the credit hours fees for the course.

Article (36): Appeals

- A student can submit an appeal to review his course marks within a week from the grades announcement, and after paying the required fees in accordance with the faculty regulations.
- In case of general complaints, a committee that includes the course instructor should review the students' marks.

Article (37): Field Training

The student must perform field training for 12 weeks in industrial or service facilities related to the student's program and under the faculty supervision as follows:

- The programs' academic advisor should follow-up the training.
- Identifying a company official contact person.
- The student must submit an evaluation and future planning form to his academic advisor at the end of the training period.
- 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 4 weeks each summer at the end of the first, second, and third levels.
- Training for 6 weeks is allowed in only one summer during the study duration.
- The training after passing the third level should be in the area of specialization.
- Individual training is allowed, provided that it follows the above-mentioned programs training regulations.
- The programs are committed to train students, who have not got a training through the programs or individually, in the faculty laboratories.
- The field training is evaluated on pass/fail basis and does not count in the accumulative GPA calculation.

Article (38): Calculation of the Grade Point Average (GPA)

- Course points achieved by the student are calculated as equal to the number of credit hours of this course multiplied by the course grade points according to Article (40).
- In any semester, the total points achieved by the student are calculated as equal to the sum of the courses points the student achieved in this semester.
- The Semester GPA is calculated as equal to 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 accumulative GPA at the end of any semester are calculated as equal to the total points achieved by the student in all courses studied by the student divided by the total number of credit hours of these courses.
- The graduation accumulative GPA is calculated (after passing all the graduation requirements) by dividing the sum of all points of studied courses by the sum of credit hours for these courses. The student cannot get the degree unless he achieves at least GPA of 2.0.
- The student's transcript should include all registered courses during the study duration, including these he failed in, withdrew from, or improved.

Article (39): Study Dismissal and Academic Warning

- A student gets an academic warning if his accumulative GPA at any main semester is less than 2.0. In such a case, he will not be allowed to register in more than 12 credit hours in the following semester until he revokes the academic warning.
- The student will be dismissed from the study if he gets accumulative GPA less than 2.0 in six consecutive semesters excluding Summer semesters.
- The student will be dismissed from the study if he failed to achieve the graduation requirements during the maximum study duration, which is ten years.
- The Council of the Faculty of Engineering may allow the student who is exposed to study dismissal because he failed to achieve an accumulative GPA of at least 2.0, to have one and last chance to register in 2 consecutive main semesters to raise his accumulative GPA to 2.0 and achieve the graduation requirements, provided that he has successfully completed at least 80% of the total number of credit hours required for graduation.

Article (40): Grades of the Credit Hours Programs Courses

The points of each credit hour are computed as follows:

Percentage	Grade	Points
97% and higher	A+	4.0
93% to less than 97%	A	4.0
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

Article (41): Grades of Non-Credit Courses

- Grades of the audit courses or any additional courses that a student may register, and in which he is only required to pass or are not completed for an excuse accepted by the faculty or withdrawn from and are not included in the calculation of the average course points, will be as follows:

Grade	Meaning
AU	Audit
P	Pass
F	Fail
W	Withdraw

Article (42): Dean's List, Honor Degree, and Award of Excellence

- The student who achieves an accumulative GPA of 3.6 or higher after any semester and did not fail any course throughout his course of study is included in the Dean's List and receives partial exemption from charges on the next semester. This exemption is dependent on the student's GPA as recommended by the Programs Administration Council in this regard and after approval of the Council of the Faculty of Engineering.
- Student who keeps an accumulative GPA of 3.3 or higher in every semester all through his course of study and does not fail any course, graduates with an Honour Degree, which is documented in his graduation certificate.
- The top 30 students in Thanaweya Amma, mathematics section, who enrolled in the credit hours programs, are fully exempted from paying any tuition fees in their first semester. To maintain this exemption in the following semesters, the student should maintain an accumulative GPA of 3.6 or higher in every

semester. This exemption is declined once the student fails to achieve this accumulative GPA in any semester.

- The faculty sets a system for encouraging distinguished students through reducing their tuition fees in accordance with their accumulative GPAs. At the beginning of each semester, the distinguished students' list is announced together with the associated tuition fees reductions.

Article (43): Student Transfer to/from the Credit Hours System

- A student can transfer from the traditional system to the credit hours system if he is in year 1 at most. Course equivalency will be applied on the courses studied in the traditional system to determine the equivalent courses in the credit hours system.
- Students who are expelled from the traditional system for reaching the maximum number of failing years are not allowed to transfer to the credit hours programs.
- Students may transfer from the credit hours system to the traditional system after obtaining the approval of the department to which he wants to transfer provided that he did not complete more than 108 credit hours. A maximum of 50% of his courses will be transferred to the traditional system after performing course equivalency on these courses with the corresponding courses in the traditional system.
- The student should satisfy the traditional system acceptance conditions at the year of first enrolment into the faculty, in order to be allowed to transfer from the credit hours programs to the traditional system.
- The transfer from the credit hours system to the traditional system follows the rules of the traditional system, which are listed in its regulations.
- 10% administrative fees will be deducted if the student would like to refund the tuition fees to transfer from the credit hours programs.
- The following table is adopted in transferring credits from the traditional system into the credit hours system:

Traditional System	**Credit Hours System**	
Percentage	**Points**	**Grade**
95% and up to 100%	4.0	A+
90% to less than 95%	4.0	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

Taking into consideration items of Article (38).

- The following table is adopted in transferring from the credit hours system into the traditional system:

Credit Hours System		Traditional System
Points	**Grade**	**Percentage**
4.0	A+	98%
4.0	A	93%
3.7	A-	88%
3.3	B+	83%
3.0	B	78%
2.7	B-	73%
2.3	C+	70%
2.0	C	67%
1.7	C-	63%
1.3	D+	58%
1.0	D	53%
0.0	F	-

Article (44): Transfer from Outside the Faculty

- Transfer from similar faculties to the credit hours programs is allowed according to the rules and regulations established by the Council of the Faculty of Engineering.

Article (45): Student Status

- The following table shows the student status and the study levels depending on the number of credit hours that the student completed.

Study Level	Student Status	Percentage of Completed Credit Hours
General (0)	Freshman	Less than 20%
First (1)	Sophomore	20% to less than 40%
Second (2)	Junior	40% to less than 60%
Third (3)	Senior-1	60% to less than 80%
Fourth (4)	Senior-2	80% to less than 100%

- Whenever the student has completed 20% of the graduation requirements, he will be transferred from one level to a higher level (0-4).

Article (46): Student Evaluation

- The marks of each course are distributed as percentages of the total mark according to the following rules:
  1. A final written exam will be held for each course at the end of the semester that weighs 40% of the total course marks, with the exception of the graduation project.

2. Semester-work represents 60% of the total course marks, which includes the mid-term exam in the sixth or seventh week of the semester that weighs 25% of the total course marks. The remaining 35% of the total course marks are distributed among research, reports, quizzes ... etc., practical/oral exams, participations ... etc.

- The student must attend at least 75% of the course to be allowed to attend the final examination.
- 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.
- The student fails the course if he obtains an F grade, or was prevented from attending the final examination because of exceeding the absence percentage or cheating … etc, or did not attend the final examination without submitting an excuse that is accepted by the Programs Administration Council and approved by the Council of the Faculty of Engineering.
- If the student improves or repeats a course, he will repeat the semester-work and final exam and will be completely re-evaluated and the course grade will be calculated according to Article (35) of this regulation.
- Registering for the graduation project or for the senior seminar course requires fourth level standing.

Article (47): General Topics

- Any other topic that did not appear in the articles of this regulation is presented to the Programs Administration Council to take the appropriate recommendation and submission to the Council of the Faculty of Engineering for approval before submission to the University.

Article (48): General Provisions

- These regulations apply to the students enrolled in the credit hours engineering programs at the start of the Fall 2013 Semester and should not apply to the graduates of this system before the previous date.
- The provisions of the University Regulations Act apply to all issues that have not been mentioned in these regulations and their amendments.

University, College, and Specialization Requirements for Credit Hours Programs

All Credit Hours Programs	University Requirements		College Requirements						Specialization Requirements		Total	
			Basic Science		Engineering Science		Total					
	18 CH	10%	30 CH	16.7%	16 CH	8.9%	46 CH	25.6%	116 CH	64.4%	180 CH	100%

1. University Requirements (Humanities)

The student will study (6) General Education Elective Courses (humanities) selected by him from the following list of courses, with a total of (18) credit hours.

Course Code	Course Title	Credit Hours
HUM 011	English Language	0
HUM 012	German Language	3
HUM 013	Technical Writing and Communication	3
HUM 014	Engineering Profession, Practice, and Responsibilities	3
HUM 111	Engineering Economy	3
HUM 112	Health and Wellness	3
HUM 211	Impact of Technology on Society	3
HUM 212	Introduction to Marketing	3
HUM 311	Engineering Management	3
HUM 312	Human Resource Management	3
HUM 313	Engineering Law	3

2. College Requirements

2.1 Basic Science Courses

Course Code	Course Title	Credit Hours
PHM 012	Calculus for Engineering (1)	3
PHM 013	Calculus for Engineering (2)	3
PHM 014	Linear Algebra and Analytical Geometry	3
PHM 022	Waves, Electricity, and Magnetic Fields	3
PHM 032	Engineering Mechanics (1) - Statics	3
PHM 033	Engineering Mechanics (2) - Dynamics	3
PHM 042	General Chemistry	3
PHM 113	Calculus for Engineering (3)	3
PHM 114	Statistics and Probability for Engineering	3
PHM 115	Differential Equations and Partial Differential Equations	3

2.2 Basic Engineering Courses

Course Code	Course Title	Credit Hours
CSE 012	Engineering Computation	3
MDP 024	Production Engineering	3
MDP 061	Engineering Design and Graphics	4
MEP 112	Thermodynamics	3
MDP 132	Structures and Properties of Materials	3

Course Descriptions for University and College Requirements

HUM 011: English Language (0 Credit Hour)
The English language course is intended to teach the students at the intermediate level the mechanics of using English in everyday situations as well as in academic work. An integrated approach is applied during teaching this course. After a grammar section with many tasks highlighting the new grammar, there is at least one activity for reading and writing in every unit. There is a strong lexical component in the course. Technical texts are subject-specific but the teacher's objective is teaching language, not subject knowledge.
Lecture: 2 hours/week, Lab: 2 hours/week

HUM 012: German Language (3 Credit Hours)
The German language course is intended to teach the students at the intermediate level the mechanics of using Germany in everyday situations as well as in academic work. An integrated approach is applied during teaching this course. After a grammar section with many tasks highlighting the new grammar, there is at least one activity for reading and writing in every unit. There is a strong lexical component in the course. Technical texts are subject-specific but the teacher's objective is teaching language, not subject knowledge.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 013: Technical Writing and Communication (3 Credit Hours)
Technical writing form and style. Technical and scientific papers, abstracts, reports. Library research and referencing methods for engineers. Technical communication using information technology: document processing software, computer-assisted presentation, analysis and design of Web presentation. Choice and use of appropriate tools. Students will prepare an individual major report and make an oral presentation.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 014: Engineering Profession, Practice, and Responsibilities
(3 Credit Hours)
Introduction to engineering profession, study skills, review of the legal framework particularly the Professional Code and the Engineers Act, as well as professional ethics. Health and safety issues for engineering projects: legislations, safe work practices, general Lab safety common to all engineering disciplines, and specific Lab safety pertaining to particular engineering disciplines. Environmental concerns, career exploration, engineering reasoning and critical thinking.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 111: Engineering Economy (3 Credit Hours)
Engineering criteria for decision-making. Money flow. Financial ventures. Personal financing. Total project investment. Production and operations costs. Economic analysis. Financial attractiveness.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 112: Health and Wellness (3 Credit Hours)
This course focuses on the aspect of self-development skills in terms of health and physical health, and related skills, including personal health, psychological, and food. How to deal with injuries, identify the behaviors and aspects of mental health (opposite pressures, dealing with anxiety ...). The ability to relax, not stress and calm the nerves, the work of vital organs in the body regularly and without trouble, the ability to perform the work in the workplace wherever it without feeling tired, self-confidence. And above all, a feeling of happiness in life.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 211: Impact of Technology on Society (3 Credit Hours)
Technology definitions its relation to science, engineering, business and economy. Technology history and social developments. Karl Marx and philosophical theories for the impacts of technology. Technology political impacts. Technology development and its road mapping. Creativity, innovation and technology. Technology forecasting and development. Technology management, transfer, diffusion. Technology policies and assessment. Technology as a concept for products development. 21st century technologies and future societies.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 212: Introduction to Marketing (3 Credit Hours)
The concept and the elements of management: concept of management, Elements of management. The concept of marketing: define of marketing, the importance of marketing, the marketing system. Organizing of the marketing functions: definition of organizing, the organizing of the marketing functions. Consumer behavior: The concept of the consumer behavior, The aspects of the consumer behavior, Studying the markets. The product strategy: The product mix, The product life cycle, New products. The pricing strategy: The importance of pricing, Methods of pricing. Distribution strategy: distribution channels, distribution outlets. Promotion strategy: advertising, personal selling.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 311: Engineering Management (3 Credit Hours)
Definitions used in project management, The project life cycle, project stages, relationships and responsibilities of the different project parties, execution phase responsibilities, productivity, quality management.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 312: Human Resource Management (3 Credit Hours)
HRM in a changing Environment, HRM Functions and Strategy, Employment law, employer and employee rights effective job analysis, employee recruitment, selecting employees, training and developing employees, career development, performance management, compensation, employee benefits, health and safety, labor relation and collective bargaining.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 313: Engineering Law (3 Credit Hours)
This course aims to give the student an overview of his liabilities and rights according to the valid laws and regulations governing the engineering works in all its specializations. It reviews and explains theoretically and practically, such laws and makes references known to him. It concentrates on the laws and regulations concerning engineering syndicate, contractors union and environment protection. It concentrates as well on the relationship between the parties of local and international (e.g., FIDIC) contracts in civil and administrative laws. Claims and/or disputes during or after execution of the works.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CSE 012: Engineering Computation (3 Credit Hours)
Computer architecture, Computer systems, Operating systems, File systems, Computer networks, Internet network, Logical design of programs, Problem solving methods, Types of programming languages, Application on a structured or visual computer programming language for solving engineering problems, Database systems and information technology and decision support systems, Computer graphics and computer systems needed for graphics and image display, Multimedia systems.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

PHM 012: Calculus for Engineering (1) (3 Credit Hours)
Functions. Limits and Continuity: limits, one sided and infinite limits, tangent lines and velocity, continuity, the intermediate value theorem, and the Bisection method. Derivatives: derivatives, including the Chain Rule, implicit differentiation, related rates, approximation of derivatives and the Newton-Raphson method. Applications of the Derivative: maximum and minimum values, and the maximum-minimum theorem, mean value theorem and its applications, exponential growth and decay, analysis of graphs of functions. The Integral: definite and indefinite integrals, the fundamental theorem of calculus, integration by substitution, natural logarithmic function. Curves in the plane: basic properties of parabolas, ellipses and hyperbolas
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 013: Calculus for Engineering (2) (3 Credit Hours)
Prerequisite: PHM 012
Applications of the Integral: volume, length of a curve, area of a surface, work, moments, centers of gravity, parametrized curves, and lengths of curves given

parametrically. Inverse Functions, l'Hôpital's rule, introduction to differential equations, and exponential and logarithmic functions. Techniques of Integration: integration by parts, trigonometric substitutions, partial fractions, trapezoidal and simpson's rules, improper integrals. Curves in the Plane: polar coordinates, and length and area in polar coordinates. Complex numbers and series, De Moivre's theorem and its applications, and elementary functions of complex variable. Sequences and series: sequences and convergence of sequences, infinite series and convergence tests for series, taylor polynomials and taylor series.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 014: Linear Algebra and Analytical Geometry (3 Credit Hours)
Systems of Linear Equations: Gaussian elimination, matrix operations, finding the inverse, solution spaces. Determinants: definition, evaluation, minors, cramer's rule. Vectors in 2- and 3- space: geometric and algebraic definitions, dot product, projections. Vector Spaces: Euclidean space, subspaces, linear independence, basis and dimension, row space, rank, length and angle, Gram-Schmidt, least squares. Linear Transformations: definition, kernel and range, representation as matrices. Eigenvalues and Eigenvectors: definition, diagonalization, orthogonal diagonalization, symmetric matrices. Conic sections and their properties – rotation of axes – lines and planes in space.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 022: Waves, Electricity, and Magnetic Fields (3 Credit Hours)
Units and dimensions, Electricity: Vectors, Electric Force, Electric field, Electric potential, Capacitors and dielectrics, DC circuits, Ohm's Law, Kirchhoff's laws. Electromagnetism: Magnetic field, Magnetic force, Sources of Magnetic fields, Ampere's law, Electromagnetic induction, Magnetic properties of materials, AC circuits. Properties of waves.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 024: Production Engineering (3 Credit Hours)
Introduction to production technology, casting and joining of metals, forming processes (forging, bending, rolling, etc.), basic machining processes (turning, shaping, milling, drilling, grinding, etc.).
Lecture: 3 hours/week, Lab: 1.5 hours/week

PHM 032: Engineering Mechanics (1) - Statics (3 Credit Hours)
Resultant of force systems, equilibrium of particles and rigid bodies, distributed forces, statically determinate systems, trusses, friction, moments of inertia, virtual work. Shear and bending moment diagrams.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 033: Engineering Mechanics (2) - Dynamics (3 Credit Hours)
Prerequisite: PHM 032
Kinematics of a particle and rigid body, forces and accelerations, work and energy, impulse and momentum, dynamics of a system of particles and rigid bodies, introduction to vibrations.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 042: General Chemistry (3 Credit Hours)
Physical chemistry: Gases, Liquid state, Thermo chemistry, Solutions, Ionic equilibrium, Applied chemistry, Electrochemistry, Corrosion of metals, Water treatment, Chemistry of cements, Chemistry of polymers, Fuels combustion, Pollution and its control.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 061: Engineering Design and Graphics (4 Credit Hours)
Engineering Drawing Techniques, Geometrical Constructions, Principles of Descriptive Geometry, Introduction to AutoCAD Software, Projection, Views and Sectional Views, Intersections, Dimensioning, Introduction to Steel Structural Drawings.
Lecture: 2 hours/week, Tutorial: 4 hours/week

MEP 112: Thermodynamics (3 Credit Hours)
Prerequisite: PHM 012
Basic concepts and definitions, System and control volume, Property and state, Processes and cycles, Work definition, Definition of heat transfer, Ideal gases, State equation, Specific heat at constant pressure and volume, Pure substances and phase equilibrium, Tables of thermodynamic properties, First law of thermodynamics, Internal energy and enthalpy. First law for closed cycle, closed and open systems, 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, Ellingham diagrams.
Lecture: 3 hours/week, Lab: 1.5 hours/week

PHM 113: Calculus for Engineering (3) (3 Credit Hours)
Prerequisite: PHM 013
Vectors, Lines and Planes: Cartesian coordinates of space, vectors, lines, planes, dot and cross product. Vector-valued Functions: vector-valued functions, tangents, normals, curvature. Partial Derivatives: quadric surfaces, partial derivatives, chain rule, directional derivatives, gradients, extreme values, Lagrange multipliers. Multiple Integrals: double and triple integrals, change of variable, volume, surface area, moments and centers of gravity. Calculus of Vector Fields: line and surface integrals, Green's theorem, Stokes' theorem, Divergence theorem.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 114: Statistics and Probability for Engineering (3 Credit Hours)

Prerequisite: PHM 013

The Nature of probability and statistics: Descriptive and inferential statistics, variables and types of data, data collection and sampling techniques. Probability and counting rule: Sample spaces and probability, the addition rules for probability, multiplication rules, counting rules, permutations, combinations, conditional probability, Bays theorem, random variables, mathematical expectation. Frequency distributions and graphs: Organizing data, frequency tables, histograms, frequency polygons, and ogives. Data description: Measures of central tendency, measures of dispersion, measures of position, detecting outliers. Discrete probability distributions: binomial, Poisson, and hypergeometric distributions. Continuous probability distributions: Normal distribution, standard normal distribution, the central limit theorem, the normal approximation to the binomial distribution, normal probability plots. Confidence Intervals

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

PHM 115: Differential Equations and Partial Differential Equations (3 Credit Hours)

Prerequisite: PHM 013

Introduction to and classification of differential equations. First Order Equations: linear, separable and exact equations, existence and uniqueness of solutions, properties of nonlinear vs. linear equations, qualitative methods for autonomous equations. Second Order Equations: theory of linear equations, homogeneous linear equations with constant coefficients, reduction of order, methods of undetermined coefficients and variation of parameters for non-homogeneous equations, mechanical and electrical vibrations. Laplace Transforms: definition and calculation of transforms, applications to differential equations with discontinuous forcing functions. Systems of First Order Linear Equations: general theory, Eigenvalue-eigenvector method for systems with constant coefficients.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 132: Structures and Properties of Materials (3 Credit Hours)

Prerequisite: PHM 042

Engineering materials: metals, polymers, ceramics, and composites. The internal structure of material: atomic structure, atomic arrangement, microstructure, and macrostructure. 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.

Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

Building Engineering Program

1. Program Goals and Objectives

The program aims at meeting the needs of the Egyptian construction industry by providing engineers familiar with the overall design of built facilities. The building engineer explores all phases of the life cycle of a building and develops an appreciation of the building as an advanced technological system. Problems are identified and appropriate solutions found to improve the performance of the building in areas such as: energy efficiency, passive solar engineering, lighting and acoustics, indoor air quality, construction management, HVAC, advanced building materials, building envelope, earthquake resistance, wind effects on buildings and computer-aided design. The job market in Egypt needs building engineers with such a background especially in the course of the current national effort to render affordable and suitable housing for the people.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
MEP 113	Building Thermal Sciences	3
ARC 114	Building Engineering Drawing	3
CES 115	Structural Analysis (1)	3
CES 116	Strength of Materials	3
CES 121	Building Engineering Systems	3
CEI 122	Fluid Mechanics	3
CES 143	Building Engineering Materials	3
CEP 212	Surveying (1)	4
CEP 213	Surveying (2)	4
CES 213	Structural Analysis (2)	3
EPM 213	Acoustics & Lighting	4
CES 214	Numerical Methods in Building Engineering	3
CES 223	Concrete Structures Design (1)	3
CES 224	Building Systems Optimization	3
CES 231	Steel Structures Design (1)	3
CES 242	Concrete Technology (1)	3
CES 243	Concrete Technology (2)	3
MEP 311	Thermal Analysis of Buildings	3
MEP 312	HVAC System Design	3
CES 313	Computer Aided Structural Design	3
CES 323	Concrete Structures Design (2)	3
CES 324	Construction Engineering (1)	3
CES 352	Soil Mechanics	3
CES 353	Foundation Design	3

CES 361	Engineering Management Principles	3
ARC 414	Building Envelope Design	3
CES 418	Structural Dynamics	3
CES 419	Senior Seminar	2
CES 423	Construction Engineering (2)	3
CES 442	Modern Building Materials	3
CES 463	Project Management for Construction	3
CES 497	Graduation Project (1)	3
CES 498	Graduation Project (2)	3
	Total Credit Hours	**101**

3. Technical Electives

The student shall select five Technical Elective Courses from the following list. Four courses should be selected from one field and the fifth course can be selected from any field. Accordingly, a total number of 15 credit hours should be earned.

3.1 Technical Electives for Environmental Engineering

Course Code	Course Title	Credit Hours
ARC 362	Indoor Air Quality	3
EPM 411	Building Illumination and Day Lighting	3
MDP 445	Building Acoustics	3
CEP 449	Selected Topics in Environmental Engineering	3
ARC 453	Control Systems in Buildings	3
ARC 462	Building Energy Conservation Technologies	3

3.2 Technical Electives for Construction Engineering

Course Code	Course Title	Credit Hours
CES 362	Planning & Scheduling	3
CES 464	Resources Management	3
CES 465	Risk and Safety Management	3
CES 466	Legal Issues in Construction	3
CES 467	Selected Topics in Construction Engineering (1)	3
CES 468	Selected Topics in Construction Engineering (2)	3

3.3 Technical Electives for Structural Engineering

Course Code	Course Title	Credit Hours
CES 325	Concrete Structures Design (3)	3
CES 412	Selected Topics in Structural Engineering	3
CES 422	Design of Concrete and Steel Bridges	3
CES 424	Concrete Structures Design (4)	3
CES 439	Steel Structures Design (2)	3
CES 443	Masonry	3

4. Course Descriptions of the General Specialization Courses

MEP 113: Building Thermal Sciences (3 Credit Hours)
Introduction to the thermal environment and sustainable development issues. Topics include heat, temperature, one-dimensional steady-state processes. Convection: natural and forced. Radiation. Combined radiative and convective surface transfer. Psychrometrics. Thermal comfort. Air quality. Condensation: surface and interstitial.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 114: Building Engineering Drawing (3 Credit Hours)
Prerequisite: MDP 061
Theory and applications of descriptive geometry. Fundamentals of technical drawings: multi view & single view projections. Architectural drawings terms. Architectural and building engineering drawing stages: schematic, design development and tender drawings. 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CES 115: Structural Analysis (1) (3 Credit Hours)
Prerequisite: PHM 012, PHM 032
Analysis of statically determinate structures: introduction, reactions, internal forces for beams, inclined beams, frames, arches and trusses, and Influence lines diagrams.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 116: Strength of Materials (3 Credit Hours)
Prerequisite: CES 115
Analysis of structural elements subjected to axial, flexural, shearing and torsional loadings. Normal and shearing stresses. Shear flow. Riveted (bolted) and welded connections. Combined stresses and principal stresses.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 121: Building Engineering Systems (3 Credit Hours)
Concepts and design methodologies, Architectural plans, layout and elevations, Selection of building materials, Structural systems including skeleton frames and load bearing wall systems, Mechanical systems including heating and air-conditioning, air and ventilation system piping systems (water supply, drainage and fire-fighting) and vertical transportation system, Building electrical systems, Enclosure systems, Smart buildings and Green and sustainable buildings.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CEI 122: Fluid Mechanics (3 Credit Hours)
Prerequisite: PHM 115
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CES 143: Building Engineering Materials (3 Credit Hours)
Prerequisite: CES 115
Specifications of engineering materials and products. Main properties of engineering materials (physical chemical, mechanical, etc.). Non-metallic building materials and units. Properties and testing of building stones, lime, gypsum, timber, bricks, Tiles. Isolation materials, moisture heat and sound. Metallic building materials and units: structural steel, welding and welded splices. Behavior of metals under static loads: tension, compression, flexure, shear, surface hardness of metals. Behavior of metals under dynamic loads (Impact) and repeated loads (fatigue), Creep.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CEP 212: Surveying (1) (4 Credit Hours)
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.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CEP 213: Surveying (2) (4 Credit Hours)
Prerequisite: CEP 212
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.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CES 213: Structural Analysis (2) (3 Credit Hours)
Prerequisite: CES 116
Deflection using virtual work method. Analysis of statically indeterminate structures: the methods of consistent deformations, equation of three moments and moment distribution. Introduction to matrix methods; stiffness method.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

EPM 213: Acoustics & Lighting (4 Credit Hours)
Prerequisite: PHM 022, PHM 033
General introduction to the aural and visual environment. Psychological impact of environment. Subjective and objective scales of measurement. Introduction to vibration. The hearing mechanism. Transmission of sound, passive control of noise in buildings, transmission loss, absorption and reverberation time. Room acoustic assessment. Active control of the aural environment. Visual perception. Photometry, brightness, luminance, and illumination. Concept of natural lighting in building. Artificial lighting, light sources, luminaries. Calorimetry. Calculation methods for artificial lighting.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CES 214: Numerical Methods in Building Engineering (3 Credit Hours)
Prerequisite: PHM 014, PHM 115
Roots of equations: Bracketing methods, Open methods, Roots of polynomials, Linear algebraic equations: Gauss elimination, Matrix inversion, Curve fitting: Least square regression, Interpolation, Numerical differentiation and integration: Integration of equations, Numerical differentiation, Ordinary differential equations: Stiffness and multi-step method, Boundary value and Eigen value problems, Partial differential equations: Finite difference solution, Optimization: One dimensional and Multi-dimensional unconstrained optimization, Constrained optimization.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 223: Concrete Structures Design (1) (3 Credit Hours)
Prerequisite: CES 116, CES 143
Design methodologies, structural safety, calculation of demand, load determination and distribution. Behavior and limit states design of reinforced concrete linear elements in pure and eccentric flexure, bond, shear and axial force. Serviceability limits states.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 224: Building Systems Optimization (3 Credit Hours)
Prerequisite: CES 214
Introduction to systematic solution of building engineering problems. Techniques treated include linear programming, network analysis, nonlinear programming. Introduction to decision analysis and simulation. Application of optimization methods for solution of design problems in building science, building environment, building structures, and construction management, taking into account sustainability issues.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 231: Steel Structures Design (1) (3 Credit Hours)
Prerequisite: CES 116, CES 143
Loads on steel structures, analysis and design concepts, structural systems and general layout, Tension members, axially loaded compression members, flexural members, local buckling of beams, lateral torsion-flexure buckling, floor beams, purlins, crane track girders, design of beam-column joints, bolted connections, welded connections, plate girders, wind bracing systems and design of steel bases. Corrosion protection of steel structures. Cost estimate of steel structures.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 242: Concrete Technology (1) (3 Credit Hours)
Prerequisite: PHM 042, CES 116
Concrete materials: cement, aggregate, mixing water, admixtures and reinforcing steel. Properties of fresh concrete: Consistency, Workability, Cohesion, Segregation, Bleeding. Mix design: engineered methods, empirical methods. Properties of hardened concrete: compressive strength, tensile strength, flexural strength, bond strength and modulus of elasticity.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 243: Concrete Technology (2) (3 Credit Hours)
Prerequisite: CES 242
Concrete manufacturing: storage, mixing, transportation, pouring, compacting, curing, construction joints, shrinkage and movement joints. Properties of hardened concrete: volumetric changes, elasticity and creep, durability of concrete. Non-destructive testing: rebound hammer, ultrasonic, pulse velocity, core, steel detection, pull-off, pull-out. Statistical analysis: to judge the concrete quality. Introduction on special concrete: polymer, fiber and lightweight concretes. Repair and strengthening of R.C. structures: Assessment methods, repair materials, overview for different techniques.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MEP 311: Thermal Analysis of Buildings (3 Credit Hours)
Prerequisite: MEP 112, MEP 113
Two and three-dimensional steady-state and transient conductive heat transfer together with convection and radiation as applied to building materials and geometries. Heating and cooling load analysis, including building shapes,

construction type, solar radiation, infiltration, occupancy effects, and daily load variations. Computer applications for thermal load analysis. Introduction to heat exchangers.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MEP 312: HVAC System Design (3 Credit Hours)
Prerequisite: MEP 311
Principles of HVAC system design and analysis, sustainable design issues and impact on environment, component and system selection criteria including room air distribution, fans and air circulation, humidifying and dehumidifying processes, piping and ducting design. Air quality standards. Control systems and techniques, operational economics, computer applications.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 313: Computer Aided Structural Design (3 Credit Hours)
Prerequisite: CES 231, CES 323
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. A design project is an integral part of this course.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 323: Concrete Structures Design (2) (3 Credit Hours)
Prerequisite: CES 223
Design of reinforced concrete slabs: solid slabs, hollow blocks, panelled beams and flat slab. Selection and design of reinforced concrete systems: beams, frames, polygons, sheds, arch slabs, arch girders, trusses, vierendeel girders. Types and details of joints in RC structures.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 324: Construction Engineering (1) (3 Credit Hours)
Prerequisite: CES 361
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 form design, concrete, steel, and masonry construction, project planning, scheduling, and control, construction safety.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 352: Soil Mechanics (3 Credit Hours)
Prerequisite: CES 143
Introduction to geotechnical engineering, earth crust, soil and rock, minerals, soil formation, Index properties and classification of soils. Weight-volume relationships.

