

## Energy and Renewable Energy Engineering Program

### **Program Description**

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

### **Career Prospects**

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

### **Program Concentrations**

There are two concentrations in this program:

**1. Power generation:** This concentration focuses on the Power generation field taking into consideration conventional (thermal) and renewable energy (hydro, tidal, wave, wind, solar photovoltaic, concentrated solar power, biomass, geothermal ...etc.), and waste conversion generating power stations. Power system analysis, stability, reliability, modelling, and advanced control are a core direction in this concentration. Graduates from these concentrations are qualified to join electricity

utilities such as generation (public and private) and transmission entities. The graduation project could focus on the design and the evaluation of possible uses of renewable energies, power delivery systems analysis and control ...etc.

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

### **Agreements with another University**

The program is partnered with University of East London (UEL), UK.

## Required Courses

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

*List of Energy and Renewable Energy Engineering Program Requirements courses.*