Soil structures. Moisture-density relationships. Permeability. Principle of total and effective stresses. Steady state seepage through isotropic soil media. Stress distribution due to external loads, and analysis of total settlements. Outline of theory of consolidation. Shear strength of soil, soil compaction and site investigation.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 353: Foundation Design (3 Credit Hours)
Prerequisite: CES 223, CES 352
Loads, bearing capacity and settlement. Lateral pressures. Foundation drainage and water-proofing. Spread footings. Strip footings. Pile foundations. Caissons. Retaining walls. Sheet-piling walls. Braced cofferdams. Cellular cofferdams. Anchors.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 361: Engineering Management Principles (3 Credit Hours)
Introduction to project delivery systems. Principles of project management, role and activity of a manager, enterprise organizational charts, cost estimating, planning and control. Company finances, interest and time value of money, discounted cash flow, evaluation of projects in private and public sectors, depreciation methods, business tax regulations, decision tree, sensitivity analysis.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 414: Building Envelope Design (3 Credit Hours)
Prerequisite: MEP 312
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 418: Structural Dynamics (3 Credit Hours)
Prerequisite: PHM 033, CES 213, CES 214
Theory of vibration. Dynamic response of simple structural systems. Effects of blast, wind, traffic, and machinery vibrations. Basic concepts in earthquake resistant design. Computer applications.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 419: Senior Seminar (2 Credit Hours)
The student selects a topic of his/her choice, perform literature search, read and critique technical papers, write a technical report and make a presentation.
Lecture: 2 hours/week

CES 423: Construction Engineering (2) (3 Credit Hours)
Prerequisite: CES 324
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. Site visits.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 442: Modern Building Materials (3 Credit Hours)
Prerequisite: CES 143, CES 223
Introduction, different types of new construction materials, advanced composite materials, constituent materials of the new construction materials, properties (physical, chemical, mechanical), fabrication technology, and comparison with conventional construction materials, structural applications, testing, and economical point of view.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 463: Project Management for Construction (3 Credit Hours)
Prerequisite: CES 121, CES 361
Introduction to project management techniques in construction, including project delivery methods, construction contracts, cost estimating and bidding planning and scheduling, cash flow analysis, project tracking and control, computer applications.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 497: Graduation Project (1) (3 Credit Hours)
The project will encompass the integrated design of at least three sub-systems of a new or retrofitted building to achieve high performance and efficiency at a reasonable cost, sustainable design issues and environmental impact will be addressed in all projects. In the process, students will learn, through brain storming sessions, the information gathering and decision/design process, problem-resolution as well as aspects related to management, teamwork and communication.
Lecture: 2 hours/week, Lab: 3 hours/week

CES 498: Graduation Project (2) (3 Credit Hours)
The project will encompass the integrated design of at least three sub-systems of a new or retrofitted building to achieve high performance and efficiency at a reasonable cost, sustainable design issues and environmental impact will be addressed in all projects. In the process, students will learn, through brain storming sessions, the information gathering and decision/design process, problem-resolution as well as aspects related to management, teamwork and communication.
Lecture: 2 hours/week, Lab: 3 hours/week

5. Course Descriptions of the Technical Electives

CES 325: Concrete Structures Design (3) (3 Credit Hours)
Prerequisite: CES 323
Design of saw tooth slab and girder types. 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. Introduction to strut and tie design method.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 362: Indoor Air Quality (3 Credit Hours)
Prerequisite: MEP 113
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 362: Planning & Scheduling (3 Credit Hours)
Prerequisite: CES 361
Planning in the different project stages, planning using Bar-charts, network techniques (CPM & PERT), LOB, progress monitoring, progress curves, resources allocation and leveling. Project cost and time integrated control systems.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

EPM 411: Building Illumination and Day Lighting (3 Credit Hours)
Prerequisite: EPM 213
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 412: Selected Topics in Structural Engineering (3 Credit Hours)
Prerequisite: Determined according to course contents
This course may be offered in a given year upon the authorization of the Department. The course content may vary from offering to offering and will be chosen to complement the available elective courses.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 422: Design of Concrete and Steel Bridges (3 Credit Hours)
Prerequisite: CES 325, CES 439
The course includes the conceptual design of bridges. Different structural systems will be introduced (e.g., girder type bridges), Box girder bridges and Arch bridges. Analysis and design of different structural elements, Decks, Bearings, Piers and Footings are involved. The influence of the construction techniques and construction details on the design are included.
Lectures: 3 hours/week, Tutorial: 1.5 hours/week

CES 424: Concrete Structures Design (4) (3 Credit Hours)
Prerequisite: CES 323
Types of prestressing and applications, concepts, losses, flexure design of beams, shear design of beams, bond and anchorage, deflection, construction details. Design of surface of revolution. Lateral resistance of buildings: earthquake and wind.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 439: Steel Structures Design (2) (3 Credit Hours)
Prerequisite: CES 231
Orthotropic structures: orthotropic systems, orthotropic floors and decks, behavior and design, construction details. Steel box girders: members design, connections design, details of connections. Steel hollow section structures: different applications in trusses, arches and vierendeels, connection design, details of connections. Storage structures: Tanks, types of tanks, analysis and design, and construction details, Silos, types of silos, analysis and design, and construction details.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 443: Masonry (3 Credit Hours)
Prerequisite: CES 223
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 445: Building Acoustics (3 Credit Hours)
Prerequisite: EPM 213
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 computer codes for building acoustics
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CEP 449: Selected Topics in Environmental Engineering

(3 Credit Hours)

Prerequisite: Determined according to course contents

This course may be offered in a given year upon the authorization of the Department. The course content may vary from offering to offering and will be chosen to complement the available elective courses.

Lectures: 3 hours/week, Tutorial: 1.5 hours/week

ARC 453: Control Systems in Buildings (3 Credit Hours)

Prerequisite: MEP 312

Introduction to automatic control systems. Control issues related to energy conservation, indoor air quality and thermal comfort in buildings. Control system hardware: selection and sizing of sensors, actuators and controllers. Designing and tuning of controllers. Building automation systems. Case studies.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 462: Building Energy Conservation Technologies (3 Credit Hours)

Prerequisite: MEP 112, MEP 113, MEP 312

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. Case studies. Computer simulation: self-designed or available computer model for numerical evaluation.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 464: Resources Management (3 Credit Hours)

Prerequisite: CES 361

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.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 465: Risk and Safety Management (3 Credit Hours)

Prerequisite: CES 361

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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 466: Legal Issues in Construction (3 Credit Hours)
Prerequisite: CES 361
Legal concepts and processes applicable to the development of constructed facilities and to the operation of the construction firm. Emphasis on Egyptian law and institutions.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 467: Selected Topics in Construction Engineering (1)
(3 Credit Hours)
Prerequisite: Determined according to course contents
This course may be offered in a given year upon the authorization of the Department. The course content may vary from offering to offering and will be chosen to complement the available elective courses.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CES 468: Selected Topics in Construction Engineering (2)
(3 Credit Hours)
Prerequisite: Determined according to course contents
This course may be offered in a given year upon the authorization of the Department. The course content may vary from offering to offering and will be chosen to complement the available elective courses.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
PHM 113	Calculus for Engineers (3)	**3**	3	1.5	0	PHM 013
ARC 114	Building Engineering Drawing	**3**	2	2	2	MDP 061
CES 115	Structural Analysis (1)	**3**	3	1.5	0	PHM 012, PHM 032
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
CES 121	Building Engineering Systems	**3**	3	1.5	0	
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
	Total Hours	**18**	**16**	**10**	**3.5**	
Second Main Semester (Term 4)						
MEP 113	Building Thermal Sciences	**3**	3	1.5	0	
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
CES 116	Strength of Materials	**3**	3	1.5	0	CES 115
CEI 122	Fluid Mechanics	**3**	2	2	2	PHM 115
CES 143	Building Engineering Materials	**3**	3	1.5	0	CES 115
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**18**	**16**	**10**	**2**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
CEP 212	Surveying (1)	**4**	3	2	2	
CES 213	Structural Analysis (2)	**3**	3	1.5	0	CES 116
EPM 213	Acoustics & Lighting	**4**	3	2	2	PHM 022, PHM 033
CES 214	Numerical Methods in Building Engineering	**3**	3	1.5	0	PHM 014, PHM 115
CES 223	Concrete Structures Design (1)	**3**	3	1.5	0	CES 116, CES 143
CES 242	Concrete Technology (1)	**3**	3	1.5	0	PHM 042, CES 116
	Total Hours	**20**	**18**	**10**	**4**	
Second Main Semester (Term 6)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
CEP 213	Surveying (2)	**4**	3	2	2	CEP 212
CES 224	Building Systems Optimization	**3**	3	1.5	0	CES 214
CES 231	Steel Structures Design (1)	**3**	3	1.5	0	CES 116, CES 143
CES 243	Concrete Technology (2)	**3**	3	1.5	0	CES 242
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**19**	**17**	**8.5**	**3.5**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
MEP 311	Thermal Analysis of Building	**3**	3	1.5	0	MEP 112, MEP 113
CES 323	Concrete Structures Design (2)	**3**	3	1.5	0	CES 223
CES 352	Soil Mechanics	**3**	3	1.5	0	CES 143
CES 361	Engineering Management Principles	**3**	3	1.5	0	
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**15**	**14**	**8**	**0**	
Second Main Semester (Term 8)						
MEP 312	HVAC System Design	**3**	3	1.5	0	MEP 311
CES 313	Computer Aided Structural Design	**3**	3	1.5	0	CES 231, CES 323
CES 324	Construction Engineering (1)	**3**	3	1.5	0	CES 361
CES 353	Foundation Design	**3**	3	1.5	0	CES 223, CES 352
XXX xxx	Technical Elective (1)	**3**	3	1.5	0	Course-specific
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**18**	**17**	**9.5**	**0**	

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
CES 418	Structural Dynamics	**3**	3	1.5	0	PHM 033, CES 213, CES 214
CES 442	Modern Building Materials	**3**	3	1.5	0	CES 143, CES 223
CES 463	Project Management for Construction	**3**	3	1.5	0	CES 121, CES 361
CES 497	Graduation Project (1)	**3**	2	0	3	
XXX xxx	Technical Elective (2)	**3**	3	1.5	0	Course-specific
XXX xxx	Technical Elective (3)	**3**	3	1.5	0	Course-specific
Total Hours		**18**	**17**	**7.5**	**3**	
Second Main Semester (Term 10)						
ARC 414	Building Envelope Design	**3**	3	1.5	0	MEP 312
CES 419	Senior Seminar	**2**	2	0	0	
CES 423	Construction Engineering (2)	**3**	3	1.5	0	CES 324
CES 498	Graduation Project (2)	**3**	2	0	3	
XXX xxx	Technical Elective (4)	**3**	3	1.5	0	Course-specific
XXX xxx	Technical Elective (5)	**3**	3	1.5	0	Course-specific
Total Hours		**17**	**16**	**6**	**3**	

Communication Systems Engineering Program

1. Program Goals and Objectives

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/her 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/her degree by taking a balanced curriculum that is predominantly concerned with communication systems on different levels and which does not neglect required basic sciences used in this field. This fills the gap in many telecommunication companies.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
EPM 114	Electrical Circuits	3
PHM 116	Complex and Special Functions and Fourier Analysis	4
CSE 122	Computer Programming	3
PHM 123	Modern Physics and Quantum Mechanics	3
ECE 132	Electronic Materials	3
CSE 141	Logic Design	3
ECE 161	Electrostatics and Magnetostatics	3
CSE 212	Computer Architecture	3
PHM 212	Numerical Techniques	3
PHM 221	Optical and Thermal Physics	3
ECE 233	Solid State Electronic Devices	3
ECE 242	Electronic Circuits (1)	4
ECE 252	Signals and Systems	4
ECE 253	Analog Communication Systems	3
ECE 254	Digital Signal Processing	3
ECE 261	Engineering Electromagnetics	3
ECE 262	Waves and Transmission Lines	4
ECE 343	Electronic Circuits (2)	3
ECE 344	Digital Circuit Design	3
ECE 354	Digital Communications	3
ECE 355	Communication Networks	3
ECE 363	Antenna Engineering and Propagation	3
CSE 373	Control Systems	3
CSE 435	Computer Networks	3
ECE 458	Information Theory and Coding	3

ECE 495	Introduction to Decision Analysis	3
ECE 496	High-Tech Entrepreneurship	3
ECE 497	Graduation Project (1)	3
ECE 498	Graduation Project (2)	4
	Total Credit Hours	**92**

3. Technical Electives

Technical electives are distributed in three fields: **Signals and Communication Systems**, **Circuits and Systems**, and **Physical and Wave Electronics**. The student has to select eight technical elective courses for a total of (24) credit hours with at least five of these courses from one of the mentioned fields.

Field	Course Code	Course Title	Credit Hours
Signals and Communication Systems	ECE 357	Acoustics	3
	ECE 358	Satellite Communications	3
	ECE 359	Statistical Signal Processing	3
	CSE 367	Digital Image Processing	3
	CSE 445	Multimedia Engineering	3
	ECE 459	Wireless and Mobile Communications	3
	CSE 491	Network Security	3
	ECE 491	Selected Topics in Signals and Communication Systems	3
Circuits and Systems	CSE 341	Introduction to Embedded Systems	3
	ECE 372	Electronic Measurements and Instrumentation	3
	ECE 381	VLSI Technology	3
	ECE 382	Analog Integrated Circuit Design	3
	ECE 486	Analog Integrated Systems Design	3
	ECE 487	VLSI Design and Automation	3
	ECE 488	RF Circuit Design	3
	ECE 492	Slected Topics in Circuits and Systems	3
Physical and Wave Electronics	ECE 336	Optoelectronic Devices	3
	ECE 337	Principles of Nanoelectronics	3
	ECE 356	Optical Communication Systems	3
	ECE 364	Microwave Circuits	3
	ECE 411	Integrated Optics and Optical MEMS	3
	ECE 463	Microwave Devices	3
	ECE 464	Microwave Measurements	3
	ECE 493	Selected Topics in Physical and Wave Electronics	3

4. Course Descriptions of the General Specialization Courses

EPM 114: Electrical Circuits (3 Credit Hours)
Prerequisite: PHM 022
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, Mutual inductance, Resonance in electrical circuits, Electric filters, Two-port networks, Locus of phasor diagrams at variable frequency, Analysis of electrical circuits with non-sinusoidal alternating currents.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

PHM 116: Complex and Special Functions and Fourier Analysis
(4 Credit Hours)
Prerequisite: PHM 113
Periodic functions, Fourier series expansion and its applications, Fourier transform. Sequences Z-transform. Complex numbers and complex planes, Complex functions and their derivatives, Integration of complex functions, The Cauchy integral theorem, Singularities and the residue theorem, Conformal mapping, Series solution of linear differential equations, Special functions: Gamma, Beta, Bessel and Legendre. Bessel and Legendre series.
Lecture: 3 hours/week, Tutorial: 2 hours/week

CSE 122: Computer Programming (3 Credit Hours)
Prerequisite: CSE 012
Introduction to problem analysis, Variables, Data types, Input and Output, Operators and simple functions, Selection structure, Repetition and Loop statements, Modular programming, Arrays, Strings and other data types, Files, Pointers, S/W testing. Programming principles such as structuring, looping, data structures and abstract. Data type ADT. Arrays, list, stacks, queues, binary trees.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

PHM 123: Modern Physics and Quantum Mechanics (3 Credit Hours)
Prerequisite: PHM 114, PHM 115
Modern physics: Plank's theory of quantization of energy of radiation, Photo-electric effect, x-rays and Compton's effect, Wave properties of matter and wave function, Principles of quantum mechanics and Schrödinger equation, Atomic structure and study of the tunnelling phenomenon. Solution of Schrödinger equations in Quantum well, quantum dot and periodic structures. Bloch function, Kronig-Penny model. Quantum theory of free electrons in metals, Statistical distribution laws. Fermi-Dirac Distribution.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 132: Electronic Materials (3 Credit Hours)
Prerequisite: PHM 022
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, Bipolar junction transistor (BJT).
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 141: Logic Design (3 Credit Hours)
Prerequisite: CSE 122
Review on number systems, Binary number systems, Number base conversion, Octal and hexadecimal, Negative numbers, 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: 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 systems, Incompletely specified states, Counters, Shift registers. Miscellaneous topics: Adders, Subtracters, Decoders, Coders, Multiplexer/Demultiplexer, Memories (ROM, PLA, RAM).
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 161: Electrostatics and Magnetostatics (3 Credit Hours)
Prerequisite: PHM 022, PHM 113
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 212: Computer Architecture (3 Credit Hours)
Prerequisite: CSE 141
Fundamentals of computer architecture and organization, Basic computer organization and design: Information format, Instruction formats. Computer instructions, Timing and control execution, Register transfer, Micro operations, Control functions, Memory organization, CPU structure and function, Processor organization, Register organization, ALU, Instruction execution cycles, Control memory, Microinstruction sequencing and execution. Bus organization: Bus timing analysis, Memory devices and systems. I/O systems. Hardware implementation of

data path and memory systems: Control signalling and interrupts, Programmed I/O, interrupt priority, Bidirectional bus interfaces, Programmable peripherals devices, Interface design issues.
Lecture: 3 hours/week, Tutorial: 1 hour/week

PHM 212: Numerical Techniques (3 Credit Hours)
Prerequisite: PHM 014, PHM 115
Roots of algebraic and transcendental equations, function approximation, Splines, Least square data fitting, numerical differentiation, numerical integration, solution of simultaneous algebraic equations, Finite difference techniques, Finite element techniques. Introduction to a numerical solver in a Mathematical software system (MSS): elementary numerical methods: Euler, Improved Euler, Runge-Kutta, local and global error, reliability of numerical methods, finding eigenpairs and solving linear systems with a MSS.
Lecture: 3 hours/week, Tutorial: 1 hour/week

PHM 221: Optical and Thermal Physics (3 Credit Hours)
Prerequisite: PHM 013
Heat and thermodynamics: Heat transfer, Kinetic theory of gases, First law of thermodynamics. Geometrical optics: Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 233: Solid State Electronic Devices (3 Credit Hours)
Prerequisite: EPM 114, ECE 132
Bipolar junction transistor (BJT): Eber-Moll model, Static and dynamics characteristics, Field effect transistors. (linear and nonlinear and pinch off regions), JFETs model and biasing. Insulated gate FETs: Types, Regions of operation, MOSFETs model and biasing. FETs applications: MOSFET as a resistance, JFET as a constant current source, Metal semiconductor contacts, MOS capacitors, stimulated and spontaneous emission, Light emitting diodes (LED), laser diode (LD), Power devices, Device simulators.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 242: Electronic Circuits (1) (4 Credit Hours)
Prerequisite: ECE 233
Review of physics and operation of diodes and bipolar and MOS transistors. Equivalent circuits and models of semiconductor devices. Analysis and design of single-stage amplifiers. DC biasing circuits. Small-signal analysis. Operational amplifier systems. Introduction to Filters, ADCs, DACs & PLLs.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 252: Signals and Systems (4 Credit Hours)

Prerequisite: PHM 114

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 signals: Fourier representation of continuous time periodic signals, Fourier series representation of discrete time periodic signals, Filters described by differential equations and filters described by difference equations. The continuous-time Fourier transform and its properties, The discrete-time Fourier transform and its properties, The Z-transform, Region of convergence, The Inverse Z-transform, Properties of the Z-transform, Analysis and characterization of LTI systems using Z-transform, System function algebra, The unilateral Z-transform.

Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 253: Analog Communication Systems (3 Credit Hours)

Prerequisite: ECE 252

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, Noise effect on CW modulation Systems: DSB-SC, AM envelope, FM. Baseband, Noise Figure, Signal to noise ratio in Analog systems.

Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 254: Digital Signal Processing (3 Credit Hours)

Prerequisite: ECE 252

Relationship between continuous-time and discrete-time signals. Sampling theorem. Z-transform. Discrete Fourier transform. Fast Fourier transform. Structures and Realizations of digital filters. State-space representation. Lattice Filters. FIR filter design techniques: windowing and frequency sampling. IIR filter design techniques: S-to-Z domain transformation. Fixed-point and Floating-point Arithmetic. Quantization Effects. Implementation of Digital Filters. Introduction to Multirate DSP systems. Applications of DSP.

Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 261: Engineering Electromagnetics (3 Credit Hours)

Prerequisite: PHM 116, ECE 161

Time-varying electromagnetic fields, Maxwell equations, plane electromagnetic waves in free space, Gaussian Beams in Free space, Propagation of electromagnetic waves in matter, Reflection and refraction, Multiple reflections, Field polarization, Coaxial transmission line, Transverse Electro-Magnetic TEM Waves,

Power flow on TL, Power and energy relations, Smith chart and impedance matching, Fundamentals and definitions of antennas, infinitesimal dipole antenna.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 262: Waves and Transmission Lines (4 Credit Hours)
Prerequisite: ECE 261
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, Hybrid modes in step index optical fibres, Propagation in multimode waveguide. Equivalent circuit of waveguides, N-port circuit, Circuit description, Scattering parameters, Excitation of wave guides, Waveguides coupling by aperture, Passive devices: Terminations, Attenuators, Phase shifters, Directional couplers, Hybrid junctions, non reciprocal devices resonators.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 343: Electronic Circuits (2) (3 Credit Hours)
Prerequisite: ECE 242
Analysis and design of differential amplifiers in bipolar and CMOS technologies. Current mirrors and active loads. Frequency response of amplifiers. Feedback and its properties. Stability issues and frequency compensation. Oscillators and Voltage Controlled Oscillators.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 344: Digital Circuit Design (3 Credit Hours)
Prerequisite: CSE 141, ECE 242
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 354: Digital Communications (3 Credit Hours)
Prerequisite: ECE 253
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, QPSK, Pe, Spectrum, generation. M-ary PSK, Hybrid Amplitude-phase modulation, Coherent

Frequency shift keying, M-ary FSK, Noncoherent binary FSK. Differential phase shift Keying, Multiple a Spread Spectrum techniques.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 355: Communication Networks (3 Credit Hours)
Prerequisite: ECE 253
Introduction to telecommunication networks, Network topology, Switching: Telegraph, Telephone, Telex, Data, Signalling, ISDN, Broad band, Private switching. Management network multiplexing: Analog, Digital, Wavelength division. Data transmission interface equipment: Modems, Digital data interface equipment. Codecs: Audio, Video. Copper lines: Open wire, Twisted pair cable, Coaxial cable. Optical fibre technology: Types of optical fibres, Cables, Wavelength Division Multiplexing in optical networks, Applications, Radio relay technology, Systems. Mobile radio: Service mode technology. Satellites: Services, Technology, Digital subscriber lines
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 363: Antenna Engineering and Propagation (3 Credit Hours)
Prerequisite: ECE 262
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 373: Control Systems (3 Credit Hours)
Prerequisite: ECE 252
Introduction to feedback control systems, Advantages and disadvantages of feedback, Standard test signals, Transient response, Response of first and second order systems, Properties of transient response. Stability of linear systems, The root locus method. Frequency response plots: Bode plots, Polar plots, Systems with transportation lag, Estimation of transfer functions from bode plots. Stability from frequency response: Nyquist criterion, Relative stability, the closed loop frequency response. Compensation methods.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CSE 435: Computer Networks (3 Credit Hours)
Prerequisite: ECE 355
Introduction to computer networks, Network architecture, ISO/OSI reference model, TCP/IP model, Examples of networks, Network topology, Physical layer, Data communication networks, Telephone system, Integrated services digital network, Asynchronous transfer mode, Data link layer design issues, Error handling, Elementary data link protocols, Medium access control protocols, Local, area

networks, Carrier sense multiple access with collision detection protocol (CSMA/CD), Ethernet like local area networks, High speed local area networks.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 458: Information Theory and Coding (3 Credit Hours)
Prerequisite: ECE 354
Introduction: Uncertainty, Information, Entropy and its properties. Source coding: Shannon coding Prefix coding, First Shannon theorem, Huffman coding, discrete memoryless channels, Binary symmetric channel, Mutual information and its properties. Channel capacity, Channel coding, Second Shannon theorem, Mutual information. Channel capacity, Compression of information. Linear block codes, Cyclic codes, Well-Known Block codes, Convolution codes: Code tree, Trellis and state diagram, Maximum likelihood decoding of convolution codes.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 495: Introduction to Decision Analysis (3 Credit Hours)
Distinctions, possibilities and probabilities, relevance, value of information and experimentation, relevance and decision diagrams, risk attitude. What makes a good decision, how decisions can be made better, framing and structuring techniques, modeling and analysis tools, biases and probability assessment, evaluation and appraisal methods, and effective presentation styles.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 496: High-Tech Entrepreneurship (3 Credit Hours)
Developing and protecting your idea, Writing the business plan, getting the necessary funds, money and legal issues, Managing projects, people and products, marketing and selling, growth and exit.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 497: Graduation Project (1) (3 Credit Hours)
A single or group project performed under the supervision of a faculty member and an industrial entity
Lecture: 1 hour/week, Lab: 6 hours/week

ECE 498: Graduation Project (2) (4 Credit Hours)
A single or group project performed under the supervision of a faculty member and an industrial entity
Lecture: 1 hour/week, Lab: 9 hours/week

5. Course Descriptions of the Technical Electives

ECE 336: Optoelectronic Devices (3 Credit Hours)
Prerequisite: ECE 233
interaction of radiation and atomic systems, Theory of laser oscillation: Fabry-perot laser, Oscillation frequency and output power, Some laser systems, Semiconductor laser, DC and AC characteristics, Semiconductor laser modulation, Opto-electronic semiconductor devices, PIN and avalanche photodiodes, Applications, Optoelectronic circuit applications, External modulators, Solar cells, LCD's.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 337: Pronciples of Nanoelectronics (3 Credit Hours)
Prerequisite: PHM 123, ECE 233
Introduction to CMOS scaling and the coming challenges, Nanoscale electronic components: carbon nanotube based devices, quantum dots and molecular devices, Basic electrical properties of these devices, their fabrication, their characterization methods and their uses.
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 341: Introduction to Embedded Systems (3 Credit Hours)
Prerequisite: CSE 212
Introduction to embedded systems. A case study of an embedded system including Assembly programing, C-programing, timers, serial I/O, analog input/output, and memory systems.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 356: Optical Communication Systems (3 Credit Hours)
Prerequisite: ECE 336
Overview of optical fiber communications, Optical fibre power launching and coupling, Optical receiver operation, Digital and analog detectors and preamplifiers, Digital transmission systems, Point to point links, Systems considerations, Power and rise time budgets, Analog systems, Carrier to noise ratio, Multichannel transmission techniques, Coherent optical fibber communication, WDM multiplexing, Optical amplifiers.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 357: Acoustics (3 Credit Hours)
Prerequisite: ECE 262
Parameters and definitions, Acoustic wave propagation in free space, Acoustic Impedance, Acoustic transmitters and receivers, Speech analysis, Biomedical Applications.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 358: Satellite Communications (3 Credit Hours)
Prerequisite: ECE 363
Communication satellite system, Orbiting satellites, The satellite channel, Link calculation, Satellite electronics, Frequency division multiple access, Time division multiple access and code division multiple access, On board processing.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 359: Statistical Signal Processing (3 Credit Hours)
Prerequisite: ECE 254
Signal Detection and Classification, Hypothesis, Testing, Detection of Signals in Noise, Detection in the Presence of Unknowns, Signal Estimation Theory, Estimation of Signal Parameters, Mean-Squared Error, Maximum-Likelihood, Bayesian, Minimax, Signal Waveform Estimation, Least Squares Estimation, Wiener and Kalman Filters, Adaptive Filtering, Iterative Minimization and Gradient Descent.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 364: Microwave Circuits (3 Credit Hours)
Prerequisite: ECE 262
Planar transmission lines: microstrip, slotlines, coplanar waveguide, couple lines. Impedance matching networks, microwave filters: periodic structures, insertion method, Hi-Low impedance, coupled line filters. Microwave amplifiers: power gain amplifier, wide band amplifier, and low noise amplifier.
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 367: Digital Image Processing (3 Credit Hours)
Prerequisite: ECE 254
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. Image coding. Image reconstruction from projections. Image compression. Color image processing. Image segmentation. Morphological operations. Super resolution. Wavelets and image pyramids.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

ECE 372: Electronic Measurements and Instrumentation
(3 Credit Hours)
Prerequisite: ECE 343
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 381: VLSI Technology (3 Credit Hours)
Prerequisite: ECE 242
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 382: Analog Integrated Circuit Design (3 Credit Hours)
Prerequisite: ECE 343, ECE 381
Review of basic analog building blocks (current mirrors, common-source, common-drain, common-gate, cascade-differential pair), Frequency response, Stability and frequency compensation, Operational amplifiers (basic, two-stage, Miller, symmetrical, telescopic, folded, cascade, low voltage), Voltage and current references, Noise, non-linearity, mismatches.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 411: Integrated Optics and Optical MEMS (3 Credit Hours)
Prerequisite: ECE 356
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, Fibre lens, Variable optical attenuators, Multilayer filter design, Tuneable MEMS filters.
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 445: Multimedia Engineering (3 Credit Hours)
Prerequisite: CSE 367
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

ECE 459: Wireless and Mobile Communications (3 Credit Hours)
Prerequisite: ECE 354, ECE 363
Basic concepts of mobile communications, Cell site planning, Traffic engineering, RF propagation characteristics, Fading and Path loss phenomena, Noise in cellular systems, Frequency planning, Frequency reuse, Types of interference. GSM system, Multiple access techniques, GSM architecture, TDMA frame structure, Types of bursts, Mapping of logical channels on physical channels, Bit interleaving, Modulation, Frequency hopping, Power control, Carrier and burst synchronization, CDMA spread spectrum systems, Types of codes and power control in CDMA.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 463: Microwave Devices (3 Credit Hours)
Prerequisite: ECE 364
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 464: Microwave Measurements (3 Credit Hours)
Prerequisite: ECE 463
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

ECE 486: Analog Integrated Systems Design (3 Credit Hours)
Prerequisite: ECE 382
Introduction to the types of systems environment in which analog integrated circuit design is employed. A/D and D/A converters, including over-sampled S-D A/D converters, switched capacitor amplifiers, multipliers, wave-shaping circuits, oscillators, PLLs, and the design of filters
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 487: VLSI Design and Automation (3 Credit Hours)
Prerequisite: ECE 344, ECE 381
Design and layout of complex gates, Low power digital design. The method of logical effort. Fundamentals of design automation of VLSI circuits and systems, including introduction to circuit and system platforms such as field programmable gate arrays

and multicore systems; HDL languages (VHDL/Verilog), high-level synthesis, logic synthesis, and technology mapping; physical design; and testing and verification.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 488: RF Circuit Design (3 Credit Hours)
Prerequisite: ECE 382
RF transceivers, Noise figure, harmonic distortion, matching, Low Noise Amplifiers, Mixers, Oscillators, phase noise, RF frequency synthesis, RF Power Amplifiers (class A, class B, class C, class AB).
Lecture: 3 hours/week, Tutorial: 1 hour/week

CSE 491: Network Security (3 Credit Hours)
Prerequisite: CSE 435
Overview of computer and network security and methods of defence, Secure encryption systems (symmetric and public key encryption schemes, AES (advanced encryption standard), RSA standard, Security protocols (key distribution, authentication, and digital signature schemes, Software security (protection from viruses and similar programs, design of secure operating systems, database security), Network security (IP security and the IPSec protocol, firewalls, web security, electronic mail security, network management security aspects).
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 491: Selected Topics in Signals and Communication Systems
(3 Credit Hours)
Prerequisite: Determined according to course contents
Selected topics in recent directions in signals and communication systems will be presented in this course.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 492: Selected Topics in Circuits and Systems (3 Credit Hours)
Prerequisite: Determined according to course contents
Selected topics in recent directions in circuits and systems be presented in this course.
Lecture: 3 hours/week, Tutorial: 1 hour/week

ECE 493: Selected Topics in Physical and Wave Electronics
(3 Credit Hours)
Prerequisite: Determined according to course contents
Selected topics in recent directions in physical and wave electronics will be presented in this course.
Lecture: 3 hours/week, Tutorial: 1 hour/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
EPM 114	Electrical Circuits	**3**	2	2	2	PHM 022
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
CSE 122	Computer Programming	**3**	2	2	2	CSE 012
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
	Total Hours	**18**	**15**	**10.5**	**5.5**	
Second Main Semester (Term 4)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
PHM 116	Complex and Special Funtions and Fourier Analysis	**4**	3	2	0	PHM 113
PHM 123	Modern Physics and Quantum Mechanics	**3**	3	1	0	PHM 114, PHM 115
ECE 132	Electronic Materials	**3**	3	1	0	PHM 022
CSE 141	Logic Design	**3**	2	2	2	CSE 122
ECE 161	Electrostatics and Magnetostatics	**3**	3	1	0	PHM 022, PHM 113
	Total Hours	**19**	**17**	**7**	**3.5**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
PHM 212	Numerical Techniques	**3**	3	1	0	PHM 014, PHM 115
PHM 221	Optical and Thermal Physics	**3**	2	2	2	PHM 013
ECE 233	Solid State Electronic Devices	**3**	3	1	0	EPM 114, ECE 132
ECE 252	Signals and Systems	**4**	3	2	2	PHM 114
ECE 261	Engineering Electromagnetics	**3**	3	1	0	PHM 116, ECE 161
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**19**	**16**	**9**	**4**	
Second Main Semester (Term 6)						
CSE 212	Computer Architecture	**3**	3	1	0	CSE 141
ECE 242	Electronic Circuits (1)	**4**	3	2	2	ECE 233
ECE 253	Analog Communication Systems	**3**	2	2	2	ECE 252
ECE 254	Digital Signal Processing	**3**	3	1	0	ECE 252
ECE 262	Waves and Transmission Lines	**4**	3	2	2	ECE 261
	Total Hours	**17**	**14**	**8**	**6**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
ECE 343	Electronic Circuits (2)	**3**	3	1	0	ECE 242
ECE 363	Antenna Engineering and Propagation	**3**	3	1	0	ECE 262
CSE 373	Control Systems	**3**	2	2	2	ECE 252
XXE 3xx	Technical Elective (1)	**3**	x	x	x	Course-specific
XXE 3xx	Technical Elective (2)	**3**	x	x	x	Course-specific
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**18**	**x**	**x**	**x**	
Second Main Semester (Term 8)						
ECE 344	Digital Circuit Design	**3**	3	1	0	CSE 141, ECE 242
ECE 354	Digital Communications	**3**	2	2	2	ECE 253
ECE 355	Communication Networks	**3**	3	1	0	ECE 253
XXE 3xx	Technical Elective (3)	**3**	x	x	x	Course-specific
XXE 3xx	Technical Elective (4)	**3**	x	x	x	Course-specific
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**18**	**x**	**x**	**x**	

Technical Elective (1) and (2)

ECE 336: Optoelectronic Devices	Prerequisite: ECE 233
ECE 337: Principles of Nanoelectronics	Prerequisite: PHM 123, ECE 233
CSE 341: Introduction to Embedded Systems	Prerequisite: CSE 212
ECE 357: Acoustics	Prerequisite: ECE 262
ECE 359: Statistical Signal Processing	Prerequisite: ECE 254
ECE 381: VLSI Technology	Prerequisite: ECE 242

Technical Elective (3) and (4)

ECE 356: Optical Communication Systems	Prerequisite: ECE 336
ECE 358: Satellite Communications	Prerequisite: ECE 363
ECE 364: Microwave Circuits	Prerequisite: ECE 262
CSE 367: Digital Image Processing	Prerequiste: ECE 254
ECE 372: Electronic Measurements and Instrumentation	Prerequisite: ECE 343
ECE 382: Analog Integrated Circuit Design	Prerequisite: ECE 343, ECE 381

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
CSE 435	Computer Networks	**3**	3	1	0	ECE 355
ECE 495	Introduction to Decision Analysis	**3**	3	1	0	
ECE 497	Graduation Project (1)	**3**	1	0	6	
XXE 4xx	Technical Elective (5)	**3**	x	x	x	Course-specific
XXE 4xx	Technical Elective (6)	**3**	x	x	x	Course-specific
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**18**	**x**	**x**	**x**	
Second Main Semester (Term 10)						
ECE 458	Information Theory and Coding	**3**	2	2	2	ECE 354
ECE 496	High-Tech Entrepreneurship	**3**	3	1	0	
ECE 498	Graduation Project (2)	**4**	1	0	9	
XXE 4xx	Technical Elective (7)	**3**	x	x	x	Course-specific
XXE 4xx	Technical Elective (8)	**3**	x	x	x	Course-specific
	Total Hours	**16**	**x**	**x**	**x**	

Technical Elective (5) and (6)

ECE 411: Integrated Optics and Optical MEMS — Prerequisite: ECE 356
CSE 445: Multimedia Engineering — Prerequisite: CSE 367
ECE 459: Wireless and Mobile Communications — Prerequisite: ECE 354, ECE 363
ECE 463: Microwave Devices — Prerequisite: ECE 364
ECE 486: Analog Integrated Systems Design — Prerequisite: ECE 382
ECE 487: VLSI Design and Automation — Prerequisite: ECE 344, ECE 381

Technical Elective (7) and (8)

ECE 464: Microwave Measurements — Prerequisite: ECE 463
ECE 488: RF Circuit Design — Prerequisite: ECE 382
CSE 491: Network Security — Prerequisite: CSE 435
ECE 491: Selected Topics in Signals and Communication Systems
Prerequisite: Determined according to course contents
ECE 492: Selected Topics in Circuits and Systems
Prerequisite: Determined according to course contents
ECE 493: Selected Topics in Physical and Wave Electronics
Prerequisite: Determined according to course contents

Materials Engineering Program

1. Program Goals and Objectives

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.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
PHM 123	Modern Physics and Quantum Mechanics	3
MEP 131	Fluid Dynamics	3
MDP 133	Crystalline Structures of Materials	4
MDP 141	Mechanical Engineering Measurements	3
PHM 141	Introduction to Organic Chemistry	3
PHM 142	Reaction Kinetics and Chemical Analysis	3
MDP 162	Mechanical Engineering Drawing	3
MDP 222	Design and Analysis of Experiments	3
MEP 222	Heat and Mass Transfer	4
ECE 231	Materials for Electronic Applications	3
MDP 231	Material Testing	3
MDP 232	Mechanical Behavior of Materials	3
MDP 233	Phase Transformations and Heat Treatment	4
MDP 234	Glass, Ceramics, and Binding Materials	3
PHM 241	Electrochemistry	3
PHM 242	Polymer Chemistry	3
MDP 253	Stress Analysis	3
MDP 311	Composites Technology	3
MDP 326	Quality Control	3
MDP 332	Polymer Materials	3
MDP 333	Modern Steel Making	3
MDP 334	Welding Technology and Metallurgy	3
MDP 335	Failure Analysis	3
MDP 336	Biomedical Materials	3

MDP 337	Corrosion	4
MDP 356	FE and Computational Materials Engineering	4
MDP 391	Industrial Project	4
MDP 411	Advanced Manufacturing Processes	3
MDP 432	Material and Process Selection	3
MDP 491	Graduation Project (1)	4
MDP 492	Graduation Project (2)	4
	Total Credit Hours	**101**

3. Technical Electives

The student should select (5) Elective courses with a total of (15) Credit Hours from the following list:

Course Code	Course Title	Credit Hours
MDP 412	Polymer Processing	3
MDP 413	Forming Technology	3
MDP 414	Machining Technology	3
MDP 415	Casting and Industrial Furnaces	3
MDP 416	Introduction to Nano Technology	3
MDP 420	Quality Systems	3
MDP 430	Selected Topics in Materials Science and Engineering	3
MDP 433	Glass Materials and Technology	3
MDP 434	Binding Materials and Technology	3
MDP 435	Ceramic Materials and Technology	3
MDP 436	Polymer Testing	3
MDP 437	Materials Characterization	3
MDP 438	Non-Ferrous Engineering Metals	3
MDP 439	Extractive Metallurgy	3
CES 444	Building Materials	3
MDP 464	Mechanical Engineering Design	3

4. Course Descriptions of the General Specialization Courses

PHM 123: Modern Physics and Quantum Mechanics (3 Credit Hours)
Prerequisite: PHM 114, PHM 115
Modern physics: Plank's theory of quantization of energy of radiation, Photo-electric effect, x-rays and Compton's effect, Wave properties of matter and wave function, Principles of quantum mechanics and Schrödinger equation, Atomic structure and study of the tunnelling phenomenon. Solution of Schrödinger equations in Quantum well, quantum dot and periodic structures. Bloch function, Kronig-Penny model. Quantum theory of free electrons in metals, Statistical distribution laws. Fermi-Dirac Distribution.
Lecture: 3 hours/week, Tutorial: 1 hour/week

MEP 131: Fluid Dynamics (3 Credit Hours)
Prerequisite: PHM 115
Fluid Properties, hydrostatics, fluid Kinematics, conservation Laws, application of continuity, momentum and energy equations. Reynolds transport theorem, dynamics laws of incompressible flows, Navier-Stokes equations, dimensional analysis and similarity, internal and external flows, compressible flow, turbulence, modern models of turbulence, boundary layer theory, boundary layer applied to submerged and conduit flows, unsteady flow, flow measurement devices, and fluid machinery: Pumps and turbines classification, theory, performance and application.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 133: Crystalline Structures of Materials (4 Credit Hours)
Prerequisite: MEP 112, MDP 132
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.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 141: Mechanical Engineering Measurements (3 Credit Hours)
Prerequisite: PHM 032
Static and dynamic characteristics of instruments, statistical analysis of measurement errors, variable conversion elements and signal amplification, Measurement of strain, force, pressure, flow, temperature, speed and power.
Lecture: 3 hours/week, Lab: 1 hour/week

PHM 141: Introduction to Organic Chemistry (3 Credit Hours)
Prerequisite: PHM 042
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.
Lecture: 3 hours/week, Lab: 1.5 hours/week

PHM 142: Reaction Kinetics and Chemical Analysis (3 Credit Hours)
Prerequisite: PHM 141
General concepts of equilibrium based on methods of detection, determination, and separation; equilibrium in aqueous and nonaqueous 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.
Lecture: 3 hours/week, Lab: 1.5 hours/week

MDP 162: Mechanical Engineering Drawing (3 Credit Hours)
Prerequisite: MDP 061
Machine parts, assembly drawing, machining marks, types of fittings, illustration of M/C parts, application of manufacturing details, design drawings and workshop working drawings.
Lecture: 1 hour/week, Tutorial: 4 hours/week

MDP 222: Design of Experiments (3 Credit Hours)
Prerequisite: PHM 114
Guidelines for Designing Experiments, Basic Concepts, Statistical Techniques in Experimentation, Review of elementary probability and statistics, Inferences about the Difference in Means, Randomized Design, Inferences about the Difference in Means, Paired Comparison Designs, Inferences about the Variances of Normal Distributions, The Analysis of variance, Single factor experiment, One-Way Analysis of Variance, The Sheffe Test and the Tuckey Test, Basic Definitions and Principles, The Advantage of Factorials, The Two Factor Factorial Design, Scatter Diagrams Correlation, Linear Regression Models, Estimation of the parameter in Linear regression Models, Hypothesis Testing in Regression, Advantages and Disadvantages of Nonparametric Methods.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 222: Heat and Mass Transfer (4 Credit Hours)
Prerequisite: MEP 112, MEP 131
Laws of conduction, convection and radiation and related problems and applications: Steady and transient conduction in solids, one and multi-dimensional steady and unsteady conduction heat transfer, heat transfer from extended surfaces, free and

forced convection heat transfer, laminar and turbulent heat convection, boiling and condensation phenomena and its correlation formulae, fundamentals of heat exchangers, radiation processes and properties, radiation exchange between surfaces, gaseous emission and absorption, mechanism of multi-mode heat transfer. Phenomenological and mechanistic approaches to diffusion, boundary conditions, diffusion in fluids and solids.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

ECE 231: Materials for Electronic Applications (3 Credit Hours)
Prerequisite: PHM 123, MDP 132
Fundamental properties of materials used in electronic applications (dielectric, magnetic and optoelectric properties, operation of devices and fabrication methods of electronic circuits and packaging, semiconductors and doped semiconductors, electrons in solids and electron band model, electron hole behavior in electric and magnetic fields.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 231: Material Testing (3 Credit Hours)
Prerequisite: MDP 132, MDP 141
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.
Lecture: 2 hours/week, Lab: 3 hours/week

MDP 232: Mechanical Behavior of Materials (3 Credit Hours)
Prerequisite: MDP 231, MDP 253
Material response to different external forces, factors affecting the mechanical behavior of materials, elastic and plastic deformation, yielding criteria, creep, fatigue and fracture of engineering materials, treatment of multiaxial stresses and strains, physical models (rheological) for elastic, plastic and creep deformation.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1 hour/week

MDP 233: Phase Transformations and Heat Treatment (4 Credit Hours)
Prerequisite: MDP 133, MEP 222
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, Carburising, and Nitriding, De-carburising, Re-heat treatment, Re-tempering, Annealing, and Normalising, Heat treatment of Aluminium alloys, Annealing, Solution treatment, Natural ageing, Artificial ageing, Over ageing, Explanation of the heat treatment of Aluminium alloys, Control testing.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 234: Glass, Ceramics, and Binding Materials (3 Credit Hours)
Prerequisite: MDP 133
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, colouration, ionic consuction, 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.
Lecture: 3 hours/week, Lab: 1 hour/week

PHM 241: Electrochemistry (3 Credit Hours)
Prerequisite: PHM 042
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.).
Lecture: 3 hours/week, Lab: 1 hour/week

PHM 242: Polymer Chemistry (3 Credit Hours)
Prerequisite: PHM 142
Introduction to polymers, nomenclature and classification of polymers, raw materials for the production of synthetic polymers, natural polymers, polymer structure, molecular weight and molecular weight distribution, chemical formation of polymers: polymerization, polycondensation, polyaddition, commercial polymerization.
Lecture: 3 hours/week, Lab: 1 hour/week

MDP 253: Stress Analysis (3 Credit Hours)
Prerequisite: PHM 033
Principles of statics and its application on deformable bodies. Stress and strain. Elastic behavior of simple elements under axial loading, bending and twisting. Principal stresses. Beams deflection. Statically indeterminate beams.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 311: Composites Technology (3 Credit Hours)
Prerequisite: MDP 332
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.
Lecture: 3 hours/week, Lab: 2 hours/week

MDP 326: Quality Control (3 Credit Hours)
Prerequisite: MDP 222
Introduction, definition of quality, quality regulations. Quality control program fundamentals: customer voice, variables, inspection, measurement, documentation, control, worker empowerment, challenges. Evaluation through statistics: calculating mean and standard deviation, ranges, confidence intervals. Evaluating Quality through graphs: control charts, cause and effect diagram, histograms, quality control techniques: six sigma, total quality management (TQM), Lean. Applications and case studies.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 332: Polymer Materials (3 Credit Hours)
Prerequisite: MDP 132, PHM 242
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 short destructive testing showing the effect of test speed (tension, compression, impact, torsion), long destructive testing (relaxation, retardation, fatigue), quick overview on polymer processing technologies.
Lecture: 3 hours/week, Lab: 1.5 hours/week

MDP 333: Modern Steel Making (3 Credit Hours)
Prerequisite: MDP 233
Types of steel, History of modern steelmaking, Status of steelmaking in Egypt and world, Steel production and consumption, Steelmaking 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 334: Welding Technology and Metallurgy (3 Credit Hours)
Prerequisite: MDP 024
Basic welding processes (gas, arc, laser-beam and electron-beam welding), heat and fluid flow during welding, chemical reactions, residual stresses and distortions, weld metal solidification (grain structure, subgrain structure, microsegregation, macrosegregation, porosity, inclusions and cracking), partially melted zone

(liquidation and cracking), heat-affected zone (loss of strength, embrittlement and cracking in work-hardened materials, precipitation-hardening materials, transformation-hardening materials and corrosion-resistant materials), heat treatment and stress relief, dissimilar metal welding, welding, of steels, stainless steels, aluminium and titanium.
Lecture: 3 hours/week, Lab: 1 hour/week

MDP 335: Failure Analysis (3 Credit Hours)
Prerequisite: MDP 232
General Procedures for Failure Analysis: data and sample collection, preliminary examination, non-destructive inspection, mechanical testing, selection and preservation of fracture surfaces, macroscopic and microscopic examination, selection, preparation and examination of metallographic sections, fracture classification, report writing. Types of Failure and Stress: fracture, wear, corrosion, and distortion failures, tensile, compressive, torsional and shear stresses, residual stresses. Ductile and brittle fractures: definitions and comparisons, dimple rupture, tearing and shearing, plastic deformation ductile-brittle transition, cleavage, intergranular fracture, thermally-induced and environmentally-assisted embrittlement, effect of fabrication and heat treatment, residual stresses. Fatigue failures: factors affecting fatigue life, stages of fatigue fracture, fatigue cracking, effects of variables, mean stress, stress concentration, metal characteristics, manufacturing process, elevated temperatures, contact fatigue. Wear failures: abrasive wear, adhesive wear, lubricated wear, non-lubricated wear, examination of worn parts, effect of microstructure and hardness, surface-fatigue pitting, wear rates. Elevated temperature failures: creep, stress rupture, thermal fatigue. Short notes on corrosion failure.
Lecture: 3 hours/week, Lab: 1 hour/week

MDP 336: Biomedical Materials (3 Credit Hours)
Prerequisite: MDP 132
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.
Lecture: 3 hours/week, Lab: 1 hour/week

MDP 337: Corrosion (4 Credit Hours)
Prerequisite: PHM 241
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.
Lecture: 3 hours/week, Tutorial: 2 hours/week

MDP 356: FE and Computational Materials Engineering (4 Credit Hours)
Prerequisite: PHM 014, PHM 115
Overview and Introduction to Variational Methods: Calculus of Variations, Function vs. functional, Stationary or extremal values of a functions and functionals, Strong vs. weighted residual vs. weak forms, Identification of essential and natural boundary conditions. Introduction to Finite Element Modeling: Axially loaded slender body, Virtual work, Construction of element stiffness matrix and load vector, Assembly of global stiffness matrix and global load vector, Determination of displacement and stress. Fundamentals of Structural Mechanics: Strain and Stress, Equilibrium, Principle of virtual work. Two and Three Dimensional Solids: Finite element modeling via isoparametric formulation for mapping and shape functions, Stiffness matrix, Load vector.
Lecture: 3 hours/week, Tutorial: 2 hours/week

MDP 391: Industrial Project (4 Credit Hours)
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. Along 15 weeks, 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.
Lecture: 3 hours/week, Lab: 4 hours/week

MDP 411: Advanced Manufacturing Processes (3 Credit Hours)
Prerequisite: MDP 024
Electrical discharge machining (EDM), electrochemical machining (ECM), photochemical machining (PCM), ultrasonic machining, lasers cutting, plasma cutting, rapid prototyping, hybrid machining, etc.
Lecture: 3 hours/week

MDP 432: Material and Process Selection (3 Credit Hours)
Prerequisite: MDP 024, MDP 162, MDP 232
Materials and Process Selection: 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 491: Graduation Project (1) (4 Credit Hours)
Prerequisite: MDP 391
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.
Lecture: 2 hours/week, Lab: 6 hours/week

MDP 492: Graduation Project (2) (4 Credit Hours)
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 to prove his competence in materials engineering practice.
Lecture: 2 hours/week, Lab: 6 hours/week

5. Course Descriptions of the Technical Electives

MDP 412: Polymer Processing (3 Credit Hours)
Prerequisite: MDP 332
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 moulding related processes, decorative moulding, extrusion and injection blow moulding, compression moulding, thermoforming, coating, etc..
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 413: Forming Technology (3 Credit Hours)
Prerequisite: MDP 024, MDP 232
Elastic and plastic material behavior, material forming procedure, forming parameters in cold or hot working, tension and compression in die forming, flow curve description, criteria and equations of the flow curve, introduction to elemental plasticity theory, stress calculation during forming process in both friction and frictionless conditions, technical die forming processes (rolling, fine sheet production, forging, wire drawing, tube extrusion, sheet metal work).
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 414: Machining Technology (3 Credit Hours)
Prerequisite: MDP 024, MDP 232
Principles of machining, basic concepts and definitions, short review on machining processes (Sawing, Turning, Shaping, Planning & Slotting, Broaching, Drilling, Milling, and Grinding process and the details of the machines cutting tool materials, chip formation, mechanics of metal cutting, cutting forces and power consumption, cutting temperature, cutting fluids, tool failure, tool life, chatter, surface roughness, machining economy, optimization of machining variables, machining time, methods of tools and work piece fixation.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 415: Casting and Industrial Furnaces (3 Credit Hours)
Prerequisite: MDP 334
Foundary and castshop layouts, melting techniques (induction, electric, cupola), melt treatment, sand casting, new trends in casting techniques, principles of castable materials, die casting, semi finished castings (continuous casting, ribbon casting, rheocasting), casting defects and remedy, cast inspection.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 416: Introduction to Nano Technology (3 Credit Hours)
Prerequisite: PHM 123
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 420: Quality Systems (3 Credit Hours)
Prerequisite: PHM 114
Basic concepts, history of quality control, Quality control engineering, Quality Control for design and development, construction of quality control systems, quality control of purchases, planning, organization, quality costs, economics of quality, training, quality control during product use, introduction to statistical quality control and data analysis.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 430: Selected Topics in Materials Science and Engineering
(3 Credit Hours)
Prerequisite: Determined according to course contents
Selected Materials Science and Engineering related topics to be defined on the basis of developments and trends in research and market in this field.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 433: Glass Materials and Technology (3 Credit Hours)
Prerequisite: MDP 234
Technology of glasses: definitions and glass raw material, reactions, viscosity and brittleness, manufacturing of glasses, fibre glass manufacturing, glass solidification, defects in glasses.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 434: Binding Materials and Technology (3 Credit Hours)
Prerequisite: MDP 234
Principles of binding agents: introduction, thermal behavior, combustibles, cement, calk, mechanical properties.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 435: Ceramic Materials and Technology (3 Credit Hours)
Prerequisite: MDP 234
Principles of ceramics: raw material, ceramic forming, thermal behavior, special technology of porcelain.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 436: Polymer Testing (3 Credit Hours)
Prerequisite: MDP 332
Introduction to the significance of polymer testing and its applications, destructive and non-destructive testing, thermal analysis (DTA, TGA, DSC), mechanical analysis (DMA, TMA), special techniques (μTA), chemical analysis.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 437: Materials Characterization (3 Credit Hours)
Prerequisite: MDP 231
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 438: Non-Ferrous Engineering Metals (3 Credit Hours)
Prerequisite: MDP 333
Non ferrous metals today, physical and mechanical properties of important non-ferrous materials, metals and their important alloying elements: aluminium and its alloys, copper and its alloys, titanium and its alloys, magnesium and its alloys, lead and tin alloys, nickel and zinc alloys, super-alloys.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 439: Extractive Metallurgy (3 Credit Hours)
Prerequisite: MDP 233
background of extraction, thermodynamics, oxides and sulphides. 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 aluminium. Developments in extraction and in biometallurgy. Separation equipment, materials handling devices.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CES 444: Building Materials (3 Credit Hours)
Prerequisite: MDP 234
Non-metallic building materials and units: properties and testing of building stones, lime, gypsum, timber, bricks, tiles. Metallic building materials and units: structural steel, welding and welded splices. Isolation materials, moisture heat and sound. Modern building materials: advanced composite materials in construction applications.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 464: Mechanical Engineering Design (3 Credit Hours)
Prerequisite: MDP 162
Basic considerations in design for manufacturing, design for strength & design for rigidity, Fits & tolerances, static & dynamic loads, safety factors. Permanent joints: Shrink fit, rivets, welds & glueing, Detachable joints: Bolted, prestressed, joints, keys, feathers, splines & serrations.
Lecture: 2 hours/week, Tutorial: 2 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
PHM 141	Introduction to Organic Chemistry	**3**	3	0	1.5	PHM 042
	Total Hours	**18**	**17**	**6.5**	**4.5**	
Second Main Semester (Term 4)						
PHM 123	Modern Physics and Quantum Mechanics	**3**	3	1	0	PHM 114, PHM 115
MEP 131	Fluid Dynamics	**3**	2	2	1.5	PHM 115
MDP 133	Crystalline Structures of Materials	**4**	3	2	1.5	MEP 112, MDP 132
MDP 141	Mechanical Engineering Measurements	**3**	3	0	1	PHM 032
PHM 142	Reaction Kinetics and Chemical Analysis	**3**	3	0	1.5	PHM 141
MDP 162	Mechanical Engineering Drawing	**3**	1	4	0	MDP 061
	Total Hours	**19**	**15**	**9**	**5.5**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
MDP 222	Design of Experiments	**3**	2	2	0	PHM 114
MEP 222	Heat and Mass Transfer	**4**	3	2	1.5	MEP 112, MEP 131
MDP 231	Material Testing	**3**	2	0	3	MDP 132, MDP 141
PHM 241	Electrochemistry	**3**	3	0	1	PHM 042
MDP 253	Stress Analysis	**3**	2	2	0	PHM 033
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**19**	**14**	**8**	**5.5**	
Second Main Semester (Term 6)						
ECE 231	Materials for Electronic Applications	**3**	2	2	0	PHM 123, MDP 132
MDP 232	Mechanical Behavior of Materials	**3**	2	2	1	MDP 231, MDP 253
MDP 233	Phase Transformations and Heat Treatment	**4**	3	2	1.5	MDP 133, MEP 222
MDP 234	Glass, Ceramics, and Binding Materials	**3**	3	0	1	MDP 133
PHM 242	Polymer Chemistry	**3**	3	0	1	PHM 142
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**19**	**15**	**8**	**4.5**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
MDP 326	Quality Control	**3**	2	2	0	MDP 222
MDP 332	Polymer Materials	**3**	3	0	1.5	MDP 132 PHM 242
MDP 333	Modern Steel Making	**3**	2	2	0	MDP 233
MDP 334	Welding Technology and Metallurgy	**3**	3	0	1	MDP 024
MDP 335	Failure Analysis	**3**	3	0	1	MDP 232
MDP 336	Biomedical Materials	**3**	3	0	1	MDP 132
	Total Hours	**18**	**16**	**4**	**4.5**	
Second Main Semester (Term 8)						
MDP 311	Composites Technology	**3**	3	0	2	MDP 332
MDP 337	Corrosion	**4**	3	2	0	PHM 241
MDP 356	FE and Computational Materials Engineering	**4**	3	2	0	PHM 014, PHM 115
MDP 391	Industrial Project	**4**	3	0	4	
XXX xxx	Technical Elective (1)	**3**	2	2	0	Course-specific
	Total Hours	**18**	**14**	**6**	**6**	

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
MDP 411	Advanced Manufacturing Processes	**3**	3	0	0	MDP 024
MDP 491	Graduation Project (1)	**4**	2	0	6	MDP 391
XXX xxx	Technical Elective (2)	**3**	2	2	0	Course-specific
XXX xxx	Technical Elective (3)	**3**	2	2	0	Course-specific
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**16**	**11**	**6**	**6**	
Second Main Semester (Term 10)						
MDP 432	Material and Process Selection	**3**	2	2	0	MDP 024, MDP 162, MDP 232
MDP 492	Graduation Project (2)	**4**	2	0	6	
XXX xxx	Technical Elective (4)	**3**	2	2	0	Course-specific
XXX xxx	Technical Elective (5)	**3**	2	2	0	Course-specific
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**16**	**10**	**8**	**6**	

Manufacturing Engineering Program

1. Program Goals and Objectives

Egypt is in need of modernization of the manufacturing industry to cope with the global challenges of producing cost effective products that can compete with the international market. Manufacturing Engineering is a complex discipline that requires a great deal of specialized knowledge. Manufacturing engineers are required by all kinds of companies which manufacture a wide variety of products, machines and equipment. The aim of the program is to prepare manufacturing engineers who will be responsible for the product design, selection of materials, manufacturing process planning, and the improvement of manufacturing processes and equipment, as well as plant maintenance.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
MDP 121	Manufacturing Technology (1)	3
MDP 134	Mechanical Behavior and Testing of Materials	3
MDP 141	Mechanical Engineering Measurements	3
MDP 162	Mechanical Engineering Drawing	3
MDP 164	Mechanical Design (1)	3
PHM 210	Modeling and Numerical Solutions	3
MEP 213	Thermodynamics (2)	3
EPM 214	Electrical Power Engineering	3
MEP 232	Fluid Mechanics	4
ECE 234	Electronics and Instrumentation	3
MDP 240	Metrology Lab (1)	3
MDP 253	Stress Analysis	3
MDP 254	Theory of Machines	3
MDP 264	Mechanical Design (2)	3
MDP 265	Mechanical Design (3)	3
MDP 273	Metal Removal Processes	3
MEP 321	Heat Transfer	3
MDP 340	Metrology Lab (2)	3
MDP 350	Industrial Robots	3
MDP 365	Mechanical Vibrations	3
MDP 366	Automatic Control	3
MDP 367	Finite Element Applications	3
MDP 373	Numerical Control Machines	3
MDP 374	Metal Forming Processes	3
MDP 375	Production Facilities	3
MDP 389	Selected Topics in Manufacturing Engineering	2

MDP 410	Properties and Processing of Composites & Ceramics	3
MDP 417	Processing Techniques of Polymers	3
MDP 419	Manufacturing Technology (2)	3
MDP 459	Mechatronics	2
MDP 472	Non-Conventional Material Fabrication and Heat-Treatment Processes	3
MDP 473	Computer Aided Manufacturing (CAM)	3
MDP 481	Industrial Organization	3
MDP 493	Graduation Project (1)	3
MDP 494	Graduation Project (2)	3
	Total Credit Hours	**104**

3. Technical Electives

Student studies (4) elective courses selected from the following list with a total of (12) credit hours:

Course Code	Course Title	Credit Hours
MDP 418	Materials Selection and Processing Techniques	3
MDP 420	Quality Systems	3
MDP 456	System Modeling	3
MDP 457	Noise Analysis and Control	3
MDP 461	Computer Applications in Industry	3
MDP 465	Computer Aided Design (CAD)	3
MDP 476	Non-Conventional Machining	3
MDP 482	Reliability Engineering	3
MDP 483	Work Study	3
MDP 484	Operation Research	3
MDP 485	Mechatronics Applications	3
MDP 486	Ergonomics	3
MDP 487	Computer Integrated Manufacturing (CIM)	3

4. Course Descriptions of the General Specialization Courses

MDP 121: Manufacturing Technology (1) (3 Credit Hours)
Prerequisite: MDP 024
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.
Lecture: 3 hours/week, Lab: 2 hours/week

MDP 134: Mechanical Behavior and Testing of Materials
(3 Credit Hours)
Prerequisite: MDP 132
Introduction: Types of material failure, economic importance of fracture. Structure and deformation in materials: Elastic deformation, inelastic deformation. Mechanical testing: Tension test, Compression test, Bending test, Hardness test. Stress-Strain relationships and behavior: Strain-hardening of metals, mathematical models, power-law. Yielding and fracture under combined stresses: Plasticity Theory, yielding criteria, Tresca, Von Mises Pressure Vessels. Fatigue of materials. Time-dependent behavior: creep
Lecture: 3 hours/week, Lab: 2 hours/week

MDP 141: Mechanical Engineering Measurements (3 Credit Hours)
Prerequisite: PHM 032
Static and dynamic characteristics of instruments, statistical analysis of measurement errors, variable conversion elements and signal amplification, Measurement of strain, force, pressure, flow, temperature, speed and power.
Lecture: 3 hours/week, Lab: 1 hours/week

MDP 162: Mechanical Engineering Drawing (3 Credit Hours)
Prerequisite: MDP 061
Machine parts, assembly drawing, machining marks, types of fittings, illustration of M/C parts, application of manufacturing details, design drawings and workshop working drawings.
Lecture: 1 hour/week, Tutorial: 4 hours/week

MDP 164: Mechanical Design (1) (3 Credit Hours)
Prerequisite: MDP 162
Basic considerations in design for manufacturing, design for strength & design for rigidity, Fits & tolerances, static & dynamic loads, safety factors. Permanent joints:

Shrink fit, rivets, welds & gluing, Detachable joints: Bolted, pre-stressed, joints, keys, feathers, splines & serrations.
Lecture: 2 hours/week, Tutorial: 2 hours/week Lab: 1 hour/week

PHM 210: Modeling and Numerical Solutions (3 Credit Hours)
Prerequisite: PHM 115
An introductory course in numerical analysis covering such topics as solution of differential and nonlinear equations, matrices and systems of linear equations. One tutorial period, every other week, devoted to the modeling of mechanical systems.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 213: Thermodynamics (2) (3 Credit Hours)
Prerequisite: MEP 112
Re-examination of the thermodynamic laws. Applied thermodynamics including advanced engineering thermodynamic processes, psychrometry, and an introduction to combustion, compressible flow and environmental problems.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

EPM 214: Electrical Power Engineering (3 Credit Hours)
Prerequisite: PHM 022
Fundamentals of electromechanical energy conversion. Motors and generators, transformers, single and polyphase power circuits, synchronous and induction machines, power measurements.
Lecture: 3 hours/week, Lab: 1.5 hours/week

MEP 232: Fluid Mechanics (4 Credit Hours)
Prerequisite: PHM 115
Fluid Properties, hydrostatics, fluid Kinematics, conservation Laws, application of continuity, momentum and energy equations. Reynolds transport theorem, dynamics laws of incompressible flows, Navier-Stokes equations, dimensional analysis and similarity, internal and external flows, compressible flow, turbulence, modern models of turbulence, boundary layer theory, boundary layer applied to submerged and conduit flows, unsteady flow, flow measurement devices, and fluid machinery: Pumps and turbines classification, theory, performance and application.
Lecture: 3 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

ECE 234: Electronics and Instrumentation (3 Credit Hours)
Prerequisite: EPM 214
Semiconductor devices, diodes, transistors and silicon controlled rectifiers. Transistor characteristic and load lines. Amplifier circuits with and without feedback. Rectifier and passive filter circuits. Operational amplifiers and active filters. Digital circuits, Microcomputers, Interfacing.
Lecture: 3 hours/week, Lab: 1.5 hours/week

MDP 240: Metrology Lab (1) (3 Credit Hours)
Prerequisite: PHM 114
Theory of measurments, Definitions, Errors, Linear measuments, Angle measuments.
Lecture: 2 hours/week, Lab: 4 hours/week

MDP 253: Stress Analysis (3 Credit Hours)
Prerequisite: PHM 033
Principles of statics and its application on deformable bodies. Stress and strain. Elastic behavior of simple elements under axial loading, bending and twisting. Principal stresses. Beams deflection. Statically indeterminate beams.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 254: Theory of Machines (3 Credit Hours)
Prerequisite: PHM 033
Mechanisms: Definitions Inversions of the four bar mechanisms, Quick return motion mechanisms, double slider mechanism, Motor vehicle steering mechanism, Hook's joint velocity and acceleration, Equilibrium of machines and force analysis, power analysis, Friction and inertia-effect, Center of percussion. Flywheels and turning moment diagram, Cams: Types of cams, Types of followers, Cam profile and motion of follower, Gears: Types of gears, Gear geometry and gear trains, Balancing: Balancing of rotating masses, Balancing of reciprocating mechanisms**.**
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

MDP 264: Mechanical Design (2) (3 Credit Hours)
Prerequisite: MDP 164
Rational design of M/C elements: Springs, belts, wire ropes & chains, Shafts & Axles, Threads & power Screws, Couplings: rigid & flexible, Clutches & Brakes, Friction Drives.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1 hour/week

MDP 265: Mechanical Design (3) (3 Credit Hours)
Prerequisite: MDP 164
Bearings: sliding bearings & lubrication, Rolling bearings & greasing, Gears: spur, helical, bevel & worm gearing, Pressure vessels: single & double wall.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 273: Metal Removal Processes (3 Credit Hours)
Prerequisite: MDP 121
Basic concepts and definitions, Tool geometry, Tool materials, Chip formation, Mechanics of Metal cutting, Cutting forces and power consumption, Cutting temperature, Cutting fluids, Tool failure, Tool life, Chatter, Surface Roughness, Machining economy, Optimization of machining variables.
Lecture: 2 hours/week, Lab: 3 hours/week

MEP 321: Heat Transfer (3 Credit Hours)
Prerequisite: MEP 112
Application of the laws of conduction, convection and radiation to problems in heat transfer. Steady and transient conduction in solids. Laminar and turbulent convection. Radiation heat transfer processes. Heat exchangers.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 340: Metrology Lab (2) (3 cedits)
Prerequisite: MDP 240
Roughness, geometrical errors (out of straightness flatness, roundness ... etc.) gear measurements, thread measurements, and cams measurements.
Lecture: 2 hours/week, Lab: 4 hours/week

MDP 350: Industrial Robots (3 Credit Hours)
Prerequisite: MDP 254
Introduction to robotic systems: Robot definition, General structure of robots, Robot environment, typical industrial robots. Representation of robots: Functional and Graphical representations of robots. Arms, Structure of end effectors, different types of end effectors, selection of end effectors. Kinematic analysis of robots: degrees of freedom and kinematic analysis of robots. Sensors and actuators of robots, Robot trajectory generation. Workspace of robots, path planning, trajectory generation. Robot control: Levels of robot control, logic control, control model level, trajectory level control, artificial intelligence level control. Applications of robots in manufacturing: in workshops, handling, machining, welding, assembly, and inspection.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 365: Mechanical Vibrations (3 Credit Hours)
Prerequisite: PHM 115
Transient and steady state vibration of single- and multi-degree of freedom systems. Free and forced vibrations of single and multiple degree-of-freedom mechanical systems, transient response, damping and vibration isolation.
Lecture: 2 hours/week, Tutorial: 2 hours/week Lab: 1 hour/week

MDP 366: Automatic Control (3 Credit Hours)
Prerequisite: MDP 365
Overview, Control purposes, Open loop and feedback control. Linear dynamic systems. Identification of systems using the Laplace Transform. Feedback control concept, characterization of its performance, controller design, elementary control concepts: P, PD, PI, and PID controllers.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1 hour/week

MDP 367: Finite Element Applications (3 Credit Hours)

Prerequisite: PHM 113

Theory of the finite element method, element derivation, solution procedures. Applications to static and dynamic mechanical systems using a finite element package.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 373: Numerical Control Machines (3 Credit Hours)

Prerequisite: MDP 121

Components of CNC machines (mechanical parts, sensors, transducers, limit switch, speed drives and control, hot electrical panel), Describing the operation panel of CNC machinetool, Data, Coding system, Data entry, Axes, Programming of CNC machines.

Lecture: 2 hours/week, Lab: 3 hours/week

MDP 374: Metal Forming Processes (3 Credit Hours)

Prerequisite: MDP 121

Engineering and true stress and strain. Stress-strain curves and models of mechanical behavior. Effect of temperature and strain rate on stress-strain curve. Strain hardening, Analysis of stress and strain. Elastic and Plastic deformation of metals. Forging process, Rolling process, Extrusion process, Wire drawing, Tube drawing. Deep drawing and redrawing processes. Yield criteria, Methods of calculating the required loads to metal forming in both friction and frictionless conditions: Forging, Rolling, Extrusion, Wire drawing, Tube drawing and Deep drawing. The factors affect each process.

Lecture: 3 hours/week, Lab: 2 hours/week

MDP 375: Production Facilities (3 Credit Hours)

Prerequisite: MDP 121

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. Sheet metal work dies design. Design and manufacturing of cutting form tools.

Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

MDP 389: Selected Topics in Manufacturing Engineering
(2 Credit Hours)

Prerequisite: Determined according to course contents

Selected topics related to the state of art in manufacture engineering. The course will cover selected advanced topics

Lecture: 2 hours/week, Tutorial: 1 hour/week

MDP 410: Properties and Processing of Composites & Ceramics

(3 Credit Hours)

Prerequisite: MDP 134

Intrinsic properties of matrix materials and fibers, mechanics and thermodynamics of interfaces, mechanical properties and fabrication of engineering composites (i.e. Metal, polymer and ceramic metrics). Heat treatment processes of non-ferrous alloys. Mechanisms of fracture and failure of engineering composite. Different manufacturing process of ceramics.

Lecture: 3 hours/week, Tutorial: 1 hour/week

MDP 417: Processing Techniques of Polymer (3 Credit Hours)

Prerequisite: MDP 132

An introduction: basics of polymers characteristics and the basic principles of polymer processing. Polymer extrusion (single and twin screw extruders), foils, plates, profiles, blow molding, films, fibers and reactive processing. Injection moulding, injection moulding dies, injection technique- plastics pressing, foams

Lecture: 3 hours/week, Tutorial: 1 hour/week

MDP 419: Manufacturing Technology (2) (3 Credit Hours)

Prerequisite: MDP 121

Manufacturing of screws. Thread: Turning, Milling, Rolling. Manuf. of gears: Milling, Shaping, Hobbing shaving and Grinding. Finishing & super finishing processes; grinding, honing, lapping, Non- Conventional Polishing. Process & operation planning: Sequence of Technological processes & operations, process sheet, operation sheet.

Lecture: 2 hours/week, Lab: 3 hours/week

MDP 459: Mechatronics (2 Credit Hours)

Prerequisite: MDP 366

Integration of mechanical engineering with electronics and computer control. Sensors, actuators (including pneumatic and hydraulic), modeling using building block and state space methods, model-based control, programming of PLCs with practical demonstrations.

Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MDP 472: Non-Conventional Material Fabrication and Heat-Treatment Processes (3 Credit Hours)

Prerequisite: MDP 134

Processing methods for a wide range of materials, including metals. The analytical basis for understanding and optimizing materials processes, P/M, Heat treatment processes of ferrous alloys: (Iron/Carbon phase diagram-hardenability -TTT diagram- softening- Tempering- Normalizing-Annealing- Full annealing)- Surface hardening(case hardening-carbonization- nitriding)- surface hardening by thermal cycle.

Lecture: 2 hours/week, Lab: 3 hours/week

MDP 473: Computer Aided Manufacturing (CAM) (3 Credit Hours)
Prerequisite: MDP 373
Fixturing and part setups for machining and inspection, computer-aided tool path generation for machining and inspection, sculptured surface machining and digitizing.
Lecture: 2 hours/week, Tutorials: 1 hour/week, Lab: 2 hours/week

MDP 481: Industrial Organization (3 Credit Hours)
Prerequisite: MDP 121
Plant organization: Organization charts, decision making process and theory. Project management: Planning and scheduling with Gantt charts, PERT and CPM. Design of work systems: Job design, Work measurement. Facilities layout: Basic types of layouts, Design of product layout (line balancing), Design of process layout, Production planning and control: Forecasting, Scheduling and Sequencing, Inventory management.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

MDP 493: Graduation Project (1) (3 Credit Hours)
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 manufacturing engineering oriented, in any of the related disciplines offered by the faculty.
Lecture: 1 hour/week, Lab: 6 hours/week

MDP 494: Graduation Project (2) (3 Credit Hours)
This graduation project may be seen as a continuation of the first part (MDP 493: Graduation Project (1)) of a major topic, or it might be a new subject that the student is considering to prove his competence in manufacturing engineering practice.
Lecture: 1 hour/week, Lab: 6 hours/week

5. Course Descriptions of the Technical Electives

MDP 418: Materials Selection and Processing Techniques

(3 Credit Hours)

Prerequisite: MDP 121

Behavior and processing of engineering materials: Metals, Polymers, Ceramics, Composites, Effect of material properties on design, effect of manufacturing process on design, Economics of materials, Economics of manufacturing processes, The selection methods for materials and processes, Case studies.

Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 420: Quality Systems (3 Credit Hours)

Prerequisite: PHM 114

Basic concepts, history of quality control, Quality control engineering, Quality Control for design and development, construction of quality control systems, quality control of purchases, planning, organization, quality costs, economics of quality, training, quality control during product use, introduction to statistical quality control and data analysis.

Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 456: System Modeling (3 Credit Hours)

Prerequisite: PHM 210

Basic simulation models, Modeling complex systems, Simulation software, Buiding simulation models, Output data analysis for a single system, Comparing alternative systems configurations, Sensitivity analysis, Simulation of manufacturing systems.

Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 457: Noise Analysis and Control (3 Credit Hours)

Prerequisite: MDP 365

Acoustic quantities, noise measurements and analysis, noise standards, sound generation, propagation, absorption, transmission, acoustic materials, noise control techniques, case studies.

Lecture: 2 hours/week, Lab: 2 hours/week

MDP 461: Computer Applications in Industry (3 Credit Hours)

Prerequisite: MDP 373

Introduction to computer application in industry, advantages of computer added application, Automation of manufacturing processes, Computerized numerically controlled machines, Computer aided design software.

Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 465: Computer Aided Design (CAD) (3 Credit Hours)

Prerequisite: MDP 162

Project-oriented CAD course, 3D modeling and graphics, design by features, use of mechanical design application packages.

Lecture: 2 hours/week, Lab: 2 hours/week

MDP 476: Non-Conventional Machining (3 Credit Hours)
Prerequisite: MDP 373
Aims, types and applications of non conventional process machining, 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).
Lecture: 2 hours/week, Lab: 2 hours/week

MDP 482: Reliability Engineering (3 Credit Hours)
Prerequisite: PHM 114
The increasing emphasis on product reliability, The evaluation of formal product reliability, What is product reliability, Establishing product reliability requirements, Developing the reliability program, Reliability in Design, Reliability demonstration, Quantitative reliability measures, Dynamic reliability, Static reliability models, Introduction to life distribution, Success and failure testing, Dynamic reliability models, Reliability growth.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 483: Work Study (3 Credit Hours)
Prerequisite: MDP 121
Productivity: Factors affecting productivity and role of management, Introduction to work study: Objectives, Techniques applied, Method study techniques: Steps controlling the technique, 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, Incentive schemes: design elements, study of some known schemes, Human factors.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 484: Operation Research (3 Credit Hours)
Prerequisite: PHM 113
Linear programming: Formulation, Graphical solution, Simplex method, and Duality and sensitivity analysis, Transportation models: Transportation algorithm, Assignment problem and transshipment problem, PERT/CPM: Network representation, Critical path computations and construction of the time scheduling, Network models: Minimal spanning tree algorithm, shortest route problem and maximum flow problem, Integer linear programming: Branch and Bound algorithm, Queuing theory: Queuing decision models, Simulation models: Monte Carlo simulation.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 485: Mechatronics Applications (3 Credit Hours)
Prerequisite: EPM 214
Intoduction and basic definitions, Mechatronics as interdisciplinary subject, Configuration of Mechatronic system, Mechatronics approach in the design of smart machinery, Sensors and actuator in for Mechatronics systems. Data acquisition and control cards, Data processing and signal handing.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 486: Ergonomics (3 Credit Hours)
Prerequisite: MDP 121
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, Workspace design, Hand use design, Office ergonomics, Handling loads, Work physiology, Design of special populations, Information processing, Noise, Vibration, Illumination, Control and display design.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 487: Computer Integrated Manufacturing (CIM) (3 Credit Hours)
Prerequisite: MDP 350
The Manufacturing system & The Production system, Role of design in Manuf., Manuf. system Layouts, Group technology (GT), Automation of Manuf. systems, Flexible manuf. Systems: (FMM. FMC, FMS), Computer Integrated Manuf. (CIM), Just-in time Production (JIT)
Lecture: 2 hours/week, Tutorial: 2 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
MDP 162	Mechanical Engineering Drawing	**3**	1	4	0	MDP 061
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**18**	**14**	**11**	**3**	
Second Main Semester (Term 4)						
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
MDP 121	Manufacturing Technology (1)	**3**	3	0	2	MDP 024
MDP 134	Mechanical Behavior and Testing of Materials	**3**	3	0	2	MDP 132
MDP 141	Mechanical Engineering Measurements	**3**	3	0	1	PHM 032
MDP 164	Mechanical Design (1)	**3**	2	2	1	MDP 162
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**18**	**16**	**5.5**	**6**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
PHM 210	Modeling and Numerical Solutions	**3**	2	2	0	PHM 115
EPM 214	Electrical Power Engineering	**3**	3	0	1.5	PHM 022
MEP 232	Fluid Mechanics	**4**	3	2	1.5	PHM 115
MDP 240	Metrology Lab (1)	**3**	2	0	4	PHM 114
MDP 253	Stress Analysis	**3**	2	2	0	PHM 033
MDP 264	Mechanical Design (2)	**3**	2	2	1	MDP 164
	Total Hours	**19**	**14**	**8**	**8**	
Second Main Semester (Term 6)						
MEP 213	Thermodynamics (2)	**3**	3	1.5	0	MEP 112
ECE 234	Electronics and Instrumentation	**3**	3	0	1.5	EPM 214
MDP 254	Theory of Machines	**3**	2	2	2	PHM 033
MDP 265	Mechanical Design (3)	**3**	2	2	0	MDP 164
MDP 273	Metal Removal Processes	**3**	2	0	3	MDP 121
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**18**	**14**	**7.5**	**6.5**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
MEP 321	Heat Transfer	**3**	3	1.5	0	MEP 112
MDP 365	Mechanical Vibrations	**3**	2	2	1	PHM 115
MDP 367	Finite Element Applications	**3**	3	1.5	0	PHM 013
MDP 373	Numerical Control Machines	**3**	2	0	3	MDP 121
MDP 374	Metal Forming Processes	**3**	3	0	2	MDP 121
MDP xxx	Technical Elective (1)	**3**	2	2	0	Course-specific
	Total Hours	**18**	**15**	**7**	**6**	
Second Main Semester (Term 8)						
MDP 340	Metrology Lab (2)	**3**	2	0	4	MDP 240
MDP 350	Industrial Robots	**3**	3	1.5	0	MDP 254
MDP 366	Automatic Control	**3**	2	2	1	MDP 365
MDP 375	Production Facilities	**3**	2	2	2	MDP 121
MDP 389	Selected Topics in Manufacturing Engineering	**2**	2	1	0	Determined according to course contents
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**17**	**13**	**8.5**	**7**	

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
MDP 410	Properties and Processing of Composites & Ceramics	**3**	3	1	0	MDP 134
MDP 459	Mechatronics	**2**	2	1	1	MDP 366
MDP 472	Non-Conventional Material Fabrication and Heat-Treatment Processes	**3**	2	0	3	MDP 134
MDP 493	Graduation Project (1)	**3**	1	0	6	
MDP xxx	Technical Elective (2)	**3**	2	2	0	Course-specific
MDP xxx	Technical Elective (3)	**3**	2	2	0	Course-specific
	Total Hours	**17**	**12**	**6**	**10**	
Second Main Semester (Term 10)						
MDP 417	Processing Techniques of Polymer	**3**	3	1	0	MDP 132
MDP 419	Manufacturing Technology (2)	**3**	2	0	3	MDP 121
MDP 473	Computer Aided Manufacturing (CAM)	**3**	2	1	2	MDP 373
MDP 481	Industrial Organization	**3**	3	1.5	0	MDP 121
MDP 494	Graduation Project (2)	**3**	1	0	6	
MDP xxx	Technical Elective (4)	**3**	2	2	0	Course-specific
	Total Hours	**18**	**13**	**5.5**	**11**	

Energy and Renewable Energy Engineering Program

1. Program Goals and Objectives

The program aims to meet the needs of power stations from new sources of energy available in the Arab Republic of Egypt, such as solar energy, photovoltaic energy, wind energy through the preparation of engineers familiar with the various types of these sources and how they work. Also, it defines the problems and finds appropriate solutions for the effective use of new energy sources in different industrial areas, thereby reducing the dependence on fossil fuels and reducing environmental pollution. Labor market in Egypt desperately needs engineers with this background, particularly in the framework of the national effort to provide energy at affordable prices to citizens. Also, this area attracts global attention, which makes it important to include in the higher education system in Egypt.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
MDP 113	Production Engineering & Manufacturing (1)	2
EPM 115	Electrical Circuits	3
EPM 116	Electromagnetic Fields	3
EPM 122	Energy Resources and Regenerative Energy Resources	3
EPM 123	Energy Conversion	3
EPM 172	Electrical Measurements and Measuring Instruments	3
MEP 223	Heat Transfer	3
EPM 231	Electrical Machines (1)	3
ECE 232	Electronic Engineering	3
EPM 232	Electrical Machines (2)	3
EPM 233	Electrical Power Engineering	3
MEP 233	Fluid Mechanics	3
MDP 254	Theory of Machines	3
MDP 266	Machine Construction	3
EPM 281	Automatic Control Systems	3
MEP 284	Measurements Lab	3
EPM 324	Fundamentals of Photovoltaic	3
EPM 336	Microprocessor Based Automated Systems	3
EPM 337	Power Quality	3
EPM 353	Power Electronics (1)	3
EPM 354	Power Electronics (2)	3
MEP 354	Solar Energy (1)	3
MEP 363	Combustion and Furnaces	3
MDP 364	Machine Design	3

MEP 364	Internal Combustion Engines	3
MEP 365	Thermal Power Plants	3
MDP 368	Vibrations and Dynamics	3
EPM 372	Industrial or Field Training	3
EPM 425	Storage Energy Technologies	3
EPM 433	Network Interfacing of Renewable Resources	3
EPM 434	Economics of Generation, Transmission, and Operation	3
MEP 452	Solar Energy (2)	3
MEP 453	Wind Energy	3
EPM 497	Graduation Project (1)	3
EPM 498	Graduation Project (2)	3
	Total Credit Hours	**104**

3. Technical Electives

The student chooses (4) elective courses with a total of (12) credit hours such that (3) of them must be from one of the following fields while the fourth course must be from the other field.

3.1 Technical Electives for Mechanical Engineering Field

Course Code	Course Title	Credit Hours
MEP 422	Phase Equilibrium and Mass Transfer	3
MEP 432	Turbo Machinery	3
MEP 433	Water Desalination	3
MDP 446	Quality Control, Quality Assurance, and Safety	3
MEP 472	Refrigeration and Air Conditioning	3
MEP 491	Individual Studies in Mechanical Engineering	3

3.2 Technical Electives for Electrical Engineering Field

Course Code	Course Title	Credit Hours
EPM 426	Transients in Electrical Machines	3
EPM 435	Advanced System Integrity	3
EPM 484	Electric Drives	3
EPM 485	Advanced Control on Power Systems	3
EPM 486	Computer Application in Electrical Power Systems	3
EPM 491	Individual Studies in Electrical Power and Machines	3

4. Course Descriptions of the General Specialization Courses

MDP 113: Production Engineering & Manufacturing (1) (2 Credit Hours)
Machining: Principles of machining, Materials of cutting tools, Turning machines and processes, Drilling machines and processes, Shaping and planning machines and processes, Milling machines and processes, Grinding machines and processes, Methods of tools and work piece fixation, Machining time. Metal 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, Heat treatment of alloys: Diffusion and phase transformation in alloys, Heat treatment processes for iron and steel alloys, Heat treatment processes for non-ferrous alloys.
Lecture: 1 hour/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

EPM 115: Electrical Circuits (3 Credit Hours)
Prerequisite PHM 022
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, Polyphase circuits, Magnetically coupled circuits, Mutual inductance, Resonance in electrical circuits, Electric filters, Analysis of electrical circuits with non-sinusoidal alternating currents.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

EPM 116: Electromagnetic Fields (3 Credit Hours)
Prerequisite: PHM 013, PHM 014, PHM 022
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 122: Energy Resources and Regenerative Energy Resources
(3 Credit Hours)
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 to environmental issues.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 123: Energy Conversion (3 Credit Hours)

Prerequisite: EPM 116

Conventional methods of energy conversion: Introduction, Sources of energy, Electrical power systems. Electromechanical energy conversion, Electric motors and generators, 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, Multi-fed rotating systems, Electrostatic systems. Renewable methods of energy conversion.

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 172: Electrical Measurements and Measuring Instruments

(3 Credit Hours)

Prerequisite: EPM 115, EPM 116

Electrical measuremen 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 measurements, Measurement of power, Measurement of energy and charge, Measurement of frequency and power factor, Measurement of non-electrical parameters. Cathode ray-oscilloscopes application. Dc bridges, Ac bridges, Resistance and capacitance measurement. Strain gauges, Temperature transducers, Displacement, Velocity and acceleration transducers, Force and pressure transducers, Light transducers, Data converters, Voltage-to-frequency converters. Digital devices: Digital voltmeters, Digital frequency meters.

Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MEP 223: Heat Transfer (3 Credit Hours)

Prerequisite: MEP 112

Fourier conduction equation, cylindrical and spherical surfaces, application on simple and compound walls. Critical radius of insulation. Extended surfaces (fins), Unsteady conduction for lumped and unlumped systems. General conduction equations for two and three dimensional for steady and unsteady cases. Study of parameters affecting convection, relations for free and forced convection for inner and outer surfaces. Heat exchangers. Plank's theory for thermal radiation, view factors and surface properties to identify surface resistance. Draw equivalent electric circuits. Radiation from gases and emissivity charts for H_2O and CO_2.

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 231: Electrical Machines (1) (3 Credit Hours)

Prerequisite: EPM 132

DC Machines: the generation of e.m.f., 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

ECE 232: Electronic Engineering (3 Credit Hours)
Prerequisite: EPM 115
Review on semiconductors: Bohr's model, Fermi-Dirac distribution function, N-type and P-type semiconductors, Methods of current flow, Continuity equation. PN-junction: I-V characteristics, Reverse saturation current depletion layer capacitance, Diffusion capacitance. Other two-terminal devices: Zener diodes, Schottky barrier diodes, Light emitting diodes (LED), Solar cells. Bipolar junction transistor (BJT): Static and dynamics characteristics, Field effect transistors, JFETs symbol and model and biasing. Insulated gate FETs, MOSFETs symbol, biasing, and applications.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 232: Electrical Machines (2) (3 Credit Hours)
Prerequisite: EPM 132
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 3ph induction motor based on linear magnetic circuit, torque-slip characteristics, current locus diagram (power-circle-diagram), conditions and methods of starting of 3ph induction motor (double cage & deep bar rotors), speed control of 3ph induction motor, induction generator, testing of 3ph induction motor.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

EPM 233: Electrical Power Engineering (3 Credit Hours)
Prerequisite: EPM 116
Introduction to electric power system, application of high voltage in electric power system, over head transmission lines: parameter calculation, modeling, performance, and mechanical design. Electric power distribution, underground cables, generation of high voltage, high voltage measurement, electric insulation types, corona, earthing and safety, protection in power system, types of protective relays and circuit breakers.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 233: Fluid Mechanics (3 Credit Hours)
Prerequisite: PHM 115
Definition of a fluid, fluid properties. Statics: pressure, hydraulic forces on submerged surfaces. Basic equations of fluid mechanics, kinematics of flow, control volume approach, continuity, momentum, energy and Bernoulli equations. Dimensional analysis and dynamic similitude. Flow in conduits: laminar and turbulent flows,

equation of motion. Compressible flow: Mach number, stagnation properties, nozzles and shock waves. Flow over immersed bodies, lift and drag forces. Navier-Stocks equation, stream function and velocity potential.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 254: Theory of Machines (3 Credit Hours)
Prerequisite: PHM 033
Mechanisms: Definitions Inversions of the four bar mechanisms, Quick return motion mechanisms, double slider mechanism, Motor vehicle steering mechanism, Hook's joint velocity and acceleration, Equilibrium of machines and force analysis, power analysis, Friction and inertia-effect, Center of percussion. Flywheels and turning moment diagram, Cams: Types of cams, Types of followers, Cam profile and motion of follower, Gears: Types of gears, Gear geometry and gear trains, Balancing: Balancing of rotating masses, Balancing of reciprocating mechanisms**.**
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

MDP 266: Machine Construction (3 Credit Hours)
Prerequisite: MDP 113
Machining and assembly operations, Margins and factor of safety, Design of permanent joints (Welding, riveting), Design of detachable joints, Prestressed bolted joints under static and dynamic loading, Design of shafts, Construction and design of couplings and chains. Power transmission: Clutches (positive and friction), Variation in geometry of friction surface (plane, conical, cylindrical), Various forms for force generation (mechanical, electromagnetic, hydraulic, pneumatic), Introduction to reological clutches, Belt drives: Flat, V-shape and ribbed, Variable speed drives: Stepped and stepless, Disk, Cone and Spherical drives, Gears: Straight spur, Helical, Bevel (straight, spiral, skew) and worm drives, Gear loading forms (static, dynamic, endurance and wear resistance). Brakes (radial and axial, internal and external, single and double) and band brakes, Rolling bearings: Dynamic and static capacities, Grease and oil lubrication, Rubbing and non-rubbing seals. Sliding bearings: Hydrodynamic and hydrostatic lubrication.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 281: Automatic Control Systems (3 Credit Hours)
Prerequisite: PHM 113
Introduction to control systems: terms, concepts & examples, frequency and time domain analysis, block diagram, representations of control system, feedback and its effects, disturbance & sensitivity analysis, steady-state error analysis, time domain analysis, stability analysis, root locus analysis, Tuning of PID controller, state space representation.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 284: Measurements Lab (3 Credit Hours)
Performance characteristics of measuring instruments: Calibration, Fixed and random errors, Error estimation, Sensitivity, Linearity, Dynamic characteristics. Pressure measurements: Mechanical pressure transducers, Manometers, Elastic pressure

measurement, Electrical pressure transducers, Inductive transducers, Piezo electric transducers, Strain gauges, Flow measurements: Orifices nozzles, Venturi, Turbine flow meters, Magnetic flow meters, Rotameters, Positive displacement flow meters, Ultrasonic meters, Velocity measurements: Pitot tube laser doppler anemometers, Hot wire anemometers, Temperature measurements: Thermal expansion thermometers, Bimetallic expansion, Resistance thermometers, Semi conductor thermometers, Thermocouples, Thermal radiation thermometers, Analysis of combustion products: Props, Sample condition, Gas analysis equipments for measuring O_2, CO, CO_2, UHC, Nox and Sox, Gas chromatography, Force measurements: Weights and springs, Calibrating rings, Strain and deflection measurements. Strain and stress measurements: Load cells, Strain gauges.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

EPM 324: Fundamentals of Photovoltaic (3 Credit Hours)
Prerequisite: ECE 232
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 336: Microprocessor Based Automated Systems (3 Credit Hours)
Data representations, Data processing, Data input and output, Interface software, microcontrollers: programming language and applications, Measurement and signal conditioning, automation components.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

EPM 337: Power Quality (3 Credit Hours)
Prerequisite: EPM 233, EPM 353
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 353: Power Electronics (1) (3 Credit Hours)
Prerequisite: ECE 232
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 thee-phase circuits. Static switches. AC voltage controllers: The single phase ac thyristor controller, Three phase controller, Phase control of ac controllers, Integral cycle control.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

EPM 354: Power Electronics (2) (3 Credit Hours)
Prerequisite: EPM 353
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), Inerter and rectifier mode of operations of converters. Cycloconverters and Matrix converters.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MEP 354: Solar Energy (1) (3 Credit Hours)
Prerequisite: MEP 223
Study of solar thermal energy: Its intensity in outer space and the calculation of the solar intensity on earth with different models. Availability and usability of solar energy. Study of solar angles, Shades and the equation of time. Theory of the flat plate collector, transmission through glass, heat loss calculations and definitions of all parameters involved in collector performance.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 363: Combustion and Furnaces (3 Credit Hours)
Prerequisite: MEP 223
Chemical reactions, Properties of some hydrocarbon fuels, Enthalpy of formation, Application of first law of thermodynamics on reacting systems, Combustion processes calculations, Chemical equilibrium, Chemical equilibrium constant, Equilibrium of single reaction, Equilibrium in multiple reactions, Chemical kinetics, Simple global reaction mode, Detailed mechanisms of reactions, Reaction rate formulae. Laminar premixed flame: Definitions, Simple mathematical model and solution of the equations, Factors affecting flame speed and thickness. Ignition, Extinction, Flammability limits, Flame stability, Laminar non-premixed flame, Definitions, Simple mathematical model and solution, Factors affecting flame height, Droplet evaporation. Applications, Simple mathematical model and solution, Evaporation rate, Time of evaporation, Factors affecting evaporation time. Burners: Gaseous fuel burners, Liquid fuel burners solid fuel burners.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MDP 364: Machine Design (3 Credit Hours)
Prerequisite: MDP 254
Introduction on main design considerations (type of stresses, factor of safety, material properties), Design of transmission shaft, Transmission machine parts: Clutches, Brakes, Belts drives (flat, V), Rolling bearings: Dynamic and static capacities, Selection of bearing, Grease and oil lubrication, Rubbing and non-rubbing seals, Sliding bearing: Hydrodynamic theory of lubrication, Thermal equilibrium and hydrostatic lubrication, Design of gears: Straight spur, Helical, Bevel and worm drives gear units, Design of springs, Design of cylinders, Design of some mechanical equipment. Introduction to the use of computers in machine design.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 364: Internal Combustion Engines (3 Credit Hours)
Prerequisite: MEP 363
Classification of internal combustion engines. The fuel-air standard cycle, Deviations between the actual cycle and fuel air standard cycle, Combustion chambers, Fuel properties and its impact on engine performance. 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 on 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. Performance map and the performance of 4-stroke and 2-stroke engines. Supercharging: methods, turbocharging, matching of engine and supercharger. Ignition: Types and components, Conventional and electronic ignition. Governors: Types, Components and testing. Sources of pollutant emissions from internal combustion engines to the atmosphere and the methods of reducing them.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MEP 365: Thermal Power Plants (3 Credit Hours)
Prerequisite: MEP 363
Improvements in Rankine cycle to increase its thermal efficiency, Water tube boilers, Fire tube boilers, Condensers, Heat recovery boilers, Deareators and feed water heaters, Economizers, Superheaters, Air heaters, Steam pipes and steam traps cooling towers, Co-generation plants. Performance characteristics of power stations, Heat rate and incremental rate, Optimum load division between units. Regulation of central units, Control in steam generators, Governing of steam turbines, Load, Frequency characteristics, Parallel operation, Lubrication systems, Protection and tripping systems.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 368: Vibrations and Dynamics (3 Credit Hours)
Prerequisite: MDP 254
Mechanical Vibration: Introduction, Study and analysis of single and multi degree of freedom systems (transverse and torsional), Free undamped, Free damped and forced vibration, Whirling of shafts, Design of vibration absorber, Dynamic stresses, Critical speed of shafts, Vibration isolation, Vibration of two degree of freedom systems (free, forced), Vibration absorber, Torsional vibrations (free, forced), Dynamic stresses, Equivalent torsional systems: Geared system, Crank system, Vibration of multi-degree of freedom systems (free, forced), Critical speeds of shafts: Shafts with lumped masses, Shafts with distributed masses.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 372: Industrial or Field Training (3 Credit Hours)
Students should encounter real experience and contacts in ongoing production facilities or projects to accommodate to engineering practice for graduation.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week (or to visit factories)

EPM 425: Storage Energy Technologies (3 Credit Hours)
Prerequisite: EPM 116, EPM 354
Supper Capacitors: structure, ratings, characteristics, use with the wind power plant, fuel cells, and photovoltaic interface, Superconducting magnetic energy storage (SMES): structure, operation, Batteries: types, characteristics and operation, charge and discharge, Fuel cell: types, electrochemical model, performance, Flywheels energy storage.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 433: Network Interfacing of Renewable Resources (3 Credit Hours)
Prerequisite: EPM 232, EPM 281, EPM 354
Concept of Distributed Generation, Interconnection standards, Type of interface, static synchronous generators, Power quality issues, control of active power and voltage regulation, current control mode vs. voltage control mode, Wind power interface: direct connection, back to back converters, matrix converters, Fuel cell and photo voltaic interface topologies.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 434: Economics of Generation, Transmission, and Operation
(3 Credit Hours)
Prerequisite: EPM 122, EPM 233
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 452: Solar Energy (2) (3 Credit Hours)
Prerequisite: MEP 354
Solar concentrators: Solar I (Heliostat), Point concentrators, Parabolic through, Fresnel concentrators. Thermal performance, heat transfer coefficients, efficiencies. Array design and energy conversion.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 453: Wind Energy (3 Credit Hours)

Prerequisite: MDP 368

Introduction to wind energy, wind speed classification and wind roses. Principles of energy extraction, Betz theory and basic assumptions, classification of wind machines, Theoretical analysis of wind power utilization. Study of measuring equipment for wind speed and direction. Analysis of wind energy data: Energy and frequency curves, Wind turbine theory and aerofoil theory, Study of forces acting on the wind turbine and study the turbine performance. Components of wind turbines, wind farm and main features. Wind energy for water pumping. Wind turbines economics operation and maintenance.

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 497: Graduation Project (1) (3 Credit Hours)

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. 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.

Lecture: 3 hours/week, Lab: 1.5 hours/week

EPM 498: Graduation Project (2) (3 Credit Hours)

A single or group project performed under the supervision of a faculty member and an industrial entity.

Lecture: 3 hours/week, Lab: 1.5 hours/week

5. Course Descriptions of the Technical Electives

MEP 422: Phase Equilibrium and Mass Transfer (3 Credit Hours)
Prerequisite: MEP 365
Introduction to phase equilibrium in a single substance or a mixture. Gibbs phase rule, equations governing transport phenomenon. Governing equation of mass transfer and examples in cooling towers and distillation columns.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 426: Transients in Electrical Machines (3 Credit Hours)
Prerequisite: EPM 232
Development of the transient equations of different types of electrical machines in the original frame of reference. Formulation of the state space models. Methods of solutions. Simplification through transformations. Case studies: starting process of induction and synchronous machines. Transient behavior of synchronous generator. Effect of control on the transient response.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 432: Turbo Machinery (3 Credit Hours)
Prerequisite: MEP 233
Centrifugal fans, blowers and compressors: Theory, Classification and Performance. Aerofoil theory, axial flow pumps and compressors: Theory, Components, Performance. Hydrostatic power systems: Theory, Applications, Components, Energy calculations, Calculations steam turbines: Theory, types, Components, Application, Energy calculation. Gas turbines: Theory, Types, Application, Components, Energy calculations.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 433: Water Desalination (3 Credit Hours)
Prerequisite: MEP 363, MEP 452
Water desalination is studied using different techniques. The use of solar energy in water desalination is focused upon.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 435: Advanced System Integrity (3 Credit Hours)
Prerequisite: EPM 354
Hybrid operation of renewable energy resources: Fuel cell with microturbine, photo wind with voltaic, wind with storage element, photo voltaic with storage element. Nuclear power plants, integrated system concepts, system impacts.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MDP 446: Quality Control, Quality Assurance, and Safety

(3 Credit Hours)

Prerequisite: PHM 114

Continuous probability distributions, estimation theory, testing hypothesis, regression and correlation analysis, quality definitions and concepts, theory of control charts, statistical control charts for attributes and variables. Issues related to safety and ergonomics.

Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 472: Refrigeration and Air Conditioning (3 Credit Hours)

Prerequisite: MEP 223

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 equipments, control of refrigerating capacity, absorption refrigeration, Air Conditioning: Meaning of Air Conditioning, field of application, properties of moist air, construction of psychometrics chart, psychometric processes, applied psychometric processes, summer air conditioning cycles, winter air conditioning cycles, all year air conditioning cycles, air conditioning cooling heating and calculations.

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 484: Electric Drives (3 Credit Hours)

Prerequisite: EPM 232, EPM 281, EPM 354

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.

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 485: Advanced Control on Power Systems (3 Credit Hours)

Prerequisite: EPM 232, EPM 233, EPM 281

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. The power system stabilizer: Case study:

Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 486: Computer Application in Electrical Power Systems

(3 Credit Hours)

Prerequisite: EPM 233

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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

EPM 491: Individual Studies in Electrical Power and Machines

(3 Credit Hours)

The student is assigned a research in a selected topic. The study could be either theoretical or practical. This should be different from the graduation project as the project should have a practical or applicational aspect, while the individual study has a research aspect.
Lecture: 2 hours/week, Tutorial: 2 hours/week

MEP 491: Individual Studies in Mechanical Engineering (3 Credit Hours)

The student is assigned a research in a selected topic. The study could be either theoretical or practical. This should be different from the graduation project as the project should have a practical or applicational aspect, while the individual study has a research aspect.
Lecture: 2 hours/week, Tutorial: 2 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
EPM 115	Electrical Circuits	**3**	2	2	1.5	PHM 022
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
EPM 116	Electromagnetic Fields	**3**	2	2	0	PHM 013, PHM 014, PHM 022
EPM 122	Energy Resources and Regenerative Energy Resources	**3**	2	2	0	
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
	Total Hours	**18**	**14**	**11**	**3**	
Second Main Semester (Term 4)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
MDP 113	Production Engineering & Manufacturing (1)	**2**	1	2	1.5	
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
EPM 123	Energy Conversion	**3**	2	2	0	EPM 116
EPM 172	Electrical Measurements and Measuring Instruments	**3**	2	2	1.5	EPM 115, EPM 116
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**17**	**13**	**9.5**	**4.5**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
MEP 223	Heat Transfer	**3**	2	2	0	MEP 112
EPM 231	Electrical Machines (1)	**3**	2	2	1.5	EPM 123
ECE 232	Electronic Engineering	**3**	2	2	0	EPM 115
MEP 233	Fluid Mechanics	**3**	2	2	1.5	PHM 115
MDP 266	Machine Construction	**3**	2	2	0	MDP 113
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**18**	**12**	**12**	**3**	
Second Main Semester (Term 6)						
EPM 232	Electrical Machines (2)	**3**	2	2	1.5	EPM 132
EPM 233	Electrical Power Engineering	**3**	2	2	0	EPM 116
MDP 254	Theory of Machines	**3**	2	2	2	PHM 033
EPM 281	Automatic Control Systems	**3**	2	2	0	PHM 113
MEP 284	Measurements Lab	**3**	2	2	2	
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**18**	**12**	**12**	**5.5**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
EPM 324	Fundamentals of Photovoltaic	**3**	2	2	0	ECE 232
EPM 336	Microprocessor Based Automated Systems	**3**	2	2	1.5	
EPM 353	Power Electronics (1)	**3**	2	2	1.5	ECE 232
MEP 354	Solar Energy (1)	**3**	2	2	0	MEP 223
MEP 363	Combustion and Furnaces	**3**	2	2	1.5	MEP 223
MDP 364	Machine Design	**3**	2	2	0	MDP 254
	Total Hours	**18**	**12**	**12**	**4.5**	
Second Main Semester (Term 8)						
EPM 337	Power Quality	**3**	2	2	0	EPM 233, EPM 353
EPM 354	Power Electronics (2)	**3**	2	2	1.5	EPM 353
MEP 364	Internal Combustion Engines	**3**	2	2	1.5	MEP363
MEP 365	Thermal Power Plants	**3**	2	2	0	MEP 363
MDP 368	Vibrations and Dynamics	**3**	2	2	0	MDP 254
EPM 372	Industrial or Field Training	**3**	2	2	2	
	Total Hours	**18**	**12**	**12**	**5**	

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
EPM 425	Storage Energy Technologies	**3**	2	2	0	EPM 116, EPM 354
EPM 434	Economics of Generation, Transmission, and Operation	**3**	2	2	0	EPM 122, EPM 233
MEP 452	Solar Energy (2)	**3**	2	2	0	MEP 354
EPM 497	Graduation Project (1)	**3**	3	0	1.5	
XXX 4xx	Technical Elective (1)	**3**	2	2	0	Course-specific
XXX 4xx	Technical Elective (2)	**3**	2	2	0	Course-specific
	Total Hours	**18**	**13**	**10**	**1.5**	
Second Main Semester (Term 10)						
EPM 433	Network Interfacing of Renewable Resources	**3**	2	2	0	EPM 232, EPM 281, EPM 354
MEP 453	Wind Energy	**3**	2	2	0	MDP 368
EPM 498	Graduation Project (2)	**3**	3	0	1.5	
XXX 4xx	Technical Elective (3)	**3**	2	2	0	Course-specific
XXX 4xx	Technical Elective (4)	**3**	2	2	0	Course-specific
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**18**	**13**	**10**	**1.5**	

Computer Engineering and Software Systems Program

1. Program Goals and Objectives

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 the 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. The graduate of this program will establish technical leadership in this area. 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, 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.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
CSE 115	Digital Design	3
CSE 116	Computer Architecture	3
CSE 125	Computer Programming (1)	3
CSE 126	Computer Programming (2)	3
CSE 127	Data Structures and Algorithms	3
CSE 128	Software Engineering (1)	3
ECE 141	Electrical and Electronic Circuits	3
CSE 215	Electronic Design Automation	3
CSE 221	Object-Oriented Analysis and Design	3
CSE 222	Software Engineering (2)	3
CSE 223	Operating Systems	3
CSE 224	Design and Analysis of Algorithms	3

CSE 225	Software Testing, Validation, and Verification	3
CSE 226	Design of Compilers	3
CSE 227	Database Systems (1)	3
ECE 255	Signals and Systems	3
CSE 275	Control Engineering	3
CSE 316	Microcontrollers and Interfacing	3
CSE 325	Agile Software Engineering	3
CSE 326	Software Formal Specifications	3
CSE 335	Computer Networks	3
CSE 336	Distributed Computing	3
CSE 345	Real-Time and Embedded Systems Design	3
CSE 365	Computer Vision	3
CSE 415	High-Performance Computing	3
CSE 425	Software Design Patterns	3
CSE 426	Software Maintenance and Evolution	3
CSE 427	Software Project Management	2
CSE 436	Computer and Network Security	3
CSE 437	Mobile Computing	3
CSE 496	Graduation Project (1)	3
CSE 497	Graduation Project (2)	3
	Total Credit Hours	**95**

3. Technical Electives

Technical elective courses are categorized into four fields; the student must select seven courses with a total of (21) credit hours. Three of these seven courses must be from the courses that have course codes in the form 3xx, while the remaining four courses are from the courses that have course codes in the form 4xx. The student must select a specific field from these four fields by selecting at least five courses from this field.

Field	Course Code	Course Title	Credit Hours
Multimedia and Computer Graphics	CSE 366	Pattern Recognition	3
	CSE 367	Digital Image Processing	3
	CSE 368	Computer Graphics	3
	CSE 369	Human-Computer Interaction	3
	CSE 444	Visualization	3
	CSE 445	Multimedia Engineering	3
	CSE 446	Computer Animation	3
	CSE 460	Selected Topics in Multimedia and Computer Graphics	3
	CSE 485	Game Design and Development	3

Distributed and Mobile Computing	CSE 317	Parallel and Cluster Computing	3
	CSE 334	Internet Programming	3
	CSE 337	Parallel and Distributed Algorithms	3
	CSE 338	Network Operation and Management	3
	CSE 430	Selected Topics in Distributed and Mobile Computing	3
	CSE 438	Cloud Computing	3
	CSE 439	Wireless Networks	3
	CSE 443	Computer and Network Forensics	3
	CSE 447	Pervasive Computing	3
Software Product Lines	CSE 327	Program Analysis	3
	CSE 328	Software Engineering Process Management	3
	CSE 329	Dependability and Reliability of Software Systems	3
	CSE 346	Business Process Modeling	3
	CSE 420	Selected Topics in Software Product Lines	3
	CSE 423	Software Performance Evaluation	3
	CSE 424	Aspect- and Service-Oriented Software Systems	3
	CSE 428	Secure Code Development	3
	CSE 429	Software Quality Assurance	3
Software Applications	CSE 320	Database Systems (2)	3
	CSE 364	Simulation of Engineering Systems	3
	CSE 385	Data Mining and Business Intelligence	3
	CSE 386	Artificial Intelligence	3
	CSE 440	Selected Topics in Software Applications	3
	CSE 448	Embedded Operating Systems	3
	CSE 449	Bioinformatics	3
	CSE 486	Ontologies and the Semantic Web	3
	CSE 487	E-learning Systems	3

4. Course Descriptions of the General Specialization Courses

CSE 115: Digital Design (3 Credit Hours)
Review on number systems. Switching functions: main operators, postulates and theorems, analysis and synthesis of switching functions, incompletely specified functions. Design using NAND and NOR gates. Design of combinational circuits using hardware description languages (VHDL, Verilog … etc.). 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, counters, shift registers. Adders, subtracters, decoders, coders, multiplexer/demultiplexer, memories (ROM, PLA, RAM). Design of sequential circuits using hardware description languages (VHDL, Verilog … etc.). Implementation of logic circuits on FPGA. Introduction to microprocessors.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 116: Computer Architecture (3 Credit Hours)
Prerequisite: CSE 115
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 125: Computer Programming (1) (3 Credit Hours)
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 126: Computer Programming (2) (3 Credit Hours)
Prerequisite: CSE 125
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 127: Data Structures and Algorithms (3 Credit Hours)
Prerequisite: CSE 125
Algorithmes: 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 128: Software Engineering (1) (3 Credit Hours)
Prerequisite: CSE 125
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ECE 141: Electrical and Electronic Circuits (3 Credit Hours)
Analysis of linear time invariant passive and active circuits. Kirchoff's laws, Thevenin and Norton equivalents, node and mesh analysis. Sinusoidal steady-state analysis and phasor diagrams. Signal waveforms, diodes, bipolar, and MOS transistors. Transistor-level digital circuit analysis and design. Analysis and design of single-stage amplifiers. Operational amplifiers and their applications. Digital-to-analog and analog-to-digital conversions.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 215: Electronic Design Automation (3 Credit Hours)
Prerequisite: CSE 116
Overview of electronic design automation (EDA): VLSI design and typical EDA flows, IC technology and design techniques, low-power circuit design techniques. Design for testability: fault models, fault collapsing, fault-simulation, test generation, manufacturing tests, testability analysis, scan design, built-in self-test, test comparison. High-level synthesis: overview, fundamentals, algorithms, scheduling, register binding, functional unit binding. Logic synthesis: ASIC and FPGA synthesis, data structures for Boolean representation, combinational logic minimization, technology mapping, timing analysis, timing optimization, test synthesis, clock and power/ground synthesis. Logic and circuit simulation: models, techniques, hardware acceleration, numerical methods, simulation of VLSI interconnects and nonlinear devices. Functional verification: hierarchy, quality measurements, simulation-based approaches, formal-approaches. Floor-planning and placement: simulated annealing and analytical approaches. Routing: general-purpose, global, and detailed routing.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 221: Object-Oriented Analysis and Design (3 Credit Hours)
Prerequisite: CSE 126
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 222: Software Engineering (2) (3 Credit Hours)
Prerequisite: CSE 128
Software design techniques. System models. Software prototyping. Architecture design: architecture analysis, refining the architecture. Architectural styles: distributed systems architecture, object-oriented architecture, layered architecture, repository model. Component-level design. Design in the small and design in the large. Design models. Design with reuse: Component-Based Software Engineering (CBSE). Introduction to user interface design. Software cost estimation techniques. Software metrics.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 223: Operating Systems (3 Credit Hours)
Prerequisite: CSE 116
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 224: Design and Analysis of Algorithms (3 Credit Hours)

Prerequisite: CSE 127

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.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 225: Software Testing, Validation, and Verification (3 Credit Hours)

Prerequisite: CSE 222

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 226: Design of Compilers (3 Credit Hours)

Prerequisite: CSE 223

Introduction: 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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 227: Database Systems (1) (3 Credit Hours)

Prerequisite: CSE 127

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

ECE 255: Signals and Systems (3 Credit Hours)
Prerequisite: PHM 114
Continuous time and discrete-time signals, impulse, step, exponential, sinusoidal, and periodic signals. Basic system properties. Linear Time Invariant (LTI) systems. System properties and description. Fourier series representation of periodic signals. Filters described by differential and difference equations. Laplace transform. Inverse Laplace transform. Transfer functions. Continuous-time Fourier transform and its properties. Sampling and Quantization. Discrete Fourier Transform (DFT) and its properties. Linear filtering based on DFT. Fast Fourier Transform (FFT) and its applications in linear filtering and correlation. Implementation of discrete-time systems. Z-transform. Regions of convergence. Inverse Z-transform. Transfer functions in the Z-domain. Analysis and characterization of LTI systems using Z-transform. Digital filters design.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 275: Control Engineering (3 Credit Hours)
Prerequisite: ECE 255
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 316: Microcontrollers and Interfacing (3 Credit Hours)
Prerequisite: CSE 116
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 325: Agile Software Engineering (3 Credit Hours)
Prerequisite: CSE 222
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 326: Software Formal Specifications (3 Credit Hours)
Prerequisite: CSE 128
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 335: Computer Networks (3 Credit Hours)
Introduction: standard models, network standardization, network layered architecture. Physical layer: guided transmission, wireless transmission, physical layer standards. Data link layer: design issues, error detection and correction, stop and wait protocols, sliding window protocols. Medium access control sublayer: multiple access protocols, Ethernet, wireless LANs, data link layer switching. Network layer: design issues, Quality of Service, internetworking, the network layer in the Internet, IPv4, IPv6, routing protocols (RIP, OSPF, BGP … etc.). Transport layer: transport services, elements of transport protocols, congestion control, flow control, TCP, UDP. Application layer: DNS, HTTP, FTP, SMTP, streaming audio and video. Computer networks design.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 336: Distributed Computing (3 Credit Hours)
Prerequisite: CSE 126, CSE 335
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 345: Real-Time and Embedded Systems Design (3 Credit Hours)
Prerequisite: CSE 223, CSE 316
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 365: Computer Vision (3 Credit Hours)
Prerequisite: ECE 255
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 415: High-Performance Computing (3 Credit Hours)
Prerequisite: CSE 116, CSE 126
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 425: Software Design Patterns (3 Credit Hours)
Prerequisite: CSE 222
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. Functors 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 426: Software Maintenance and Evolution (3 Credit Hours)
Prerequisite: CSE 225
Basic concepts of software maintenance and evolution. Corrective, adaptive, perfective, and preventive maintenance. Economic implications of maintenance. Quality measurement. Web-site maintenance. Reverse engineering. Reengineering. Software reengineering techniques and tools. Code restructuring and amendability measures. Release and configuration management. Maintenance process models. Architecture Recovery. Program visualization. Forward engineering. Software maintenance processes. Software patterns and anti-patterns. Software product lines. Open source development. Software evolution. Code analysis and restructuring. Reengineering techniques to modernize legacy systems. Software refactoring strategies. Quality issues in software maintenance. Software integration.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 427: Software Project Management (2 Credit Hours)
Prerequisite: CSE 222
Basic concepts of software projects. Planning, monitoring, and control of the personnel, processes, and events that occur as software evolves from concept to implementation. The lifecycle phases and models used for iterative and incremental software development. Schedule and budget for a software development project. The progress of a software development project. The three-stage process of risk management for software development projects. Changes in management for software development projects. Financial and economic feasibility study. Work breakdown structure. Gantt charts. Network diagrams. Scheduling techniques. Resource allocation decisions. The role of the project manager. Critical factors. Time and activity planning. Critical path analysis. Managing human resources. Project financing and Budgeting.
Lecture: 2 hours/week, Tutorial: 1.5 hours/week

CSE 436: Computer and Network Security (3 Credit Hours)
Prerequisite: CSE 223, CSE 335
Principles of computer systems security. 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 437: Mobile Computing (3 Credit Hours)
Prerequisite: CSE 336
Introduction: mobile technologies, devices, computing. Wireless communication technologies. Global System for Mobile communication (GSM). 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). Architecture for mobile computing, three-tier architecture. Mobile IP, mobile TCP. Mobile operating systems (Windows mobile, iOS, Android, Blackberry ... etc.), mobile databases, client-server computing 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 computing. Location management. Location-based services. Context-aware mobile computing. Mobile-agent middleware. Caching strategies in mobile environments. Mobile VoIP applications. Fault tolerance and security in mobile computing environments.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 496: Graduation Project (1) (3 Credit Hours)
This course represents the first part of the graduation project, where the students work in the graduation projects under the supervision of faculty members.
Lecture: 1 hour/week, Lab: 6 hours/week

CSE 497: Graduation Project (2) (3 Credit Hours)
As a continuation of the first part of the graduation project (CSE 496), the students continue work in the graduation projects under the supervision of faculty members.
Lecture: 1 hour/week, Lab: 6 hours/week

5. Course Descriptions of the Technical Electives

CSE 317: Parallel and Cluster Computing (3 Credit Hours)
Prerequisite: CSE 116
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 320: Database Systems (2) (3 Credit Hours)
Prerequisite: CSE 227
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 327: Program Analysis (3 Credit Hours)
Prerequisite: CSE 126
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 328: Software Engineering Process Management (3 Credit Hours)
Prerequisite: CSE 222
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 329: Dependability and Reliability of Software Systems

(3 Credit Hours)

Prerequisite: CSE 222

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 334: Internet Programming (3 Credit Hours)

Prerequisite: CSE 126

Web context. Web programming models. Preview of XHTML, CSS, PHP, JavaScript, JSP, ASP, client and server side scripting, handling events. Structuring pages with HTML, HTML5, CSS, and JavaScript, Classic Web Programming. ASP.NET, hosting controls on web pages, C# review, Linq. Server-side programming with ASP.NET, WebForms. ASP.NET Model-View-Controller (MVC). XML, XSL, XPath, XML islands. Relational Data Model, SQL Server. Web Services and WCF. Windows Presentation Foundation (WPF). Silverlight and AJAX.

Lecture: 3 hours/week, Lab: 2 hours/week

CSE 337: Parallel and Distributed Algorithms (3 Credit Hours)

Prerequisite: CSE 224

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 338: Network Operation and Management (3 Credit Hours)

Prerequisite: CSE 335

Introduction. Network management: goals, organization, and functions. Basic foundations: standards, models and languages. Network management architectures

and protocols. Network management tools, systems, and engineering. Simple Network Management Protocol (SNMP). SNMPv1: organization and information models. SNMPv1 communication and functional models. SNMPv2 and SNMPv3. Remote monitoring (RMON). Optimizing network performance. Policy-based network management. Network management interfaces. IP network management. Network planning. Network accounting and performance management: IP accounting, BGP policy accounting, IP service level agreements ... etc. Network capacity planning and service level management. Network management metrics. Network management assessment. Managing network security. Network disaster recovery. Network operation and tuning. Network management applications.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 346: Business Process Modeling (3 Credit Hours)
Prerequisite: CSE 222
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 364: Simulation of Engineering Systems (3 Credit Hours)
Prerequisite: PHM 114
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 queuing 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 366: Pattern Recognition (3 Credit Hours)
Prerequisite: ECE 255
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 367: Digital Image Processing (3 Credit Hours)
Prerequisite: ECE 255
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. Image coding. Image reconstruction from projections. Image compression. Color image processing. Image segmentation. Morphological operations. Super resolution. Wavelets and image pyramids.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 368: Computer Graphics (3 Credit Hours)
Prerequisite: PHM 113, CSE 126
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 369: Human-Computer Interaction (3 Credit Hours)
Prerequisite: CSE 222
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 a special focus on mobile user interfaces. Mobile interaction, augmented-reality, tangible user interfaces, and ubiquitous computing. Interaction techniques: use of voice, gesture, and eye movements.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 385: Data Mining and Business Intelligence (3 Credit Hours)
Prerequisite: PHM 114, CSE 227
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 386: Artificial Intelligence (3 Credit Hours)

Prerequisite: PHM 114, CSE 125

Introduction. Problem-solving in artificial intelligence. Problem-solving by searching: uninformed search, informed search, heuristic functions. Adversarial search and game theory. Theorem proving. Knowledge representation and reasoning: semantic networks, frames, ontologies, predicate logic, rule-based systems, inference, probabilistic reasoning, decision theory. First Order Logic (FOL): FOL representation, syntax and semantics of FOL, knowledge engineering using FOL. Inference in FOL: unification and lifting, forward chaining, backward chaining, resolution. Expert systems. Learning methodologies. Planning. Intelligent agents. Artificial intelligence languages. Computational intelligence: neural networks, evolutionary computation, swarm intelligence, artificial immune systems, fuzzy systems. Applications.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 420: Selected Topics in Software Product Lines (3 Credit Hours)

Prerequisite: Determined according to course contents

Selected topics in recent directions in software product lines will be presented in this course.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 423: Software Performance Evaluation (3 Credit Hours)

Prerequisite: CSE 222

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.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 424: Aspect- and Service-Oriented Software Systems

(3 Credit Hours)

Prerequisite: CSE 222

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 428: Secure Code Development (3 Credit Hours)

Prerequisite: CSE 126, CSE 436

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 429: Software Quality Assurance (3 Credit Hours)

Prerequisite: CSE 222

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.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 430: Selected Topics in Distributed and Mobile Computing

(3 Credit Hours)

Prerequisite: Determined according to course contents

Selected topics in recent directions in distributed and mobile computing will be presented in this course.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 438: Cloud Computing (3 Credit Hours)

Prerequisite: CSE 336

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 439: Wireless Networks (3 Credit Hours)
Prerequisite: CSE 335
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. 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 440: Selected Topics in Software Applications (3 Credit Hours)
Prerequisite: Determined according to course contents
Selected topics in recent directions in software applications will be presented in this course.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 443: Computer and Network Forensics (3 Credit Hours)
Prerequisite: CSE 436
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 444: Visualization (3 Credit Hours)
Prerequisite: CSE 368
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 445: Multimedia Engineering (3 Credit Hours)
Prerequisite: CSE 367
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 446: Computer Animation (3 Credit Hours)
Prerequisite: CSE 368
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 447: Pervasive Computing (3 Credit Hours)
Prerequisite: CSE 336
Basic concepts of pervasive computing. Mechanisms and environments of pervasive computing. Computer and network architectures for pervasive computing. Mobile computing mechanisms. Pervasive software systems. Location mechanisms. Practical techniques for security and user-authentication. Experimental pervasive computing systems. Virtualisation Techniques. Cloud systems. Application development environments. Web 2.0, Web 3.0+. Mobile APIs. Streaming and real-time applications. Internet economics and business models. Open Internet data and service markets.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 448: Embedded Operating Systems (3 Credit Hours)
Prerequisite: CSE 345
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 debugging: building the Kernel, building applications, building the root file system, integrated development environment, debugging virtual memory problems, kernel debuggers, and profiling. Embedded Linux graphics.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 449: Bioinformatics (3 Credit Hours)

Prerequisite: CSE 227

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 460: Selected Topics in Multimedia and Computer Graphics
(3 Credit Hours)

Prerequisite: Determined according to course contents

Selected topics in recent directions in multimedia and computer graphics will be presented in this course.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 485: Game Design and Development (3 Credit Hours)

Prerequisite: CSE 368

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.

Lecture: 3 hours/week, Lab: 2 hours/week

CSE 486: Ontologies and the Semantic Web (3 Credit Hours)

Prerequisite: CSE 386

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.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

CSE 487: E-learning Systems (3 Credit Hours)

Prerequisite: CSE 386

Introduction: motivations of e-learning, the roles of e-learning systems. Development of successful e-learning systems. Different means of delivering e-learning. Intelligent tutoring systems. Adaptive hypermedia. User modeling. Learning model. Evaluation strategies. Evaluation and maintenance of e-learning system.

Lecture: 3 hours/week, Tutorial: 1.5 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
CSE 115	Digital Design	**3**	3	1	1	
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
CSE 125	Computer Programming (1)	**3**	3	0	2	
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
ECE 141	Electrical and Electronic Circuits	**3**	3	1	1	
	Total Hours	**18**	**17**	**7**	**5.5**	
Second Main Semester (Term 4)						
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
CSE 116	Computer Architecture	**3**	3	1	1	CSE 115
CSE 126	Computer Programming (2)	**3**	3	0	2	CSE 125
CSE 127	Data Structures and Algorithms	**3**	3	1	1	CSE 125
CSE 128	Software Engineering (1)	**3**	3	1.5	0	CSE 125
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**18**	**17**	**7**	**4**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
CSE 221	Object-Oriented Analysis and Design	**3**	3	1.5	0	CSE 126
CSE 222	Software Engineering (2)	**3**	3	1.5	0	CSE 128
CSE 223	Operating Systems	**3**	3	1.5	0	CSE 116
ECE 255	Signals and Systems	**3**	3	1	1	PHM 114
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**18**	**17**	**7.5**	**2.5**	
Second Main Semester (Term 6)						
CSE 215	Electronic Design Automation	**3**	3	1	1	CSE 116
CSE 224	Design and Analysis of Algorithms	**3**	3	1.5	0	CSE 127
CSE 225	Software Testing, Validation, and Verification	**3**	3	1	1	CSE 222
CSE 226	Design of Compilers	**3**	3	1	1	CSE 223
CSE 227	Database Systems (1)	**3**	3	1	1	CSE 127
CSE 275	Control Engineering	**3**	3	1	1	ECE 255
	Total Hours	**18**	**18**	**6.5**	**5**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
CSE 316	Microcontrollers and Interfacing	**3**	3	0	2	CSE 116
CSE 325	Agile Software Engineering	**3**	3	1.5	0	CSE 222
CSE 335	Computer Networks	**3**	3	1	1	
CSE 365	Computer Vision	**3**	3	1	1	ECE 255
CSE 3xx	Technical Elective (1)	**3**	3	x	x	Course-specific
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
	Total Hours	**18**	**17**	**x**	**x**	
Second Main Semester (Term 8)						
CSE 326	Software Formal Specifications	**3**	3	1.5	0	CSE 128
CSE 336	Distributed Computing	**3**	3	1	1	CSE 126, CSE 335
CSE 345	Real-Time and Embedded Systems Design	**3**	3	1	1	CSE 223, CSE 316
CSE 3xx	Technical Elective (2)	**3**	3	x	x	Course-specific
CSE 3xx	Technical Elective (3)	**3**	3	x	x	Course-specific
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**18**	**17**	**x**	**x**	

Technical Elective (1), (2), and (3)

Multimedia and Computer Graphics

CSE 366: Pattern Recognition	Prerequisite: ECE 255
CSE 367: Digital Image Processing	Prerequisite: ECE 255
CSE 368: Computer Graphics	Prerequisite: PHM 113, CSE 126
CSE 369: Human-Computer Interaction	Prerequisite: CSE 222

Distributed and Mobile Computing

CSE 317: Parallel and Cluster Computing	Prerequisite: CSE 116
CSE 334: Internet Programming	Prerequisite: CSE 126
CSE 337: Parallel and Distributed Algorithms	Prerequisite: CSE 224
CSE 338: Network Operation and Management	Prerequisite: CSE 335

Software Product Lines

CSE 327: Program Analysis	Prerequisite: CSE 126
CSE 328: Software Engineering Process Management	Prerequisite: CSE 222
CSE 329: Dependability and Reliability of Software Systems	Prerequisite: CSE 222
CSE 346: Business Process Modeling	Prerequisite: CSE 222

Software Applications

CSE 320: Database Systems (2)	Prerequisite: CSE 227
CSE 364: Simulation of Engineering Systems	Prerequisite: PHM 114
CSE 385: Data Mining and Business Intelligence	Prerequisite: PHM 114, CSE 227
CSE 386: Artificial Intelligence	Prerequisite: PHM 114, CSE 125

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
CSE 415	High-Performance Computing	**3**	3	1	1	CSE 116, CSE 126
CSE 425	Software Design Patterns	**3**	3	1	1	CSE 222
CSE 436	Computer and Network Security	**3**	3	1	1	CSE 223, CSE 335
CSE 496	Graduation Project (1)	**3**	1	0	6	
CSE 4xx	Technical Elective (4)	**3**	3	x	x	Course-specific
CSE 4xx	Technical Elective (5)	**3**	3	x	x	Course-specific
	Total Hours	**18**	**16**	**x**	**x**	
Second Main Semester (Term 10)						
CSE 426	Software Maintenance and Evolution	**3**	3	1.5	0	CSE 225
CSE 427	Software Project Management	**2**	2	1.5	0	CSE 222
CSE 437	Mobile Computing	**3**	3	1	1	CSE 336
CSE 497	Graduation Project (2)	**3**	1	0	6	
CSE 4xx	Technical Elective (6)	**3**	3	x	x	Course-specific
CSE 4xx	Technical Elective (7)	**3**	3	x	x	Course-specific
	Total Hours	**17**	**15**	**x**	**x**	

Technical Elective (4), (5), (6), and (7)

Multimedia and Computer Graphics

CSE 444: Visualization	Prerequisite: CSE 368
CSE 445: Multimedia Engineering	Prerequisite: CSE 367
CSE 446: Computer Animation	Prerequisite: CSE 368
CSE 485: Game Design and Development	Prerequisite: CSE 368
CSE 460: Selected Topics in Multimedia and Computer Graphics	Prerequisite: Determined according to course contents

Distributed and Mobile Computing

CSE 438: Cloud Computing	Prerequisite: CSE 336
CSE 439: Wireless Networks	Prerequisite: CSE 335
CSE 443: Computer and Network Forensics	Prerequisite: CSE 436
CSE 447: Pervasive Computing	Prerequisite: CSE 336
CSE 430: Selected Topics in Distributed and Mobile Computing	Prerequisite: Determined according to course contents

Software Product Lines

CSE 423: Software Performance Evaluation	Prerequisite: CSE 222
CSE 424: Aspect- and Service-Oriented Software Systems	Prerequisite: CSE 222
CSE 428: Secure Code Development	Prerequisite: CSE 126, CSE 436
CSE 429: Software Quality Assurance	Prerequisite: CSE 222
CSE 420: Selected Topics in Software Product Lines	Prerequisite: Determined according to course contents

Software Applications

CSE 448: Embedded Operating Systems	Prerequisite: CSE 345
CSE 449: Bioinformatics	Prerequisite: CSE 227
CSE 486: Ontologies and the Semantic Web	Prerequisite: CSE 386
CSE 487: E-learning Systems	Prerequisite: CSE 386
CSE 440: Selected Topics in Software Applications	Prerequisite: Determined according to course contents

Landscape Architecture Program

1. Program Goals and Objectives

This new program enables Students to be specialized in landscape design. Fortunately, this specialty constitutes a real demand in the job market of Egypt. Students will acquire a practical capability to establish harmony between buildings, urban environment and nature using creative approaches. These approaches will integrate internal and external spaces, their relations with movement paths as well as green/open areas. Moreover, the aesthetic dimension of landscape elements (hard/soft), street furniture, urban lighting and finishing materials will be stressed upon. Architectural and urban characters of the surrounding environment are also to be considered in order to harmonize and to enrich the uniqueness of each place. Moreover, courses in this program widely enhance sustainability through energy/water saving, the use of local materials, recycling and preservation of the nature.

2. University, College, and Specialization Requirements

2.1 University Requirements

Course Code	Course Title	Credit Hours
HUM xxx	Elective Course (1)	3
HUM xxx	Elective Course (2)	3
	Total Credit Hours	**6**

HUM xxx Elective Course (1), (2): Student chooses only two of the following courses:

Course Code	Course Title	Credit Hours
HUM 012	German Language	3
HUM 014	Engineering Profession, Practice, and Responsibilities	3
HUM 111	Engineering Economy	3
HUM 112	Health and Wellness	3
HUM 211	Impact of Technology on Society	3
HUM 212	Introduction to Marketing	3
HUM 311	Engineering Management	3
HUM 312	Human Resources Management	3
HUM 313	Engineering Law	3

2.2 College Requirements

Course Code	Course Title	Credit Hours
CSE 012	Engineering Computation	3
PHM 012	Calculus for Engineering (1)	3
PHM 013	Calculus for Engineering (2)	3
PHM 014	Linear Algebra and Analytic Geometry	3
PHM 022	Waves, Electricity, and Magnetic Fields	3
PHM 032	Engineering Mechanic (1) - Statics	3
PHM 033	Engineering Mechanics (2) - Dynamics	3
PHM 042	General Chemistry	3
MDP 061	Engineering Design and Graphics	4
	Total Credit Hours	**28**

2.3 General Specialization Requirements

Course Code	Course Title	Credit Hours
CES 110	Soil Properties and Materials	3
CEP 113	Site Survey	3
CES 117	Structure Analysis	3
UPL 131	Freehand Drawing and Visual Training	2
UPL 133	Design Studio (1)	4
ARC 134	Construction Studio (1)	3
UPL 134	Design Studio (2)	4
ARC 135	Construction Studio (2)	3
UPL 140	Site Analysis	3
UPL 152	History and Theory of Landscape (1)	3
UPL 153	Site Photography and Documentation	2
UPL 154	History and Theory of Landscape (2)	3
CEI 213	Irrigation System & Network	2
UPL 214	Computer Applications in Landscape Architecture	2
UPL 234	Design Studio (3)	4
ARC 235	Working Drawing Studio (1)	3
UPL 235	Design Studio (4)	4
ARC 236	Working Drawing Studio (2)	3
UPL 242	Introduction to Urban Design	3
UPL 243	Urban Design & Landscape	3
UPL 252	Models & 3D Samples	2
UPL 253	Contemporary Theories of Landscape Architecture	3
UPL 255	Presentation and Communication Techniques	2
UPL 256	GIS Applications	2

CEP 312	Infrastructure Planning	2
UPL 314	Advanced Computer Applications 3D	2
UPL 337	Design Studio (5)	4
ARC 338	Working Drawing Studio (3)	3
UPL 338	Design Studio (6)	4
ARC 339	Working Drawing Studio (4)	3
UPL 354	Out Door Lighting and Effects (1)	3
UPL 355	Horticulture and Garden Design (1)	2
ARC 356	Profession Practice	3
UPL 356	Horticulture and Garden Design (2)	2
UPL 438	Land and Development	3
UPL 443	Urban Ecology	2
UPL 444	Environmental Impact Assessment	3
ARC 455	Projects Management	2
UPL 455	Out Door Lighting and Effects (2)	3
UPL 456	Urban Economy	3
UPL 457	Feasibility Studies	3
UPL 459	Sustainability in Landscape Architecture	3
UPL 493	Graduation Project (1)	5
UPL 494	Graduation Project (2)	5
	Total Credit Hours	**129**

2.4 Technical Electives

Course Code	Course Title	Credit Hours
HUM 015	Report Writing	3
HUM 021	History of Arts (1)	2
HUM 031	History of Arts (2)	2
HUM 224	Humanities in Landscape Architecture	2
HUM 325	Human Behaviors & Urbanism	2
XXX 47x	Elective Course (3)	3
UPL 41x	Elective Course (4)	3
	Total Credit Hours	**17**

UPL 47x Elective Course (3): Student chooses only one of the following courses:

Course Code	Course Title	Credit Hours
ARC 473	Green Architecture Principles	3
UPL 473	Interior Planting Design	3
ARC 474	Contemporary Vernacular Architecture	3
ARC 475	Criticism & Project Evaluation	3
UPL 478	Urban & Architectural Heritage	3

UPL 41x Elective Course (4): Student chooses only one of the following courses:

Course Code	Course Title	Credit Hours
UPL 411	Advanced Urban Design	3
UPL 414	Planning Theories and Values	3
UPL 415	Urban Renewal	3

3. Course Descriptions of the General Specialization Courses

CES 110: Soil Properties and Materials (3 Credit Hours)
Prerequisite: PHM 042
An introduction to the structure of both crystalline and amorphous solids, the physical and chemical basis for properties exhibited by materials, an overview of material properties including mechanical, electrical, magnetic and thermal behavior. In addition to, it will be studied, soil characteristics, the engineering needs for soil improvement for foundation purpose, deep and shallow compaction and the equipment used, soil parameters, preloading, soil reinforcement and reinforcing materials and its physical and mechanical properties, utilization methods, advantages and limitations. Study of grouting: properties and techniques. Study of soil improvement techniques.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CEP 113: Site Survey (3 Credit Hours)
Distance measurements by tapes and electronic devices. Theodolites and applications in angle measurements. Calculation of levels and transversal and longitudinal cross sections. Traverse calculations and setting out of buildings. Adjusting verticality of buildings.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CES 117: Structure Analysis (3 Credit Hours)
Prerequisite: PHM 014
The course covers the following fields:
Types of loads, types of supports, reactions, stability of statically determinate structures, internal forces in statically determinate plane beams, frames and arches, two and three dimensional analyses of statically determinate trusses, influence lines for statically determinate beams, frames, arches and trusses, properties of plane areas, straining actions distribution of normal stresses in homogeneous sections, distribution of normal stresses in heterogeneous and composite sections, core of cross sections.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 131: Freehand Drawing and Visual Training (2 Credit Hours)
This course is an introduction to basic equipment, media, techniques and principles of graphic communication. It previews the different design elements: Point, line, direction, shape, size, texture, color and form. The course scrutinizes and explores processes involved in perception, nature of light, movement, color, depth and distance cues. Students should be able to experiment and elaborate several ideas related to two and three dimensional forms.
Lecture: 1 hour/week, Tutorial: 2 hours/week

UPL 133: Design Studio (1) (4 Credit Hours)
Prerequisite: MDP 061
By the end of this course Students should acquire different techniques of Arch. & landscaping drafting through learning various geometric & composite shapes which reflects architectural & landscape elements and designs skills.
Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 134: Construction Studio (1) (3 Credit Hours)
Prerequisite: MDP 061
The course provides the Students with the knowledge of different building materials and possibilities of their usages. Moreover, it overviews the different basic systems of construction (wooden structures, bearing walls, reinforced concrete, etc.), and finishing materials. Students learn how to implement some simple combinations through models with different scales; they will also be able to pinpoint some details like: stairs, doors, windows, stepping, landmarks, fountains, etc.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 134: Design Studio (2) (4 Credit Hours)
Prerequisite: UPL 133
By the end of this course Students should acquire different techniques and designs skills. Consequently, They will be able to integrate form and function of simple landscape projects that will include design of light structures and fixtures as well as simple landscape elements made of natural materials (Wood, Stone, etc.). Moreover, a wide knowledge of the use of finishing materials should be acquired.
Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 135: Construction Studio (2) (3 Credit Hours)
Prerequisite: ARC 134
The course provides the Students with the knowledge of different landscape materials and possibilities of their usages, and finishing materials. Students learn how to implement some simple combinations through models with different scales; they will also be able to pinpoint various hardscape details.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 140: Site Analysis (3 Credit Hours)
Students should understand the impact of climate and topography on the site selection for different projects. Moreover, They should asses and evaluate the surrounding road systems as well as the site accessibility. Students should also be able to analyze land uses around the project and their impact on the site, taking into consideration the size of adjacent buildings (especially from climatic and visual point of view). They should be able to evaluate the capacity of the site in order to implement the suggested architectural and urban design program. This course also overviews the effect of housing and urban planning regulations on the site planning and its design.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 152: History and Theory of Landscape (1) (3 Credit Hours)
Prerequisite: HUM 031
The course is considered as an introduction to landscape architecture within a historical context. Therefore, it concentrates on the study of theories of landscape in chronological order. By the end of this course, Students should be able to identify the dissimilarities between different landscape styles in relation to different historical eras. Students should be able to recognize the origin of landscape architecture as well as a variety of special garden designs. Moreover, Students should understand different historical methods of landscaping within archeological and philosophical context.
Lecture: 3 hours/week

UPL 153: Site Photography and Documentation (2 Credit Hours)
Prerequisite: UPL 140
This course is an introduction to professional photography. Therefore, Students should be able to successfully photograph different landscape and architecture sites; in order to document and to obtain valuable data base before the design process. Trips to different sites are considered to be able to practice real application of graphic techniques in the field.
Tutorial: 2 hours/week

UPL 154: History and Theory of Landscape (2) (3 Credit Hours)
Prerequisite: UPL 152
This course is about the history, development and theories of landscape architecture. It emphasizes, especially, on the theories of landscape that appeared during the Antiquity compared to those of the Roman Empire and the Modern eras. Moreover, the impact of the emergence of different religions on the design of landscape and gardens during different ages will also be covered in this course.
Lecture: 3 hours/week

CEI 213: Irrigation System & Network (2 Credit Hours)
Prerequisite: CES 110, CEP 113
This course covers the following fields:
An introduction for the water cycle, resources and use in different sectors. Elements of the hydrologic cycle: measurements of rainfall, evaporation, surface runoff. Methods of measuring levels, discharges and groundwater flows. Introduction to groundwater, sources characteristics and movement. An overview for well design and pumps' selection. Soil-plant-water relationships. Irrigation water requirements, irrigation efficiency and calculating periods between irrigations, low rates and irrigation time. Different types of field water application: surface irrigation methods, sprinkler and drip irrigation, subsurface irrigation. Planning, design, management, operation and maintenance for different methods.
Lecture: 2 hours/week

UPL 214: Computer Applications in Landscape Architecture

(2 Credit Hours)

Prerequisite: CSE 012

The course aims to train the student on how to use computer for landscape architecture and project development. It focuses on the applications of landscape architecture computer aided design softwares (ArchiCad landscape – Archi Terra3 – LANDCADD for Rivit – Rivit Landskap -Vectorworks, etc.).

Lab: 6 hours/week

UPL 234: Design Studio (3) (4 Credit Hours)

Prerequisite: UPL 134

This course allows the Students to experiment designing simple buildings and structures and put various alternatives within a general landscape context after a comprehensive site analysis.

Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 235: Working Drawing Studio (1) (3 Credit Hours)

Prerequisite: ARC 135

The 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.

Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 235: Design Studio (4) (4 Credit Hours)

Prerequisite: UPL 234

By the end of the course, Students should acquire the skill to integrate inner and outer spaces through designing simple 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.

Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 236: Working Drawing Studio (2) (3 Credit Hours)

Prerequisite: ARC 235

In integration & continuation with ARC 235 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.

Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 242: Introduction to Urban Design (3 Credit Hours)

Prerequisite: UPL153

Students taking this course should learn the principles and theories of urban design and their inter-relation landscape. They should be able to analyze the different elements of urban landscape (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.

Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 243: Urban Design & Landscape (3 Credit Hours)

Prerequisite: UPL 242

This course basically integrates urban design theories and practices through a design studio. It focuses profoundly on space design in relation to buildings. Moreover, relations between buildings, grouping studies, spatial form and landscape elements will be taken into consideration. In addition, Students should point out the built environment on a macro scale through visual analysis, case studies as well as site visits and site design.

Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 252: Models & 3D Samples (2 Credit Hours)

Prerequisite: UPL 131

Students taking this course should identify the main goals of different types of architectural models (study models versus presentational ones). They will be able to understand the functional use of models in three dimensional spatial studies. They should be able to experiment different types of models: architectural, urban or landscape models. In addition by the end of the course, Students should construct accurately models by using the easiest, most effective and least expensive methods. These methods will be enhanced by the use of manual and computerized mechanical techniques.

Lecture: 1 hour/week, Tutorial: 2 hours/week

UPL 253: Contemporary Theories of Landscape Architecture

(3 Credit Hours)

Prerequisite: UPL 154

The course aims to explore the major contemporary theories of landscape architectural design and their relationships to broader cultural and theoretical practices. In addition, the course previews key texts and new projects in landscape architecture, architecture, art along with related fields. It emphasizes on developing critical ways of analyzing ideas, lectures, readings, discussion, and writings. Students explore how landscapes arise from and elaborate specific ideas about modernity, culture, nature, history, class, gender and identity. The course will also emphasize on competing theoretical arrangements and these relate to designed projects.

Lecture: 3 hours/week

UPL 255: Presentation and Communication Techniques (2 Credit Hours)
Prerequisite: UPL 252
Students taking this course should be able to interpret successfully their ideas throughout different techniques. They will be able to reinforce strong ideas of their projects as well as outlining the purpose of their presentations. The course covers widely the use of diagrams to demonstrate forms and functions. It also previews different methods of presentation for the final project.
Tutorial: 4 hours/week

UPL 256: GIS Applications (2 Credit Hours)
Prerequisite: CSE 012
This course is an application of (GIS) Geographic Information System, modeling techniques to landscape planning and management processes as well as selection, acquisition, and conversion of digital landscape data. The course also previews a wide range of modeling applications for studio, outreach and research projects.
Lecture: 2 hours/week

CEP 312: Infrastructure Planning (2 Credit Hours)
Prerequisite: CEI 213
By the end of this course Students should understand infrastructures' aims and objectives. It previews all basic services and utilities including electricity, gas, water supplies, sewage systems, solid waste disposal, storm networks and telecommunication. 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 environmental laws that control infrastructure utilities. Students should also be able to use modern infrastructure tools like the GIS.
Lecture: 1 hour/week, Tutorial: 2 hours/week

UPL 314: Advanced Computer Applications 3D (2 Credit Hours)
Prerequisite: UPL 214
The course is an introduction to contemporary digital media software (Sketchup–Conceptual-Archicad 12). It emphasizes on the principles and the practices on a professional level through training the Students to use advanced 3D software and rendering techniques.
Lab: 6 hours/week

UPL 337: Design Studio (5) (4 Credit Hours)
Prerequisite: UPL 235, UPL 343
By the end of this course Students should learn how to produce designs within a complex landscape context. Students should integrate building masses with external spaces (open and/or green) and landscape elements (paths, street furniture, lighting fixtures, land forms, etc.). Students will also make sense of micro-climate and environmental impacts on projects' components.
Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 338: Working Drawing Studio (3) (3 Credit Hours)
required ARC 236
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.).
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 338: Design Studio (6) (4 Credit Hours)
Prerequisite: UPL 337
In integration & continuation with UPL 337 by the end of this course Students should learn how to produce designs within a complex landscape context. Students should integrate building masses with external spaces (open and/or green) and landscape elements (paths, street furniture, lighting fixtures, land forms, etc.). Students will also make sense of micro-climate and environmental impacts on projects' components.
Lecture: 1 hour/week, Tutorial: 6 hours/week

ARC 339: Working Drawing Studio (4) (3 Credit Hours)
Prerequisite: ARC 338
In integration & continuation with ARC 338 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.).
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 354: Out Door Lighting and Effects (1) (3 Credit Hours)
Students taking this course should identify 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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 355: Horticulture and Garden Design (1) (2 Credit Hours)
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. 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. Students will also practice the accessibility to different sources of information concerning this field including internet and printed materials.
Lecture: 1 hour/week, Tutorial: 2 hours/week

ARC 356: Profession Practice (3 Credit Hours)
The course focuses on different roles of architects/urban designers, contractors and buildings' owners during the construction process. Moreover, it previews codes of professional practices and legislation. The course also investigates and illustrates the construction bylaws and executive regulation No. 119 for 2008.
This course helps Students to develop a wide range of personal and professional skills. It keeps Students aware of the current job market requirements. Moreover it enhances the self awareness via effective personal marketing methods.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 356: Horticulture and Garden Design (2) (2 Credit Hours)
Prerequisite: UPL 355
This course is considered as experiential, since it helps Students to combine theory with practice. 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.
Lecture: 1 hour/week, Tutorial: 2 hours/week

UPL 438: Land and Development (3 Credit Hours)
Prerequisite: ARC 339
This course provides Students with a thorough understanding of issues that need to be taken into account as part of the process of land development. It emphasizes particularly on the assessment of site potentials, design criteria and meeting commercial expectations. The course will also offer a practical approach in order to help Students to resolve different constraints cause by the combinations of physical, regulatory and market related factors. Moreover, it introduces Students to the processes of development appraisals and valuations.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 443: Urban Ecology (2 Credit Hours)
Students taking this course explore the relationship between humankind and the natural environment. They identify the social role in the environment as well as the change and management of this environment. Students recognize the importance of sustainability of physical and biological systems in different environments and its impact on the society. In addition, they will establish healthy practices to the planning and environmental management.
Lecture: 2 hours/week

UPL 444: Environmental Impact Assessment (3 Credit Hours)
Prerequisite: UPL 443
Students taking this course should categorize different decisions in the design process in order to conduct the optimum solution on both planning and architectural levels. They should recall multiple properties of green architecture (energy saving, planning according to the climate, site properties, holistic treatment, etc.). They should employ the Environmental Impact Assessment (EIA) on urban project. Moreover, this course will offer a great application on the design of environmental friendly buildings via studying their EIA.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 455: Project Management (2 Credit Hours)
Prerequisite: ARC 356
This course is an introduction to basics of project management and its main objectives. It scrutinizes the planning process in different phases of a project. This process will be done by using bar "Gantt", charts, networks, progress monitoring, progress curves as well as resource allocation and leveling. It also previews the role of quality in the project multistage (technical investigation, confirming assurance steps, applications using computer). Moreover it offers application on execution of urban and architectural projects.
Lecture: 2 hours/week

UPL 455: Out Door Lighting and Effects (2) (3 Credit Hours)
Prerequisite: UPL 354
This course focuses basically on more lighting details. For instance, 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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 456: Urban Economy (3 Credit Hours)
This course defines economy in general; it places however emphasis on urban and regional economy including their definitions, problems and elements. Students taking this course should identify axis and tools of economic analysis. They will also analyze and assess urban productive capacity of the city in relation to external and internal economic factors of a project. Moreover, Students will correlate economic constraints in a city along with its infrastructure. In addition, the course covers widely housing economics, housing supply and demand as well as general dimensions of the housing problem.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 457: Feasibility Studies (3 Credit Hours)
Prerequisite: UPL 456
This course focuses on the following issues: Definition of the concept of feasibility study, its main targets, general aspects of urban projects, preliminary and final

feasibility study for urban projects, environmental feasibility, marketing feasibility, engineering feasibility, fiscal feasibility, commercial feasibility, social feasibility, factors affecting land evaluation, definition of structure of projects, scope of influence of projects, investment costs, functioning, administrative and environmental costs. Analysis of the housing market, financial structure of projects, cash flow tables, balance between the execution time table and the financial structure of the projects.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 459: Sustainability in Landscape Architecture (3 Credit Hours)
This course is about sustainability in general. Students should identify different methods for saving water during the landscape design process. They should make sense of using recycled resources in landscape elements (timber, stone, wood, etc.) as well as economical methods of water usage. Students should also scrutinize the physical and chemical components of the soil in order to apply different methods to improve drainage or to improve the water content. Moreover, this course focuses on the appropriate selection of plants according to suitable water-use zones.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 493: Graduation Project (1) (5 Credit Hours)
The graduation project is considered as the final outcome of this program. This course allows Students to experiment the design of complex projects including different categories of structures integrated with different uses, spaces and natural / man-made landscape elements at large scale. Students should relate different magnitudes along with implementing sustainability principles (energy/water saving, preservation of natural resources, etc.). In addition, the project is accompanied by a report including the analysis, methodology, design considerations and concept. Evaluation of this project is based on the integration of the design perception in multiple dimensions (urban/arch., landscape elements, movement patterns, ecology,..) along with the originality and the creativity of the concept.
Lecture: 1 hour/week, Tutorial: 8 hours/week

UPL 494: Graduation Project (2) (5 Credit Hours)
The graduation project is considered as the final outcome of this program. This course allows Students to experiment the design of complex projects including different categories of structures integrated with different uses, spaces and natural / man-made landscape elements at large scale. Students should relate different magnitudes along with implementing sustainability principles (energy/water saving, preservation of natural resources, etc.). In addition, the project is accompanied by a report including the analysis, methodology, design considerations and concept. Evaluation of this project is based on the integration of the design perception in multiple dimensions (urban/arch., landscape elements, movement patterns, ecology,..) along with the originality and the creativity of the concept.
Lecture: 1 hour/week, Tutorial: 8 hours/week

4. Course Descriptions of the Technical Electives

HUM 015: Report Writing (3 Credit Hours)
This course is designed to give students exposure to the content, organization, format and style of specific kinds of technical writing such as reports, business letters, memoranda and email. It demonstrates the different types of reports, with focus on technical reports. In addition, grounding in the techniques of report writing as a process will be given together with sufficient writing practice. By the end of this course students will be able to write their own complete technical reports both from given and self-generated terms of reference.
Lecture: 2 hours/week, Tutorial: 2 hours/week

HUM 021: History of Arts (1) (2 Credit Hours)
This course is considered as a liberal art curriculum as it scrutinizes the complex relationship between visual representation and culture. It investigates the processes by which a historical art object acquires meaning within particular historical circumstances. In addition, this course covers a wide range of the occidental culture and History of Architecture. Moreover, it will provide a broad overview of Art History and offer fundamental skills of the artistic discipline such as formal analysis and iconographic. The curriculum provides both breadth and depth in art historical knowledge.
Lecture: 2 hours/week
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HUM 031: History of Arts (2) (2 Credit Hours)
Prerequisite: HUM 021
By the end of this course, Students should be able to relate and connect art and artists to society, to the history of events and ideas as well as to the culture of the preceding periods. This relation should extend to adjacent areas that will be examined with a growing sophistication of historical art methodology. Therefore, this course overviews the most international famous artists and architects that had great impact through different historical eras. Student should study the history of different Artists, the extent of their influence on the history of artistic intervals as well as circumstances and ideas surrounded these previous ages.
Lecture: 2 hours/week

HUM 224: Humanities in Landscape Architecture (2 Credit Hours)
This course explores the relationship between humankind and the natural environment as it introduces principles, methods and applications of environmental sciences and their relations to the users. Therefore, Students should implement this knowledge to the planning and landscape design process. They should also identify different physical and biological systems supporting the humankind.
Lecture: 2 hours/week

HUM 325: Human Behavior & Urbanism (2 Credit Hours)
Prerequisite: HUM 224
This course has a multi-disciplinary approach. It focuses on concepts of urban sociology as well as environmental, behavioral and cross-cultural studies. It covers the urban environmental settings in relation to different users throughout he analyses of behavioral patterns, cultural and traditional attributes as well as ethnicity, social and urban changes. Moreover, spatial location and urban growth in relation to environmental, historical and social factors will be taken into consideration.
Lecture: 2 hours/week

UPL 411: Advanced Urban Design (3 Credit Hours)
This course allows Students to scrutinize economical, social and environmental issue faced especially by environment professionals. It introduces theoretical ideas about the urban growth and transformation in different areas. Students explore contemporary processes of urban metamorphosis in Egyptian cities. They evaluate the impact of economic, social, political and environmental pressures on reshaping urban areas.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 414: Planning Theories and Values (3 Credit Hours)
This course allows Students to explore the conceptual basics of planning activity. So, Students explore the relationship between planning theory and planning practices. They should consider the impact of ethics and values on the planning perception as it affects the community and the human relations.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 415: Urban Renewal (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 473: Green Architecture Principles (3 Credit Hours)
This course represents an introduction to the energy conservation in buildings, as one of the most important goals of the ecological trend in architecture. This process will be achieved through studying the inefficient energy consumption in contemporary architecture, the principals of green architecture and its role in energy saving. Moreover, types of fossil, renewable energy resources and the application of solar energy in the passive design of buildings will be stressed upon. In addition, Students will identify various design techniques for passive cooling and passive heating via analyzing applied examples. They will also try to optimize the integrated application of each: passive, low-energy and active cooling methods in building design in order to achieve maximum efficiency in energy conservation.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 473: Interior Planting Design (3 Credit Hours)
This course is about theories and principles of interior design. It also covers the interaction and the hierarchy of internal and external spaces. Students should identify horizontal and vertical treatments and finishes via analyzing surfaces, textures, forms, movements and visual illusions. They should also identify theories of colors, color schemes and their different effects. Moreover, Students should distinguish the effects and the differences of natural and artificial lighting in spaces with different uses. The course will also preview international examples and concepts of interior design.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 474: Contemporary Vernacular Architecture (3 Credit Hours)
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 asses different debates between intellectual and cultural variables that affect the local, political and social decisions regarding architecture via various examples and case studies.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 475: Criticism & Project Evaluation (3 Credit Hours)
The course emphasizes on the multiplicity of architectural notions. 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 478: Urban & Architectural Heritage (3 Credit Hours)
The course emphasizes on the importance of architectural and urban heritage. It introduces different criteria for classifying and documenting this heritage. Students taking this course will identify environmental problems: subsoil water, air pollution, visual pollution, misuse of buildings and spaces, negligence and lack of maintenance. They will also recognize the principles of preservation and techniques of restoration for architectural heritage.
Lecture: 2 hours/week, Tutorial: 2 hours/week

5. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
HUM 021	History of Arts (1)	**2**	2	0	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
	Total Hours	**18**	**14**	**11**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
HUM 015	Report Writing	**3**	2	2	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
HUM 031	History of Arts (2)	**2**	2	0	0	HUM 021
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
	Total Hours	**17**	**15**	**8.5**	**1.5**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
CES 110	Soil Properties and Materials	**3**	2	2	0	PHM 042
UPL 131	Freehand Drawing and Visual Training	**2**	1	2	0	
UPL 133	Design Studio (1)	**4**	1	6	0	MDP 061
ARC 134	Construction Studio (1)	**3**	1	4	0	MDP 061
UPL 140	Site Analysis	**3**	2	2	0	
UPL 152	History and Theory of Landscape (1)	**3**	3	0	0	HUM 031
	Total Hours	**18**	**10**	**16**	**0**	
Second Main Semester (Term 4)						
CEP 113	Site Survey	**3**	2	2	0	
CES 117	Structure Analysis	**3**	2	2	0	PHM 014
UPL 134	Design Studio (2)	**4**	1	6	0	UPL 133
ARC 135	Construction Studio (2)	**3**	1	4	0	ARC 134
UPL 153	Site Photography and Documentation	**2**	0	4	0	UPL 140
UPL 154	History and Theory of Landscape (2)	**3**	3	0	0	UPL 152
	Total Hours	**18**	**9**	**18**	**0**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
CEI 213	Irrigation System & Network	**2**	2	0	0	CES 110, CEP 113
UPL 234	Design Studio (3)	**4**	1	6	0	UPL 134
ARC 235	Working Drawing Studio (1)	**3**	1	4	0	ARC 135
UPL 242	Introduction to Urban Design	**3**	1	4	0	UPL 153
UPL 252	Models & 3D Samples	**2**	1	2	0	UPL 131
UPL 253	Contemporary Theories of Landscape Architecture	**3**	3	0	0	UPL 154
	Total Hours	**17**	**9**	**16**	**0**	
Second Main Semester (Term 6)						
UPL 214	Computer Applications in Landscape Architecture	**2**	0	0	6	CSE 012
HUM 224	Humanities in Landscape Architecture	**2**	2	0	0	
UPL 235	Design Studio (4)	**4**	1	6	0	UPL 234
ARC 236	Working Drawing Studio (2)	**3**	1	4	0	ARC 235
UPL 243	Urban Design & Landscape	**3**	1	4	0	UPL 242
UPL 255	Presentation and Communication Techniques	**2**	0	4	0	UPL 252
UPL 256	GIS Applications	**2**	2	0	0	CSE 012
	Total Hours	**18**	**7**	**18**	**6**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
CEP 312	Infrastructure Planning	**2**	1	2	0	CEI 213
UPL 314	Advanced Computer Applications 3D	**2**	0	0	6	UPL 214
HUM 325	Human Behavior & Urbanism	**2**	2	0	0	HUM 224
UPL 337	Design Studios (5)	**4**	1	6	0	UPL 235, UPL 343
ARC 338	Working Drawing Studio (3)	**3**	1	4	0	ARC 236
UPL 355	Horticulture and Garden Design (1)	**2**	1	2	0	
HUM xxx	Elective Course (1)	**3**	2	2	0	
	Total Hours	**18**	**8**	**16**	**6**	
Second Main Semester (Term 8)						
UPL 338	Design Studios (6)	**4**	1	6	0	UPL 337
ARC 339	Working Drawing Studio (4)	**3**	1	4	0	ARC 338
UPL 354	Out Door Lighting and Effects (1)	**3**	1	4	0	
ARC 356	Profession Practice	**3**	2	2	0	
UPL 356	Horticulture and Garden Design (2)	**2**	1	2	0	UPL 355
HUM xxx	Elective Course (2)	**3**	2	2	0	
	Total Hours	**18**	**8**	**20**	**0**	

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
UPL 438	Land and Development	**3**	2	2	0	ARC 339
UPL 443	Urban Ecology	**2**	2	0	0	
UPL 455	Out Door Lighting and Effects (2)	**3**	1	4	0	UPL 354
UPL 456	Urban Economy	**3**	2	2	0	
XXX 47x	Elective Course (3)	**3**	2	2	0	
UPL 493	Graduation Project (1)	**5**	1	8	0	
	Total Hours	**19**	**10**	**18**	**0**	
Second Main Semester (Term 10)						
UPL 41x	Elective Course (4)	**3**	2	2	0	
UPL 444	Environmental Impact Assessment	**3**	2	2	0	UPL 443
ARC 455	Projects Management	**2**	2	0	0	ARC 356
UPL 457	Feasibility Studies	**3**	2	2	0	UPL 456
UPL 459	Sustainability in Landscape Architecture	**3**	2	2	0	
UPL 494	Graduation Project (2)	**5**	1	8	0	
	Total Hours	**19**	**11**	**16**	**0**	

Mechatronics Engineering and Automation Program

1. Program Goals and Objectives

Egypt needs to cope with the global modernization trends and push innovation to lead in the industrial, medical, and product development sectors. Accordingly, empowering the field of Mechatronics in our universities is a must as it uses the great advancement in the sciences of electronics and computer engineering to enhance the safety, performance, and efficiency of modern mechanical systems. The aim of the program is to graduate Mechatronics engineers that are capable of penetrating Egyptian, regional, and international markets with their knowledge, skills, professionalism and ethics. 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.

2. General Specialization Courses

Course Code	Course Title	Credit Hours
EPM 114	Electrical Circuits	3
CSE 115	Digital Design	3
MDP 121	Manufacturing Technology (1)	3
CSE 122	Computer Programming	3
ECE 142	Electronic Circuits	3
MCT 151	Introduction to Mechatronics	2
MDP 151	Stress Analysis	3
MDP 163	Machine Drawing and Solid Modeling	3
EPM 214	Electrical Power Engineering	3
CSE 228	Advanced Computer Programming	3
MEP 233	Fluid Mechanics	3
MCT 241	Engineering Measurements	3
MCT 242	Electronic Instrumentation	3
MCT 251	Theory of Machine and Multi-body	3
ECE 255	Signals and Systems	3
MDP 261	Machine Design	3
MDP 267	Machine Elements Design	3
EPM 282	Power Electronics and Drives	3
MCT 311	Introduction to Autotronics	2
CSE 318	Microcontrollers	3
MCT 321	Introduction to Nano-Mechatronics	2
MCT 333	CNC and CAD/CAM	3

MCT 334	Rapid Prototyping	3
MCT 341	Introduction to Bio-Mechatronics	2
CSE 347	Embedded System Design	3
MCT 351	Pneumatics and Hydraulics Control	3
MCT 371	Automatic Control	3
MCT 381	Design of Mechatronic Systems (1)	3
MCT 382	Design of Mechatronic Systems (2)	3
MCT 455	Industrial Robotics	3
MCT 456	Dynamic Modeling and Simulation	3
MCT 461	Industrial Networks	3
CSE 488	Machine Vision	3
MCT 498	Graduation Project (1)	3
MCT 499	Graduation Project (2)	3
	Total Credit Hours	**101**

3. Technical Electives

Technical elective courses are categorized into four fields; the student must select five courses from the same field with a total of (15) credit hours.

Field	Course Code	Course Title	Credit Hours
Autotronics	MEA 313	Automotive Theory	3
	MEA 323	Automotive Design	3
	MCT 411	Automotive Embedded Networking	3
	MCT 412	Autotronics	3
	MEA 442	Engine Management Systems	3
Nano-Mechatronics	MCT 322	Nanotechnology	3
	MCT 323	Nano-Imaging and Testing	3
	MCT 421	Introduction to MEMS/NEMS	3
	MCT 422	MEMS/NEMS Fabrication, Packaging, and Testing	3
	MCT 423	Advanced MMS/NMS Design	3
Industrial Mechatronics	MCT 331	Industrial Mechanisms and Robotics	3
	MCT 332	Industrial Automation	3
	MCT 431	Autonomous Systems	3
	MCT 432	Hybrid Control Systems	3
	CSE 488	Computational Intelligence	3
Bio-Mechatronics	MCT 342	Introduction to Biomechanics	3
	MCT 343	Locomotion and Gait Analysis	3
	MCT 441	Smart Actuators and Sensors	3
	MCT 442	Biomedical Engineering	3
	MCT 443	Rehabilitation Robots	3

4. Course Descriptions of the General Specialization Courses

EPM 114: Electrical Circuits (3 Credit Hours)
Prerequisite: PHM 022
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, Mutual inductance, Resonance in electrical circuits, Electric filters, Two-port networks, Locus of phasor diagrams at variable frequency, Analysis of electrical circuits with non-sinusoidal alternating currents.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

CSE 115: Digital Design (3 Credit Hours)
Review on number systems. Switching functions: main operators, postulates and theorems, analysis and synthesis of switching functions, incompletely specified functions. Design using NAND and NOR gates. Design of combinational circuits using hardware description languages (VHDL, Verilog … etc.). 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, counters, shift registers. Adders, subtracters, decoders, coders, multiplexer/demultiplexer, memories (ROM, PLA, RAM). Design of sequential circuits using hardware description languages (VHDL, Verilog … etc.). Implementation of logic circuits on FPGA. Introduction to microprocessors.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MDP 121: Manufacturing Technology (1) (3 Credit Hours)
Prerequisite: MDP 024
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.
Lecture: 3 hours/week, Lab: 2 hours/week

CSE 122: Computer Programming (3 Credit Hours)

Prerequisite: CSE 012

Introduction to problem analysis, Variables, Data types, Input and Output, Operators and simple functions, Selection structure, Repetition and Loop statements, Modular programming, Arrays, Strings and other data types, Files, Pointers, S/W testing. Programming principles such as structuring, looping, data structures and abstract. Data type ADT. Arrays, list, stacks, queues, binary trees.

Lecture: 3 hours/week, Lab: 2 hours/week

ECE 142: Electronic Circuits (3 Credit Hours)

Prerequisite: EPM 114

PN Junctions: construction and operation, I-V equation, biasing, circuit applications. Bipolar Junction Transistor (BJT): construction and operation, Types, I-V characteristics. Biasing: base- and emitter-bias, collector feedback bias, operating point. Metal Oxide Semiconductor Field Effect Ttransistors (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. Transistor biasing stability: current feedback, voltage feedback, current and voltage feedback, stability factor. Transistor small signal models: T models, z, y, and h parameters. Analysis of AF amplifiers: RC- and transformer-coupled AF power amplifiers: Power transistor considerations, Class-A amplifiers (direct, transformer coupled), push-pull operation (class-A, class-B). 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 (rectangular, sinusoidal, Wien bridge and phase shift).

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 151: Introduction to Mechatronics (2 Credit Hours)

Prerequisite: CSE 012, MDP 024, EPM 114

Introduction. Analog electronics. Digital electronics. Sensors and transducers. Actuators. Microprocessors. Fundamental concepts of mechatronics, common elements making up mechatronic systems. Interfacing electromechanical systems to microcontrollers. Components and measurement equipments used in the design of mechatronic products.

Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MDP 151: Stress Analysis (3 Credit Hours)

Prerequisite: MDP 132

Fundamentals of stress analysis, principles of statics and its application on deformable bodies, stress and strain, elastic behavior of simple elements under axial loading, bending and twisting, principal stresses, beams deflection. Statically indeterminate beams. Introduction to Finite Element Analysis (FEA) and computer implementation.

Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

MDP 163: Machine Drawing and Solid Modeling (3 Credit Hours)
Prerequisite: MDP 061
Machine parts, assembly drawing, machining marks, types of fittings, illustration of machine parts, application of manufacturing details, design drawings and workshop working drawings. Introduction to solid modeling. Sketcher workbench. Solid work features: applied features, pattern features, fillets, design tables. Modeling techniques. Part design: conceptual vision, concrete computer-based description, virtual worlds, physical prototyping and manufacturing. Parametric part design. Procedural modeling. 3D solid modeling. Assembly: basics, design. Drafting: basics, workbench. Visualization. Generative shape design. Sheet metal design. Weldment features. Predictive analysis and simulation**.**
Lecture: 1 hour/week, Tutorial: 2 hours/week, Lab: 3 hours/week

EPM 214: Electrical Power Engineering (3 Credit Hours)
Prerequisite: PHM 022
Fundamental theory of electromagnetism, Fundamentals of electromechanical energy conversion, single and Three-phase systems, Transformers, power measurements, Motors and generators, DC machines (Shunt motor, Separately excited motor, Series motor, Permanent magnet DC motor, Compound motor), AC motors (synchronous and induction machines), Stepper motor, Brushless motor, Reluctance motor, Linear motor, Servo motor.
Lecture: 3 hours/week, Lab: 1.5 hours/week

CSE 228: Advanced Computer Programming (3 Credit Hours)
Prerequisite: CSE 122
Introduction to object-oriented programming. Basic concepts of object-oriented programming. Modular design. Exception handling and class libraries. Input/Output and streams. Reflection. Concurrent programming. Distributed programming. Multi-threaded programming. Dynamic data structures. Template functions and classes. Graphical User Interface (GUI) programming. Graphics. Event-driven programming.
Lecture: 3 hours/week, Lab: 2 hours/week

MEP 233: Fluid Mechanics (3 Credit Hours)
Prerequisite: PHM 115
Definition of a fluid, fluid properties. Statics: pressure, hydraulic forces on submerged surfaces. Basic equations of fluid mechanics, kinematics of flow, control volume approach, continuity, momentum, energy and Bernoulli equations. Dimensional analysis and dynamic similitude. Flow in conduits: laminar and turbulent flows, equation of motion. Compressible flow: Mach number, stagnation properties, nozzles and shock waves. Flow over immersed bodies, lift and drag forces. Navier-Stocks equation, stream function and velocity potential.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 1.5 hours/week

MCT 241: Engineering Measurements (3 Credit Hours)

Prerequisite: PHM 114

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.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 242: Electronic Instrumentation (3 Credit Hours)

Prerequisite: ECE 142

Application of electronic instrumentation methodology (modeling, analysis, and design) and tools (sensors, instruments, basic electronic hardware and simulation software). Switched capacitor power supply. Time base generators. Active filters. Analog multiplier. Operational amplifiers. Sample and hold circuits. Sensors and transducers. Data transmission. Digital to Analog Converters (DACs) and Analog to Digital Converters (ADCs). Voltage to frequency and frequency to voltage conversion. Data acquisition systems. Applications.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 251: Theory of Machine and Multi-body (3 Credit Hours)

Prerequisite: PHM 033, MDP 151

Introduction: multibody systems, computational dynamics, motion and constraints, degrees of freedom, reference frames, kinematic analysis, force analysis, planar and spatial dynamics, rigid body mechanics, deformable bodies, computer and numerical methods. mechanisms: definitions, open-chain systems, closed-chain systems, four-bar mechanism, inversions of reciprocating engines, inversions of double slider mechanisms, motor vehicle steering mechanism, hook's joint, cams, gears. Kinematics: kinematics of rigid bodies, velocity equations, acceleration equations, computational methods in kinematics, computer implementation, kinematic modeling and analysis. Dynamics: D'Alembert's principle and Newton-Euler equations, constrained dynamics, augmented formulation, Lagrange multipliers, virtual work, computer implementation.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

ECE 255: Signals and Systems (3 Credit Hours)

Prerequisite: PHM 114

Continuous time and discrete-time signals, impulse, step, exponential, sinusoidal, and periodic signals. Basic system properties. Linear Time Invariant (LTI) systems. System properties and description. Fourier series representation of periodic signals. Filters described by differential and difference equations. Laplace transform. Inverse Laplace transform. Transfer functions. Continuous-time Fourier transform and its

properties. Sampling and Quantization. Discrete Fourier Transform (DFT) and its properties. Linear filtering based on DFT. Fast Fourier Transform (FFT) and its applications in linear filtering and correlation. Implementation of discrete-time systems. Z-transform. Regions of convergence. Inverse Z-transform. Transfer functions in the Z-domain. Analysis and characterization of LTI systems using Z-transform. Digital filters design.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MDP 261: Machine Design (3 Credit Hours)
Prerequisite: MDP 267
Design by evolution, design by innovation, machine design methodology. Design process: conceptual design, embodiment design, detailed design. Rational design and selection of machine elements: clutches, brakes, friction drives, bearings (sliding bearings, lubrication, rolling bearings, greasing), gears (spur, helical, bevel, worm gearing), pressure vessels (single, double wall). Machine design synthesis: machine design formalization, design optimization, optimization methodology, case studies and applications.
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

MDP 267: Machine Elements Design (3 Credit Hours)
Prerequisite: MDP 151, MDP 162
Fundamentals of machine design: introduction, fits and tolerances, types of fits, types of loads (static and dynamic), factor of safety, theories of failure, stress concentration, basic manufacturing considerations in design. Permanent joints: shrink fit, rivets, welds, gluing. Detachable joints: bolted, pre-stressed joints, keys, feathers, splines, serrations. Rational design and selection of machine elements: springs, belts (flat, vee, timing), wire ropes, chains, shafts, axles, threads, power screws, couplings (rigid and flexible).
Lecture: 2 hours/week, Tutorial: 2 hours/week, Lab: 2 hours/week

EPM 282: Power Electronics and Drives (3 Credit Hours)
Prerequisite: EPM 214
Ac voltage controllers: the single phase ac voltage controller, three phase controller, integral cycle control, thyristor commutation techniques, main principles, circuits, DC choppers: The single thyristor chopper, two thyristor choppers, inverters: single phase circuits, bridge inverter circuits, DC drives, AC drives, basics of industrial motor control, criteria for selecting drive components, DC motor drives, equivalent circuit of dc motors, permanent magnet DC motors, DC servomotors, adjustable speed DC drives, industrial examples, electric traction examples, induction motor drives, slip power recovery from induction motor, variable frequency AC motor drives, injection braking of induction motors, synchronous motor drives, stepper motor drives, computer controlled drives.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 311: Introduction to Autotronics (2 Credit Hours)
Prerequisite: MCT 151
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.
Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 318: Microcontrollers (3 Credit Hours)
Prerequisite: CSE 122
Introduction: microprocessors versus microcontrollers, the roles and functions of microcontrollers, overview of computer architecture. Microcontroller architecture. Addressing modes. Programming and debugging. Memory: RAM, ROM, Direct Memory Access (DMA), memory expansion, and external memory. Buses and parallel I/O. Interrupts, resets, power management, real-time events, timers, serial I/O. Analog I/O. Microcontroller interfaces. Interfacing techniques. Interfacing requirements. Interfacing with USB, I2C, SPI, CAN, LIN. Hardware and software development tools for microcontrollers. Microcontrollers simulators and debuggers. Typical microcontrollers and applications.
Lecture: 3 hours/week, Lab: 2 hours/week

MCT 321: Introduction to Nano-Mechatronics (2 Credit Hours)
Prerequisite: MCT 151
An 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. An 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.
Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 333: CNC and CAD/CAM (3 Credit Hours)
Prerequisite: MDP 121
Computers in industrial manufacturing: introduction, history, Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), Computer Numerical Control (CNC). Computer numerical control: introduction, CNC hardware and components (structure of CNC machine tools, spindle design, drives, actuation systems, feedback devices), CNC tooling (cutting tool materials, turning tool geometry, milling tooling systems, automatic tool changers), CNC programming, interpolation (linear and circular). CAD/CAM: introduction, hardware, software, computer graphics, geometric modeling, CAD/CAM integration.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 334: Rapid Prototyping (3 Credit Hours)

Prerequisite: MCT 333

Introduction: definitions, concepts, process chain of rapid prototyping and manufacturing. Conceiving, designing, and implementing products using rapid prototyping methods and computer aided tools. Rapid prototyping techniques: products, processes, applications. Rapid prototyping tools: 3D printing, 3D scanning. Stereo Litho-graphy: format, problems, repair. Virtual prototyping: modeling, simulating, and visualizing system behavior under real-world operating conditions, iterative refinement of system design, virtual prototyping tools. Benchmarking methodologies. Design requirements and constraints, iteration, fabrication, validation. Design optimization using structural analysis software. Digital manufacturing techniques, CAD modeling. Digital manufacturing processes: laser cutting, object printing, thermo-jet wax printing. Parametric modeling. Integration of digital manufactured objects into the building of 3D forms. Industrial case studies: automotive, consumer products, biomedical engineering.

Lecture: 2 hours/week, Lab: 3 hours/week

MCT 341: Introduction to Bio-Mechatronics (2 Credit Hours)

Prerequisite: MCT 151

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, biointerface. Examples: assistive devices and rehabilitation robotics.

Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 347: Embedded System Design (3 Credit Hours)

Prerequisite: CSE 318

Introduction: embedded system building blocks, design process of embedded systems. Communicating, linking, interfacing, processing techniques. Programming models: disciplines, methods, development. Machine instruction format and instruction timing. Interface between OS, ISA, and RTL layers of the virtual machine model. Interrupts, privileged states, and exception handling. Hardware interfacing and device driver programming. Algorithm analysis of embedded programs. Communicating with peripherals: external memory, buttons and key matrix, sensors, actuators, serial, parallel, Ethernet, WiFi communication in embedded systems. Embedded system implementation tools: software utility tools, CAD tools, translation tools, debugging tools, quality assurance and testing, maintaining embedded systems. Debugging live systems. Reducing power consumption: interrupt-based flow model, chained processors. Resource access protocols. Main challenges in the design, implementation, and validation of embedded systems. Applications.

Lecture: 3 hours/week, Lab: 2 hours/week

MCT 351: Pneumatics and Hydraulics Control (3 Credit Hours)

Prerequisite: MEP 233

Introduction to pneumatic and hydraulic control systems: physical principles, electrical versus hydraulic versus pneumatic systems, applications of pneumatic and hydraulic systems, electro-hydraulic and electro-pneumatics systems. Hydraulic system: power units, reservoirs, filters, piping and hoses, accumulators, pumps (constant displacement pumps, vane pumps, gear pumps, variable displacement pumps, piston pumps, eccentric plate pumps, pumps control systems), valves (spool valve, poppet valve, pilot-operated valves, pressure control valves, flow control valves, check valves, sequence valves, proportional valves, servo valves, cartridge valves, modular valves), actuators (rotary (motors) and linear (cylinders), hydraulic circuits. Pneumatic systems: service unit, compressors (piston, screw, rotary), filters, air dryers, lubricators, pressure regulation valves, control valves, actuators, pneumatic circuits.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 371: Automatic Control (3 Credit Hours)

Prerequisite: PHM 115, ECE 255

Introduction to feedback control systems. Basic components of control systems. Characteristics of closed loop systems. Transfer functions. Block diagram reduction. Signal flow graphs. Mathematical modeling of control systems. Modeling of single- and multi-degree of freedom vibration systems.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. Stability. Routh method for stability analysis. Root locus. Frequency response and frequency domain analysis. Design of PID controllers and compensators. State space representation. State feedback gain matrix design method. Observability and controllability analysis. Cascaded control. Feedforward control. Multivariable process control. Digital control systems: digitization, analysis of discrete systems, Z-transform, transfer function, design using discrete equivalents, stability, steady state error, transient response, cascaded compensation, digital control system design. Simulation of control systems. Applications and case studies.

Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 381: Design of Mechatronic Systems (1) (3 Credit Hours)

Prerequisite: ECE 142, MCT 151

Introduction to mechatronics systems: definitions, impact on industry and the techno-commercial benefits, mechatronics system hierarchy, basic mechatronics modules. Mechatronics design methodology: traditional approaches, V-model, nested V-model, 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,

control algorithm programming using GRAFCET – SFC – Petri nets, implementation in the form of mini-projects.
Lecture: 2 hours/week, Lab: 4 hours/week

MCT 382: Design of Mechatronic Systems (2) (3 Credit Hours)
Prerequisite: CSE 318, MCT 381
Process Control Mechatronics Module (PC-MM): choice of sensors, actuators, controller, control algorithm programming using the traditional control (P – PI – PD – PID), implementation using PLC and SCADA in the form of mini-project. Motion Control Mechatronics Module (MC-MM): 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. Machine Vision Mechatronics Module (MV-MM): 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 of Quanser, 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.
Lecture: 1 hour/week, Lab: 6 hours/week

MCT 455: Industrial Robotics (3 Credit Hours)
Prerequisite: MCT 251
Introduction to robotics: history of robotics, types of robotics, robotics applications. Kinematics analysis: generalized coordinates, rotation representations, Euler angles, fixed angles, rotation matrix, homogeneous transformation matrix, Denavit-Hartenberg rules, direct and inverse kinematics, singularities, Jacobian matrix. Dynamics analysis: joint space dynamics, Newton-Euler algorithm, inertia tensor, Lagrange equations, equations of motion, inverse and direct dynamics. Trajectory planning: trajectory generation problem, Cartesian planning, cubic polynomial, finding via point velocities, linear interpolation, higher order polynomials. Control: computed torque techniques, joint space control, PD control stability, nonlinear dynamic decoupling, trajectory tracking.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 456: Dynamic Modeling and Simulation (3 Credit Hours)
Prerequisite: MCT 371
Introduction to systems: system, classification of systems, multi-domain engineering systems, linear versus non-linear systems, time-varying versus time-invariant systems, lumped versus distributed parameter systems, continuous-time versus discrete-time systems, deterministic versus stochastic systems, time-driven versus event-driven systems. Systems modeling: need of system modeling, modeling techniques and methods, classification of models (mechanical, electrical, thermal, fluidic, etc.), mathematical modeling. Simulation: introduction, advantages of 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, such as: physical subsystems (motor, mass-spring-damper system, etc.), longitudinal control of an aircraft, submarine depth control system, pilot ejection control system.
Lecture: 2 hours/week, Tutorial: 1 hour/week, Lab: 3 hours/week

MCT 461: Industrial Networks (3 Credit Hours)
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 488: Machine Vision (3 Credit Hours)
Prerequisite: ECE 255
An overview on image processing: binary image, gray-scale image, color image, image morphology, image transforms, color image processing, color recognition, image representation, pattern recognition, texture. Pattern analysis in visual images. 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. Product inspection. Color sorting. Surface detection. Automated visual grading. Vision-based quality control. Defect detection. Estimating the size and shape of objects. Applications of machine vision in mechatronic systems.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 498: Graduation Project (1) (3 Credit Hours)
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 field chosen by the student.
Lecture: 1 hour/week, Lab: 6 hours/week

MCT 499: Graduation Project (2) (3 Credit Hours)
As a continuation of the first part of the graduation project (MCT 498), the students continue work in the graduation projects under the supervision of faculty members.
Lecture: 1 hour/week, Lab: 6 hours/week

5. Course Descriptions of the Technical Electives

MEA 313: Automotive Theory (3 Credit Hours)
Prerequisite: MCT 251
Automotive propulsion systems: types, traction forces calculations for manual and automatic transmissions, rolling resistance and tire slip, air and gradient resistances, vehicle acceleration and surplus effort. Automotive braking systems: types and performance. Automotive basic handling characteristics.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 322: Nanotechnology (3 Credit Hours)
Prerequisite: MCT 321
Introduction to nanoscale science and nanotechnology. Fundamental principles of nanotechnology and nanomaterials. Nanoscale materials: creation, characterization, manipulation. Nanoscale devices and systems. Solid-state physics and chemistry in nanotechnology. Nanoscale tools: surface probe, atomic force microscopy, nanolithography. Molecular electronics. Applications of nanotechnology.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 323: Nano-Imaging and Testing (3 Credit Hours)
Prerequisite: MCT 321
Overview of methods for imaging and manipulating objects of the nanometer length scale. Basic principles of Scanning Probe Microscopies (SPMs): Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM), near field optical microscopy, other scanning probe techniques. Critical issues in SPM-based nanoscale imaging and manipulation. Algorithms for surface reconstruction in SPM imaging. Methods for high-speed AFM imaging. Manipulation techniques used to create nanostructures, nanoscale physics, and manipulation planning.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MEA 323: Automotive Design (3 Credit Hours)
Prerequisite: MDP 261
Dry and Wet automotive clutch design. Manual transmission design. Automotive suspension system: components, design factors, static and dynamic loads. Automotive steering system: components, static and dynamic loads.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 331: Industrial Mechanisms and Robotics (3 Credit Hours)
Prerequisite: MCT 251
Industrial Mechanisms: introduction, historical development of the automation and assembly mechanisms, advantages of automatic assembly. Transfer systems: 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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 332: Industrial Automation (3 Credit Hours)

Prerequisite: MCT 351

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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 342: Introduction to Biomechanics (3 Credit Hours)

Prerequisite: MCT 251

Fundamental concepts and terminologies, anatomical basis of human body, musculoskeletal system, cardiovascular system, soft tissues, movement patterns, the anatomy of human movements, methods of biomechanics analysis, mechanical properties and structural behavior of biological tissues, modeling visco-elasticity of tissues, muscles, Hill's muscle model, modeling of anthropmorphic and biosystems, kinematics, kinetics and dynamics of human models, upper and lower limbs biomechanics of human.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 343: Locomotion and Gait Analysis (3 Credit Hours)

Prerequisite: MCT 341

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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 411: Automotive Embedded Networking (3 Credit Hours)

Prerequisite: CSE 347, MCT 461

Introduction. MISRA coding guidelines. AUTOSAR technical basics: AUTOSAR basic software, communication stack, diagnostic stack, memory stack, Input/output stack. RTE and software components. AUTOSAR operating system. Applications.
Lecture: 2 hours/week, Lab: 4 hours/week

MCT 412: Autotronics (3 Credit Hours)
Prerequisite: MCT 311, MEA 313, MEA 323
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.
Lecture: 2 hours/week, Lab: 4 hours/week

MCT 421: Introduction to MEMS/NEMS (3 Credit Hours)
Prerequisite: MCT 322
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 422: MEMS/NEMS Fabrication, Packaging, and Testing
(3 Credit Hours)
Prerequisite: MCT 321
Fundamentals of microfabrication and micromachining techniques: microlithography, dry & wet etching, deposition, surface micromachining, bulk micromachining, non-conventional micromachining. MUMPs design rules, mask layout, integration architectures and demonstrated hands-on design examples. MEMS packaging (wafer level and die), packaging equipment, MEMS measurement techniques. Examples of MEMS packages: equipments, processes, packaging schemes.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 423: Advanced MMS/NMS Design (3 Credit Hours)
Prerequisite: MCT 422
Advanced knowledge in Micro Mechatronics Systems (MMS) / Nano Mechatronics Systems (MMS). Microactuators for use in RF. Biomedical and optical MMS. MMS design, modeling, actuation mechanism, and architectures. Structured top-down design methodology. FEM analysis techniques. Standard behavioral modeling languages (e.g. VHDL-AMS) used in current simulators. Design and analysis flows and tools (e.g. matlab/Simulink, Comsol Multiphysics). MMS/NMS case studies.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 431: Autonomous Systems (3 Credit Hours)
Prerequisite: MCT 455
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.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 432: Hybrid Control Systems (3 Credit Hours)
Prerequisite: MCT 371
Introduction to hybrid control systems: basic concepts, time-driven versus event-driven control, systems and models, discrete event system, finite-state automata, hybrid control architecture. Supervisory control: feedback control with supervisors, specifications on controlled system, non-blocking control, control with modular specifications, control under partial observation, decentralized control. Petri-nets: basics, comparison of Petri-nets and automata, control of Petri-nets. Timed and hybrid models: timed automata, timed Petri-nets, hybrid models. Markov chains: discrete-time Markov chains, continuous-time Markov chains, controlled Markov chains. Hybrid control applications in m anufacturing.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 441: Smart Actuators and Sensors (3 Credit Hours)
Prerequisite: MCT 241, EPM 282
Introduction to smart material sensors and actuators, fundamentals in material and system modeling, Piezoelectric materials and systems, shape memory alloys, polymers with controllable prosperities, electro-active polymer sensors and actuators, Ionic Polymer Metal Composites (IPMC), magneto-rheological fluid, active/semi-active damping, energy harvesting, integrated sensing and actuation, artificial muscles, sensor data fusion.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 442: Biomedical Engineering (3 Credit Hours)
Prerequisite: MCT 343
Fundamental of rehabilitation and biomedical engineering, clinical engineering, tissue engineering, biomimetic systems, prosthetic, orthotics and artificial organs, basic concepts of medical instrumentation, terminology of medicine and medical devices, bioinstrumentations, biological signals. biomedical sensors: biopotential measurements, blood gas sensors, bioanalytical sensors, EMG, ECG, and EEG Sensors. Biosignal processing: physiological origins of biosignals, characteristics of biosignals, signal acquisition, frequency domain representation of biological signal, wavelet transform and Fourier analysis.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MEA 442: Engine Management Systems (3 Credit Hours)
Prerequisite: MEP 112
Introduction to internal combustion engines: components, types of combustion, and types of fuels. Engine valve timing and lubrication systems. Naturally aspirated engines and turbo charged engines. Engine Management systems: Gasoline engines injection and ignition modern systems. Diesel engines modern injection systems. Engine emissions Devices.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

MCT 443: Rehabilitation Robots (3 Credit Hours)
Prerequisite: MCT 441, MCT 442
Introduction to rehabilitation robots, the role of robotic in rehabilitation, physical Human-Robot Interaction (HRI), cognitive Human-Machine Interface (HMI), Human-Computer Interface (HCI) and Brain Computer Interface (BCI). Rehabilitation of patients with motor disorders, pathological tremor, amputation, paralysis and disability management. Artificial mechanical systems. Artificial actuation systems, artificial sensory systems, artificial motor control, case studies: upper and lower limb prostheses (prosthetic hand, arm, leg, knee and ankle), upper and lower limb exoskeletons, wheelchair.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

CSE 488: Computational Intelligence (3 Credit Hours)
Prerequisite: PHM 114
Overview: 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, intelligent Mechatronic systems.
Lecture: 3 hours/week, Tutorial: 1 hour/week, Lab: 1 hour/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
CSE 012	Engineering Computation	**3**	2	2	2	
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM xxx	Humanities Elective (1)	**3**	2	2	0	
	Total Hours	**19**	**14**	**13**	**3.5**	
Second Main Semester (Term 2)						
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM xxx	Humanities Elective (2)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8.5**	**3**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
MEP 112	Thermodynamics	**3**	3	0	1.5	PHM 012
PHM 113	Calculus for Engineering (3)	**3**	3	1.5	0	PHM 013
EPM 114	Electrical Circuits	**3**	2	2	2	PHM 022
PHM 115	Differential Equations and Partial Differential Equations	**3**	3	1.5	0	PHM 013
MDP 132	Structures and Properties of Materials	**3**	2	2	1.5	PHM 042
MDP 163	Machine Drawing and Solid Modeling	**3**	1	2	3	MDP 061
	Total Hours	**18**	**14**	**9**	**8**	
Second Main Semester (Term 4)						
PHM 114	Statistics and Probability for Engineering	**3**	3	1.5	0	PHM 013
MDP 121	Manufacturing Technology (1)	**3**	3	0	2	MDP 024
CSE 122	Computer Programming	**3**	3	0	2	CSE 012
ECE 142	Electronic Circuits	**3**	3	1	1	EPM 114
MCT 151	Introduction to Mechatronics	**2**	2	1	1	CSE 012, MDP 024, EPM 114
MDP 151	Stress Analysis	**3**	2	2	2	MDP 132
	Total Hours	**17**	**16**	**5.5**	**8**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
EPM 214	Electrical Power Engineering	**3**	3	0	1.5	PHM 022
CSE 228	Advanced Computer Programming	**3**	3	0	2	CSE 122
MEP 233	Fluid Mechanics	**3**	2	2	1.5	PHM 115
MCT 242	Electronic Instrumentation	**3**	3	1	1	ECE 142
MCT 251	Theory of Machine and Multi-body	**3**	3	1	1	PHM 033, MDP 151
MDP 267	Machine Elements Design	**3**	2	2	2	MDP 151, MDP 162
	Total Hours	**18**	**16**	**6**	**9**	
Second Main Semester (Term 6)						
CSE 115	Digital Design	**3**	3	1	1	
MCT 241	Engineering Measurements	**3**	3	1	1	PHM 114
ECE 255	Signals and Systems	**3**	3	1	1	PHM 114
MDP 261	Machine Design	**3**	2	2	2	MDP 267
EPM 282	Power Electronics and Drives	**3**	3	1	1	EPM 214
HUM xxx	Humanities Elective (3)	**3**	2	2	0	
	Total Hours	**18**	**16**	**8**	**6**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
MCT 311	Introduction to Autotronics	**2**	2	1	1	MCT 151
CSE 318	Microcontrollers	**3**	3	0	2	CSE 122
MCT 321	Introduction to Nano-Mechatronics	**2**	2	1	1	MCT 151
MCT 341	Introduction to Bio-Mechatronics	**2**	2	1	1	MCT 151
MCT 351	Pneumatics and Hydraulics Control	**3**	3	1	1	MEP 233
MCT 371	Automatic Control	**3**	3	1	1	PHM 115, ECE 255
MCT 381	Design of Mechatronic Systems (1)	**3**	2	0	4	ECE 142, MCT 151
	Total Hours	**18**	**17**	**5**	**11**	
Second Main Semester (Term 8)						
MCT 333	CNC and CAD/CAM	**3**	3	1	1	MDP 121
MCT 334	Rapid Prototyping	**3**	2	0	3	MCT 333
CSE 347	Embedded System Design	**3**	3	0	2	CSE 318
MCT 382	Design of Mechatronic Systems (2)	**3**	1	0	6	CSE 318, MCT 381
XXX 3xx	Technical Elective (1)	**3**	3	1	1	Course-specific
XXX 3xx	Technical Elective (2)	**3**	3	1	1	Course-specific
	Total Hours	**18**	**15**	**3**	**14**	

Technical Elective (1) and (2)

Autotronics

MEA 313: Automotive Theory — Prerequisite: MCT 251
MEA 323: Automotive Design — Prerequisite: MDP 261

Nano-Mechatronics

MCT 322: Nanotechnology — Prerequisite: MCT 321
MCT 323: Nano-Imaging and Testing — Prerequisite: MCT 321

Industrial Mechatronics

MCT 331: Industrial Mechanisms and Robotics — Prerequisite: MCT 251
MCT 332: Industrial Automation — Prerequisite: MCT 351

Bio-Mechatronics

MCT 342: Introduction to Biomechanics — Prerequisite: MCT 251
MCT 343: Locomotion and Gait Analysis — Prerequisite: MCT 341

Fourth Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
MCT 455	Industrial Robotics	**3**	3	1	1	MCT 251
MCT 461	Industrial Networks	**3**	3	1	1	
MCT 498	Graduation Project (1)	**3**	1	0	6	
MCT 4xx	Technical Elective (3)	**3**	x	x	x	Course-specific
MCT 4xx	Technical Elective (4)	**3**	x	x	x	Course-specific
HUM xxx	Humanities Elective (4)	**3**	2	2	0	
	Total Hours	**18**	x	x	x	
Second Main Semester (Term 10)						
MCT 456	Dynamic Modeling and Simulation	**3**	2	1	3	MCT 371
CSE 488	Machine Vision	**3**	3	1	1	ECE 255
MCT 499	Graduation Project (2)	**3**	1	0	6	
MCT 4xx	Technical Elective (5)	**3**	x	x	x	Course-specific
HUM xxx	Humanities Elective (5)	**3**	2	2	0	
HUM xxx	Humanities Elective (6)	**3**	2	2	0	
	Total Hours	**18**	x	x	x	

Technical Elective (3), (4), and (5)

Autotronics

MCT 411: Automotive Embedded Networking — Prerequisite: CSE 347, MCT 461
MCT 412: Autotronics — Prerequisite: MCT 311, MEA 313, MEA 323
MEA 442: Engine Management Systems — Prerequisite: MEP 112

Nano-Mechatronics

MCT 421: Introduction to MEMS/ NEMS — Prerequisite: MCT 322
MCT 422: MEMS/NEMS Fabrication, Packaging, and Testing — Prerequisite: MCT 321
MCT 423: Advanced MMS/NMS Design — Prerequisite: MCT 422

Industrial Mechatronics

MCT 431: Autonomous Systems — Prerequisite: MCT 455
MCT 432: Hybrid Control systems — Prerequisite: MCT 371
CSE 488: Computational Intelligence — Prerequisite: PHM 114

Bio-Mechatronics

MCT 441: Smart Actuators and Sensors — Prerequisite: MCT 241, EPM 282
MCT 442: Biomedical Engineering — Prerequisite: MCT 343
MCT 443: Rehabilitation Robots — Prerequisite: MCT 441, MCT 442

Environmental Architecture and Urbanism Program

1. Program Goals and Objectives

The main goal of the program is to prepare architects and urban planners specialized in environmental design. Graduates are capable of understanding the relationship between humans and buildings and between buildings and their environment. They are capable of integrating 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.

2. University, College, and Specialization Requirements

2.1 University Requirements

Course Code	Course Title	Credit Hours
HUM x11	English Language	2
HUM x41	Professional Ethics	2
HUM x42	Principles of Law & Human Rights	2
HUM x51	Nile River & Contemporary Issues	2
HUM x52	Communication & Presentation Skills	2
HUM x53	Research & Analysis Skills	2
HUM x61	Computer Skills	0
HUM x91	Humanities Elective (1)	2
HUM x92	Humanities Elective (2)	2
	Total Credit Hours	**16**

HUM x91 and HUM x92 Humanities Elective (1), (2): Student chooses only two of the following courses:

Course Code	Course Title	Credit Hours
HUM x54	Psychology	2
HUM x55	Arabic & Islamic Civilization	2
HUM x63	Technology of Ancient Egypt	2
HUM x64	First aid Skills	2

HUM x71	Music Appreciation	2
HUM x72	Trends in Contemporary Arts	2
HUM x81	Heritage of Egyptian Literature	2
HUM x82	Literary Appreciation	2
HUM x83	Recent Egypt's History	2
HUM x84	Geography of Egypt	2
HUM x85	Introduction to the History of Civilizations	2
HUM x86	Engineering History	2

2.2 College Requirements

Course Code	Course Title	Credit Hours
PHM 012	Calculus for Engineering (1)	3
PHM 013	Calculus for Engineering (2)	3
PHM 014	Linear Algebra and Analytical Geometry	3
PHM 022	Waves, Electricity, and Magnetic Fields	3
MDP 024	Production Engineering	3
PHM 032	Engineering Mechanics (1) - Statics	3
PHM 033	Engineering Mechanics (2) - Dynamics	3
PHM 042	General Chemistry	3
MDP 061	Engineering Design and Graphics	4
	Total Credit Hours	**28**

2.3 General Specialization Requirements

Course Code	Course Title	Credit Hours
ARC 011	Visual Studies and Design Fundamentals	2
UPL 111	History and Theory of Urbanism	2
CEP 114	Land Surveying	2
ARC 115	Architectural Design Studio (1)	3
ARC 116	Shades, Shadows, and Perspective	2
CES 117	Structure Analysis	3
UPL 121	Urbanism and Climate	3
ARC 122	History and Theory of Architecture	2
ARC 132	Building Technology (1)	3
ARC 136	Digital Presentation of the Built Environment	2
ARC 143	Control of Thermal Environment	3
CES 143	Building Engineering Materials	3
ARC 152	Architectural Design Studio (2)	3
UPL 211	Introduction to Urban Design	3
UPL 212	People and Environment	3
UPL 224	Sustainable Urban Development	3

CES 225	Reinforced Concrete Structures	3
ARC 232	Building Technology (2)	3
CEP 241	Green Infrastructure	3
ARC 242	Acoustics in Architecture	2
ARC 243	Renewable Energy and Buildings	2
ARC 244	Lighting in Architecture	2
ARC 245	Principles of Sustainable Architecture	3
ARC 252	Environmental Architectural Design Studio (1)	3
ARC 253	Environmental Architectural Design Studio (2)	3
UPL 261	Ecological Landscape	3
UPL 313	Housing Studies and Design	3
UPL 315	Eco Urban Design (1)	3
ARC 316	Modeling of the Built Environment	2
CES 325	Steel Structures	3
ARC 334	Working Drawings (1)	3
ARC 335	Working Drawings (2)	3
UPL 343	Sustainable Urban Landscape	3
ARC 354	Sustainable Architectural Design Studio (1)	3
ARC 355	Sustainable Architectural Design Studio (2)	3
UPL 362	Eco Urban Design (2)	3
UPL 441	Eco Urban Design (3)	3
ARC 456	Sustainable Architectural Design Studio (3)	3
UPL 474	Environmental Impact Assessment	3
	Total Credit Hours	**108**

2.4 Specific Specialization Requirements

The student chooses either **Environmental Architecture** field or **Environmental Urbanism** field by studying the specific specialization courses corresponding to the chosen field. The student must be in the fourth level to be able to register for the Technical Electives courses, with the exception of **Technical Elective (1)** where the student should be at least in the third level to be able to register for this course.

2.4.1 Specific Specialization Courses of Environmental Architecture Field

Course Code	Course Title	Credit Hours
ARC 415	Building Performance Simulation	2
ARC 443	Renewable Energy Systems	3
ARC 448	Sustainable Building Rating Systems	2
ARC 476	Execution Documents	3

ARC 4xx	Technical Elective (1)	3
ARC xxx	Technical Elective (2)	3
ARC 4xx	Technical Elective (3)	3
ARC 4xx	Technical Elective (4)	3
ARC 492	Studies and Program of Graduation Project	2
ARC 493	Graduation Project	4
	Total Credit Hours	**28**

The student studies only one course from each of the following groups.

Course Code	Course Title	Credit Hours
	Technical Elective (1)	
ARC 426	Architectural Criticism and Project Evaluation	3
ARC 442	Human Aspects of Sustainable Architecture	3
ARC 457	Interior Design	3
ARC 474	Contemporary Vernacular Architecture	3
	Technical Elective (2)	
ARC 357	Outdoor Lighting and Effects	3
ARC 362	Indoor Air Quality	3
ARC 446	Soundscape and Aural Architecture	3
ARC 447	Outdoor Noise Propagation in Built Environment	3
	Technical Elective (3)	
ARC 441	Building Life Cycle Assessment	3
ARC 477	Professional Practice and Building Legislations	3
	Technical Elective (4)	
ARC 436	Maintenance of Buildings	3
ARC 444	Building Commissioning	3
ARC 445	Economics of Green Building	3

2.4.2 Specific Specialization Courses of Environmental Urbanism Field

Course Code	Course Title	Credit Hours
UPL 445	Sustainable Urban Mobility	2
UPL 446	Introduction to Geographic Information System (GIS)	3

CES 447	Sustainable Waste Management	2
UPL 448	Environmental Planning	3
UPL 4xx	Technical Elective (1)	3
UPL 4xx	Technical Elective (2)	3
UPL 4xx	Technical Elective (3)	3
UPL 4xx	Technical Elective (4)	3
UPL 495	Studies and Program of Graduation Project	2
UPL 496	Graduation Project	4
	Total Credit Hours	**28**

The student studies only one course from each of the following groups.

Course Code	Course Title	Credit Hours
	Technical Elective (1)	
UPL 415	Urban Renewal	3
UPL 475	Urban and Architectural Heritage	3
	Technical Elective (2)	
UPL 424	Economics for Sustainability	3
UPL 425	Disasters and Environmental Risk Reduction	3
	Technical Elective (3)	
UPL 423	Smart Cities	3
UPL 427	Cities and Climate Change	3
	Technical Elective (4)	
UPL 422	Selected Topics in Urbanism	3
UPL 426	Management of Urban Environment	3

3. Course Descriptions of General Specialization Courses

ARC 011: Visual Studies and Design Fundamentals (2 Credit Hours)
The course introduces the students to visual properties of form and space, study of different design elements: texture, color, light and movement, spatial relationships, spatial organizations, proportions and scale, ordering principles, basic principles of architectural design, architectural vocabularies. Students are trained to use manual drafting techniques in expressing their thoughts.
Lecture: 0 hour/week, Tutorial: 4 hours/week

UPL 111: History and Theory of Urbanism (2 Credit Hours)
This course is a general introduction to the theory and practice of urban planning. It aims to acquaint students with the wide body of literature pertinent to the theory and practice of urban planning and with the historical roots of modern town planning; to introduce them to planning problems and strategies in a wide range of cities and countries; and to engage them in the study and discussion of current planning issues in the light of our current understanding of the city. By the end of the course, students are expected to form a better understanding of what urban planners and concerned urban activists can now do for cities and the people inhabiting them.
Lecture: 2 hours/week

CEP 114: Land Surveying (2 Credit Hours)
Introduction to survey and mapping science. Measurements units, Scales and maps. Direct and indirect methods of distance measurements by classical and electronic methods. Directions and angles measurements using theodolites and its relation to traverse. Traverse observation calculations and adjustment. Methods of area calculation and land divisions. Coordinate transformation. Vertical control using levels or theodolites. Calculating elevations or difference in elevations. Sources and kinds of errors in leveling. Methods of setting out of buildings.
Lecture: 1 hour/week, Tutorial: 2 hours/week

ARC 115: Architectural Design Studio (1) (3 Credit Hours)
Prerequisite: ARC 011
Students apply the fundamentals of architectural design through the design process, analysis, concepts, development and presentation. Training includes simple projects focusing on the functional relationships and the internal furniture to accommodate different functions. Design objectives include orientation, privacy and spatial composition. They should be able to present their design concepts based on their acquired presentation skills.
Tutorial: 6 hours/week

ARC 116: Shades, Shadows, and Perspective (2 Credit Hours)
The course introduces the students to the role of shades and shadows in the visualization of objects. Study the principles of casting the shades and shadows of objects and architectural elements on different surfaces. Students are trained to present architectural elements and forms through the shades and shadows. Study the methods of drawing one vanishing point and two vanishing point perspectives. The course develops the student's skills of imagination and visualization of 3D objects and presenting them in terms of perspective. The course includes representation of architectural objects using shades and shadows in perspective.
Lecture: 1 hour/week, Tutorial: 2 hours/week

CES 117: Structure Analysis (3 Credit Hours)
Prerequisite: PHM 012, PHM 032
The course covers the following fields:
Types of loads, types of supports, reactions, stability of statically determinate structures, internal forces in statically determinate plane beams, frames and arches, two and three dimensional analyses of statically determinate trusses, influence lines for statically determinate beams, frames, arches and trusses, properties of plane areas, straining actions distribution of normal stresses in homogeneous sections, distribution of normal stresses in heterogeneous and composite sections, core of cross sections.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 121: Urbanism and Climate (3 Credit Hours)
The aim of the course is to give students the possibility to explore how an adequate design of the built environment can minimize negative impact on the climate. It also aims at supporting students' learning on how the built environment in different climates is affected by the microclimate, vegetation, orientation etc. An introduction to climatic parameters and thermal comfort is followed by a study of the elements of sun, wind and daylight as they pertain to passive design, focusing on building form and solar radiation, natural ventilation strategies and day lighting design principles and applications. Moreover the course highlights the impact of people's attitude and behavior towards climate and energy issues.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 122: History and Theory of Architecture (2 Credit Hours)
Introduction of the scientific method to solve design problems and identify ways to design. Program formulation. Diagnostic Analysis. Development of design solutions. Comparison and evaluation. Ways of expressing design solutions. Basic concepts and fundamental considerations, ideas and design concepts for some types of buildings. In addition to the study of the relationship between architectural concepts and design philosophy in light of the natural and cultural influences and construction capabilities and its impact on the architectural elements through a comparative analysis of the various ancient civilizations and cultures: (Egyptian, West Asiatic, Babylonian,

Assyrian and Persian) and classical ages: (Greek, Roman, Early Christian and Byzantine Periods).
Lecture: 2 hours/week

ARC 132: Building Technology (1) (3 Credit Hours)
The course aims at understanding building construction processes and related technologies: Study methods of building construction systems; bearing walls construction, skeleton construction, and different processes of building such as, building with brick and building with stone. Study process of insulation layers: damp proofing, heat and sound insulation, flooring and staircases. The course develops student's skills in understanding building construction process and stages theoretically and practically by identifying the common structural systems, materials and equipment used.
Lecture: 1 hour/week, Tutorial: 4 hours/week

ARC 136: Digital Presentation of the Built Environment (2 Credit Hours)
This course aims at enhancing the students' abilities to use computers as a medium for presenting basic environmental data, architectural concepts and ideas, and designs. In addition, it enriches their cognition about the scientific differences between the main two types of digital graphics; Vector and Raster. Through the course, students learn how to use spread sheets programs such as EXCEL, to manipulate and present numerical data as charts. Also, they learn how to use Raster image editors, such as Photoshop, to produce presented architectural 2D graphics. In addition, they know how to use CAD programs, such as AutoCAD, to produce architectural drawings based on the United States National CAD Standard (USNCS).
Lab: 6 hours/week

ARC 143: Control of Thermal Environment (3 Credit Hours)
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, indoor air quality, and human health, students will learn how to shape the form of a building to respond to climate and the needs of its occupants' thermal comfort.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CES 143: Building Engineering Materials (3 Credit Hours)
Prerequisite: CES 117
Specifications of engineering materials and products. Main properties of engineering materials (physical chemical, mechanical, etc.). Non-metallic building materials and units. Properties and testing of building stones, lime, gypsum, timber, bricks, Tiles. Isolation materials, moisture heat and sound. Metallic building materials and units: structural steel, welding and welded splices. Behavior of metals under static loads: tension, compression, flexure, shear, surface hardness of metals. Behavior of metals under dynamic loads (Impact) and repeated loads (fatigue), Creep.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 152: Architectural Design Studio (2) (3 Credit Hours)
Prerequisite: ARC 011
Students apply the fundamentals of vernacular architectural design through the design process, analysis, concepts, development and presentation. Vernacular design is design rooted in its locale. In some respects vernacular design can be said to be indigenous, the way a language is indigenous, or native, to a certain place and people. The process includes simple projects focusing on the environmental responsive to accommodate different adaptations. Design objectives include responding to local needs, construction materials and reflecting local traditions. They should be able to present their design concepts based on their acquired presentation skills.
Tutorial: 6 hours/week

UPL 211: Introduction to Urban Design (3 Credit Hours)
Prerequisite: UPL 111
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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 212: People and Environment (3 Credit Hours)
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. Pests and pest control. Sustainability.
Lecture: 2 hours/week, Tutorial: 2 hour/week

UPL 224: Sustainable Urban Development (3 Credit Hours)
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 ıdentify the theoretical and methodological challenges which face urban development.
Lecture: 2 hours/week, Tutorial: 2 hours/week

CES 225: Reinforced Concrete Structures (3 Credit Hours)
Prerequisite: CES 117
Structural systems of buildings. Physical and mechanical properties of concrete and reinforcing steel. Loads on buildings, load distribution on beams. Behavior and design of reinforced concrete beams (simple, continuous and cantilever beams). Behavior and design of axially loaded short columns. Structural systems of slabs (solid, hollow blocks, ribbed, flat slab and paneled beams).Behavior and design of reinforced concrete solid slab (one and two way). Structural systems of stairs. Structural systems of reinforced concrete halls (frames, domes, cones, surfaces of revolution, folded plates, shells ... etc.).
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 232: Building Technology (2) (3 Credit Hours)
Prerequisite: ARC 132
Study the processes and elements of building construction: Types of foundation, Retaining walls. Roof covering methods. Expansion and settlement joints. Types of timber and wood joinery (doors and windows) Metal Works, (doors and windows), finishing works (tiles, plaster and paint). Course develops student's skills in understanding the basic structural elements of the building as well as finishing processes used by identifying the types of foundations, ceilings, joints, materials and equipment used in building finishes.
Lecture: 1 hour/week, Tutorial: 4 hours/week

CEP 241: Green Infrastructure (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 242: Acoustics in Architecture (2 Credit Hours)
Prerequisite: PHM 022
This course focuses on what architects need to know about acoustics. Fundamentals of architectural acoustics. Behavior of sound waves in enclosures, sound absorption, sound reflections, sound isolation, the concepts and objectives of acoustic design. Design considerations for auditorium acoustics.
Lecture: 1 hour/week, Tutorial: 2 hours/week

ARC 243: Renewable Energy and Buildings (2 Credit Hours)
Prerequisite: ARC 143
Energy sources, the future of renewable energy sources, building types and energy consumption, energy consumption of buildings in construction, operation and maintenance phases, the environmental impact of energy use in buildings, energy use, global effects of energy use in buildings. Standards and codes related to building.
Lecture: 2 hours/week, Tutorial: 1 hour/week

ARC 244: Lighting in Architecture (2 Credit Hours)

Prerequisite: PHM 022

This course explores natural and artificial lighting that integrates occupant comfort, energy efficiency and daylight availability in an architectural context. Students are asked to evaluate daylighting in real space and simulations, and also high dynamic range photography and physical model building. Among the topics included: human eye and visual perception, opening's orientation, lighting techniques, glazing types, units of light, luminous flux, luminous intensity, inverse square law, cosine law, luminance, Visual comfort, artificial lighting, light output ratio, lumen design method, daylight factor, components of daylight factor, artificial lighting mechanism, Light sources and luminance design.

Lecture: 1 hour/week, Tutorial: 2 hours/week

ARC 245: Principles of Sustainable Architecture (3 Credit Hours)

Prerequisite: ARC 143, ARC 242, ARC 244

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.

Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 252: Environmental Architectural Design Studio (1)

(3 Credit Hours)

Prerequisite: ARC 152

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. The course aims at understanding of architecture in its cultural context.

Tutorial: 6 hours/week

ARC 253: Environmental Architectural Design Studio (2) (3 Credit Hours)

Prerequisite: ARC 252

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.

Tutorial: 6 hours/week

UPL 261: Ecological Landscape (3 Credit Hours)
The course introduces the principles of urban landscape: open spaces, built forms, plantation, street furniture, and movement patterns. It aims to integrate buildings with the environment through the theories and principles of landscape design towards producing integrated sustainable solutions. The course includes the theoretical and historical backgrounds of landscape studies, site analysis, plant materials and landscape elements.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 313: Housing Studies and Design (3 Credit Hours)
This course provides introduction to context, history and framework of regional, city and urban planning. It explains concepts, features and characteristics of human settlements. It clarifies the interrelationships between socio-cultural contexts and housing processes. By the end of this course, students should be able to design housing areas and housing units. Also, design of 'appropriate' and 'responsive' residential environments within specific resources is within the course scope.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 315: Eco Urban Design (1) (3 Credit Hours)
Prerequisite: UPL 224, UPL 261
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. current urban environments. 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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

ARC 316: Modeling of the Built Environment (2 Credit Hours)
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.
Lab: 6 hours/week

CES 325: Steel Structures (3 Credit Hours)
Prerequisite: CES 117
Structural steel technology: Metallurgy of steel, Steel grades, Fatigue. Design synthesis: structural systems, Lateral resistance and bracing systems, Codes and specifications. Elements design: Structural behavior 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 structures. 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 334: Working Drawings (1) (3 Credit Hours)
Introduction to the specialized sets of drawings. Symbols and terminologies of each. Recognizing architectural projects from an execution point of view. Detailed plans, elevation and sections. Data, dimensions, levels. Finishing tables. Opening tables. Architectural detailing. Coordination between specialized drawings.
Lecture: 1 hour/week, Tutorial: 4 hours/week

ARC 335: Working Drawings (2) (3 Credit Hours)
Prerequisite: ARC 334
Studio work aims at preparing complete specialized sets of drawings and applying previous courses knowledge gained with an emphasis on methods of construction and high technology working details. Detailed plans, elevation and sections. Finishing tables. Opening tables. Producing a whole set of detailing including electrical and plumbing drawings.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 343: Sustainable Urban Landscape (3 Credit Hours)
Prerequisite: UPL 261
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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

ARC 354: Sustainable Architectural Design Studio (1) (3 Credit Hours)
Prerequisite: ARC 245
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.
Tutorial: 6 hours/week

ARC 355: Sustainable Architectural Design Studio (2) (3 Credit Hours)
Prerequisite: ARC 354
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.
Tutorial: 6 hours/week

UPL 362: Eco Urban Design (2) (3 Credit Hours)
Prerequisite: UPL 315
This course principally integrates ecological urban design theories and practices that previously introduced in "UPL 315" through a design studio. It emphasizes the application of contemporary urban design research and multidisciplinary collaboration into the design process with harmony of the local context and surrounding environment. In addition, students should point out the built environment on a macro scale through visual analysis, case studies as well as site visits and site design.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 441: Eco Urban Design (3) (3 Credit Hours)
Prerequisite: UPL 362
This course is designed to allow students to apply the principles of ecological design on a real site with a larger scale than the sites introduced in "UPL 362". Students will make use of all the skills, the fundamentals, and the technical information they gained during their study in order to design buildings, spaces, pedestrians, paths and landscape in a "responsive" manner to the local context and the surrounded environment.
Tutorial: 6 hours/week

ARC 456: Sustainable Architectural Design Studio (3) (3 Credit Hours)
Prerequisite: ARC 355
A design studio focusing upon the study of sustainable building concepts, 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.
Tutorial: 6 hours/week

UPL 474: Environmental Impact Assessment (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

4. Course Descriptions of Specific Specialization Courses

5.1 Environmental Architecture Field

ARC 415: Building Performance Simulation (2 Credit Hours)
Prerequisite: ARC 245
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.
Tutorial: 1 hour/week, Tutorial: 3 hours/week

ARC 443: Renewable Energy Systems (3 Credit Hours)
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.
Lecture: 2 hour/week, Tutorial: 2 hours/week

ARC 448: Sustainable Building Rating Systems (2 Credit Hours)
Introduction to 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.
Lecture: 2 hours/week, Tutorial: 1 hour/week

ARC 476: Execution Documents (3 Credit Hours)
Prerequisite: ARC 335
Elements of contract documents. Writing of specifications documents that complement the working drawings. General and special conditions of the job. Defining the scope of work and detailed description of items and materials. Quality surveyor;

rules and methods. The techniques of calculating the quantities of building items. Check listing the finished work and detecting faulty items.
Lecture: 1 hour/week, Tutorial: 4 hours/week

ARC 492: Studies and Program of Graduation Project (2 Credit Hours)
Prerequisite: ARC 355
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.
Lecture: 2 hours/week, Tutorial: 1 hour/week

ARC 493: Graduation Project (4 Credit Hours)
Prerequisite: ARC 456, ARC 492
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.
Tutorial: 8 hours/week

5.2 Environmental Urbanism Field

UPL 445: Sustainable Urban Mobility (2 Credit Hours)
Cities are the engines of economic activity and play a vital role in national development, but are becoming overwhelmed by congestion and the associated costs this incurs to both people and business. Rapid urbanization and an unprecedented increase in private motorized transport are creating a crisis that will seriously restrict economic growth and quality of life. This is an introductory course that examines 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.
Lecture: 2 hours/week, Tutorial: 1 hour/week

UPL 446: Introduction to Geographic Information System (GIS)
(3 Credit Hours)
Geographic Information System (GIS) deals with the analysis and management of geographic information. This course offers an introduction to methods of managing and processing geographic information. Emphasis will be placed on the nature of geographic information, data models and structures for geographic information, geographic data input, data manipulation and data storage, spatial analytic and modeling techniques, and error analysis. The course is made of two components: lectures and labs. In the lectures, the conceptual elements of the above topics will be discussed. The labs are designed in such a way that students will gain first-hand experience in data input, data management, data analyses, and result presentation in a geographical information system. Students must be clear that this is not a class specifically on any particular GIS software. It is a course on the underlying theory and concepts in GIS. The understanding of these concepts and theories will help students to perform spatial analysis in a GIS system properly and efficiently.
Lecture: 2 hours/week, Lab: 3 hours/week

CES 447: Sustainable Waste Management (2 Credit Hours)
This course provides students with technical and professional knowledge in waste technology and management in order to meet the requirements expected of modern waste managers working in the industrial, government and consulting sectors. The course provides an integrated and cross-disciplinary approach to sustainable waste management. Students will be equipped to select and apply scientific, technical and engineering principles; assess economic consequences and risks of waste management options; and apply acquired knowledge to team working and independent problem solving.
Lecture: 2 hours/week, Tutorial: 1 hour/week

UPL 448: Environmental Planning (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 495: Studies and Program of Graduation Project (2 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 1 hour/week

UPL 496: Graduation Project (4 Credit Hours)
Prerequisite: UPL 495
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.
Tutorial: 8 hours/week

5. Course Descriptions of the Technical Electives

6.1 Environmental Architecture Field

ARC 357: Outdoor Lighting and Effects (3 Credit Hours)
Students taking this course should identify 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 lighting 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 362: Indoor Air Quality (3 Credit Hours)
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.
Lecture: 3 hours/week, Tutorial: 1.5 hours/week

ARC 426: Architectural Criticism and Project Evaluation
(3 Credit Hours)
This course discusses the theoretical background of an architectural end-product within its context, and relevant architectural discourse. The notion of conceptualization will be given for encouraging the students for using architectural criticism as a tool for producing new ideas or creating products. The importance of re-reading of an architectural end-product for a better comprehension and evaluation will be emphasized. Principles of architectural criticism and techniques of evaluating projects are discussed.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 436: Maintenance of Buildings (3 Credit Hours)
Durability of buildings: Life expectancy of different types of buildings, effect of environmental elements such as heat, dampnessand precipitation on buildings, effect of chemical agents on building materials, effect of pollution on buildings, effect of fire on buildings, damage by biological agents like algae, fungus, moss, insects. 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 441: Building Life Cycle Assessment (3 Credit Hours)
An introduction to 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 442: Human Aspects of Sustainable Architecture (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 444: Building Commissioning (3 Credit Hours)
An introduction to 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 445: Economics of Green Building (3 Credit Hours)
The course introduces the students to the techniques of green building construction estimation, and the concept of building economic analysis, time value of money and life cycle costing. Basic concepts of building economics: initial cost, life cycle cost in use, cost and benefit ratio analysis, and control of cost and depreciation. Cost estimating, including determination of material, labor, equipment, overhead, profit, and other construction costs.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 446: Soundscape and Aural Architecture (3 Credit Hours)
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 soundmarks. Sound sculptures, vocal sculptures, and the effect on the surrounding aural environment. Sound, time, space mapping.
Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 447: Outdoor Noise Propagation in Built Environment

(3 Credit Hours)

The course introduces students to Outdoor sound propagation fundamentals, atmospheric sound propagation as well as environmental acoustics which is concerned with the control of sound and vibrations in an outdoor environment. Spreading, absorption, ground configuration, terrain profile, obstacles, pressure, wind, turbulence, temperature, humidity, etc. The course covers as well speed of sound in air, decibel scales, spreading losses, attenuation by atmospheric absorption, attenuation over the ground, refraction, diffraction and sound reduction examples. Sound propagation through the Urban Texture, effect of urban densities, facades profiles,…etc. Self protecting building, environmental regulation, standards and regulations.Outdoor Noise propagation modeling, prediction and strategic mitigation theories.

Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 457: Interior Design (3 Credit Hours)

Study of theories and principles of interior design, Internal and external spaces hierarchy and interaction, Study of horizontal and vertical planes treatments and finishes, Study of movement, Visual perception, Space time internally and externally, Study of surfaces: Textures, Forms,and visual illusions, Theories of color, Color schemes and their different effects, The effects of natural and artificial lighting on interior spaces. International examples and concepts in interior design.

Lecture: 2 hours/week, Tutorial: 2 hours/week

ARC 474: Contemporary Vernacular Architecture (3 Credit Hours)

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 asses different debates between intellectual and cultural variables that affect the local, political and social decisions regarding architecture via various examples and case studies.

Lecture: 2 hour/week, Tutorial: 2 hours/week

ARC 477: Professional Practice and Building Legislations

(3 Credit Hours)

The course introduces the students to the roles of the architect, the contractor and the owner during the building and construction processes. It explains the professional practice codes and legislations in terms of rights, commitments, ethics and scope of services. The course discusses the issues of fees, types of contracts, bidding and construction supervision. It discusses also types of contracting agreements and guarantee against construction flaws through analyzing case studies. Discussion of building codes and examples.

Lecture: 2 hours/week, Tutorial: 2 hours/week

6.2 Environmental Urbanism Field

UPL 415: Urban Renewal (3 Credit Hours)
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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 422: Selected Topics in Urbanism (3 Credit Hours)
This course is designed to introduce students to contemporary urbanism challenges and improve their critical understanding of their local context. Students will work in groups on a case study related to contemporary urbanism 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: Analyse 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.
Lecture: 1 hour/week, Tutorial: 4 hours/week

UPL 423: Smart Cities (3 Credit Hours)
The concept of a “smart city” addresses the use of information technology (IT) to accentuate the positive and eliminate the negative in urban life, which can result in an unprecedented opportunity to optimize the operations of cities – energy, water, transportation systems, food supply, urban design, resilience and much more. This course will explore the “smart city”, and the IT that underpins it. It will discuss what IT can and cannot do. The course is designed to build awareness of the potential for IT to improve the interactions between mankind in cities and the planet, and encourage students to think. 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.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 424: Economics for Sustainability (3 Credit Hours)
This course aims at improving the students’ knowledge of economics and valuing ecosystems in order the critically analyze How can the economy be harnessed to serve world sustainability. The irrational growth in the physical scale of the economy and its rapacious character under economic globalization has depleted resources, destroyed ecosystems, overwhelmed natural waste disposal sinks, waged war on subsistence cultures, and produced shocking mal-distribution of wealth and income. How, then, can economy be turned around to reinforce sustainable development

rather than to destroy ecosystems, resource endowments, and indigenous cultures is the core of this course.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 425: Disasters and Environmental Risk Reduction (3 Credit Hours)
This course provides students with theoretical concepts and practical tools in understanding environment and disaster linkages and applications of ecosystem-based disaster risk management. Course topics include understanding disaster risk and resilience, disaster trends analysis, ecosystem management tools for Disaster Risk Reduction (DRR), climate change and ecosystem-based adaptation, and mainstreaming into development, among others. It emphasizes the relevance of spatial planning for DRR. It introduces different models of urban development and integrated planning as the comprehensive framework.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 426: Management of Urban Environment (3 Credit Hours)
This course provides fundamentals for "Management" and factors affecting the urban environment. It discusses the key environmental issues in urban areas and environmental management considerations. It offers a review of the tools of environmental management and how they can be utilized in different urban contexts.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 427: Cities and Climate Change (3 Credit Hours)
This course examines cities as the primary sources of energy demand; the major contributors to climate change; the most vulnerable loci to climate change impacts; and the logical focal point for assessing, designing, and implementing climate mitigation and adaptation solutions. After characterizing energy demand and climate change in the urban context, sector-specific options for alternative energy production, resilient water systems, green buildings, energy efficient transport and sustainable infrastructure generally will be explored. Local level government climate policy options that cut across these sectors are examined, including land use, transportation planning, building practices, financing, local level offsets and urban-based Clean Development Mechanisms. The course is meant to provide a solid framework, broad overview and rich set of references for future pursuits involving urban climate change.
Lecture: 2 hours/week, Tutorial: 2 hours/week

UPL 475: Urban and Architectural Heritage (3 Credit Hours)
The course emphasizes on the importance of architectural and urban heritage. It introduces different criteria for classifying and documenting this heritage. Students taking this course will identify environmental problems: subsoil water, air pollution, visual pollution, misuse of buildings and spaces, negligence and lack of maintenance. They will also recognize the principles of preservation and techniques of restoration for architectural heritage.
Lecture: 2 hours/week, Tutorial: 2 hours/week

6. Study Plan

General Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 1)						
PHM 012	Calculus for Engineering (1)	**3**	3	1.5	0	
MDP 024	Production Engineering	**3**	3	0	1.5	
PHM 032	Engineering Mechanics (1) - Statics	**3**	3	1.5	0	
PHM 042	General Chemistry	**3**	2	2	1.5	
MDP 061	Engineering Design and Graphics	**4**	2	4	0	
HUM x11	English Language	**2**	1	2	0	
HUM x61	Computer Skills (Self Study)	**0**	0	0	0	
	Total Hours	**18**	**14**	**11**	**3**	
Second Main Semester (Term 2)						
ARC 011	Visual Studies and Design Fundamentals	**2**	0	4	0	
PHM 013	Calculus for Engineering (2)	**3**	3	1.5	0	PHM 012
PHM 014	Linear Algebra and Analytical Geometry	**3**	3	1.5	0	
PHM 022	Waves, Electricity, and Magnetic Fields	**3**	2	2	1.5	
PHM 033	Engineering Mechanics (2) - Dynamics	**3**	3	1.5	0	PHM 032
HUM x41	Professional Ethics	**2**	2	0	0	
HUM x51	Nile River & Contemporary Issues	**2**	2	0	0	
	Total Hours	**18**	**15**	**10.5**	**1.5**	

First Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 3)						
UPL 111	History and Theory of Urbanism	**2**	2	0	0	
CEP 114	Land Surveying	**2**	1	2	0	
ARC 115	Architectural Design Studio (1)	**3**	0	6	0	ARC 011
CES 117	Structure Analysis	**3**	2	2	0	PHM 012, PHM 032
ARC 122	History and Theory of Architecture	**2**	2	0	0	
ARC 132	Building Technology (1)	**3**	1	4	0	
HUM x91	Humanities Elective (1)	**2**	2	0	0	
	Total Hours	**17**	**10**	**14**	**0**	
Second Main Semester (Term 4)						
ARC 116	Shades, Shadows, and Perspective	**2**	1	2	0	
UPL 121	Urbanism and Climate	**3**	2	2	0	
ARC 136	Digital Presentation of the Built Environment	**2**	0	0	6	
ARC 143	Control of Thermal Environment	**3**	2	2	0	
CES 143	Building Engineering Materials	**3**	3	1.5	0	CES 117
ARC 152	Architectural Design Studio (2)	**3**	0	6	0	ARC 011
HUM x52	Communication & Presentation Skills	**2**	1	1	0	
	Total Hours	**18**	**9**	**14.5**	**6**	

Second Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 5)						
UPL 211	Introduction to Urban Design	**3**	1	4	0	UPL 111
UPL 212	People and Environment	**3**	2	2	0	
ARC 232	Building Technology (2)	**3**	1	4	0	ARC 132
ARC 242	Acoustics in Architecture	**2**	1	2	0	PHM 022
ARC 243	Renewable Energy and Buildings	**2**	2	1	0	ARC 143
ARC 244	Lighting in Architecture	**2**	1	2	0	PHM 022
ARC 252	Environmental Architectural Design Studio (1)	**3**	0	6	0	ARC 152
	Total Hours	**18**	**8**	**21**	0	
Second Main Semester (Term 6)						
UPL 224	Sustainable Urban Development	**3**	2	2	0	
CES 225	Reinforced Concrete Structures	**3**	2	2	0	CES 117
CEP 241	Green Infrastructure	**3**	2	2	0	
ARC 245	Principles of Sustainable Architecture	**3**	2	2	0	ARC 143, ARC 242, ARC 244
ARC 253	Environmental Architectural Design Studio (2)	**3**	0	6	0	ARC 252
UPL 261	Ecological Landscape	**3**	1	4	0	
	Total Hours	**18**	**9**	**18**	**0**	

Third Level

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 7)						
UPL 313	Housing Studies and Design	**3**	1	4	0	
UPL 315	Eco Urban Design (1)	**3**	1	4	0	UPL 224, UPL 261
CES 325	Steel Structures	**3**	2	2	0	CES 117
ARC 334	Working Drawings (1)	**3**	1	4	0	
ARC 354	Sustainable Architectural Design Studio (1)	**3**	0	6	0	ARC 245
UPL 343	Sustainable Urban Landscape	**3**	1	4	0	UPL 261
	Total Hours	**18**	**6**	**24**	**0**	
Second Main Semester (Term 8)						
ARC 316	Modeling of the Built Environment	**2**	0	0	6	
ARC 335	Working Drawings (2)	**3**	1	4	0	ARC 334
ARC 355	Sustainable Architectural Design Studio (2)	**3**	0	6	0	ARC 354
UPL 362	Eco Urban Design (2)	**3**	1	4	0	UPL 315
ARC 4xx/ UPL 4xx	Technical Elective (1)	**3**	2	2	0	
HUM x42	Principles of Law & Human Rights	**2**	2	0	0	
HUM x53	Research & Analysis Skills	**2**	1	1	0	
	Total Hours	**18**	**7**	**17**	**6**	

Fourth Level: Environmental Architecture Field

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
ARC 415	Building Performance Simulation	**2**	1	3	0	ARC 245
UPL 441	Eco Urban Design (3)	**3**	0	6	0	UPL 362
ARC 448	Sustainable Building Rating Systems	**2**	2	1	0	
ARC 456	Sustainable Architectural Design Studio (3)	**3**	0	6	0	ARC 355
ARC 476	Execution Documents	**3**	1	4	0	ARC 335
ARC xxx	Technical Elective (2)	**3**	x	x	0	
ARC 492	Studies and Program of Graduation Project	**2**	2	1	0	ARC 355
	Total Hours	**18**	**x**	**x**	**0**	
Second Main Semester (Term 10)						
ARC 443	Renewable Energy Systems	**3**	2	2	0	
UPL 474	Environmental Impact Assessment	**3**	2	2	0	
ARC 4xx	Technical Elective (3)	**3**	2	2	0	
ARC 4xx	Technical Elective (4)	**3**	2	2	0	
ARC 493	Graduation Project	**4**	0	8	0	ARC 456, ARC 492
HUM x92	Humanities Elective (2)	**2**	2	0	0	
	Total Hours	**18**	**10**	**18**	**0**	

Fourth Level: Environmental Urbanism Field

Course Code	Course Title	Credit Hours	Weekly Hours			Prerequisite
			Lec.	Tut.	Lab	
First Main Semester (Term 9)						
UPL 441	Eco Urban Design (3)	**3**	0	6	0	UPL 362
UPL 445	Sustainable Urban Mobility	**2**	2	1	0	
UPL 446	Introduction to Geographic Information System (GIS)	**3**	2	0	3	
CES 447	Sustainable Waste Management	**2**	2	1	0	
ARC 456	Sustainable Architectural Design Studio (3)	**3**	0	6	0	ARC 355
UPL 4xx	Technical Elective (2)	**3**	2	2	0	
UPL 495	Studies and Program of Graduation Project	**2**	2	1	0	
	Total Hours	**18**	**10**	**17**	**3**	
Second Main Semester (Term 10)						
UPL 448	Environmental Planning	**3**	2	2	0	
UPL 474	Environmental Impact Assessment	**3**	2	2	0	
UPL 4xx	Technical Elective (3)	**3**	2	2	0	
UPL 4xx	Technical Elective (4)	**3**	x	x	0	
UPL 496	Graduation Project	**4**	0	8	0	UPL 495
HUM x92	Humanities Elective (2)	**2**	2	0	0	
	Total Hours	**18**	**x**	**x**	0	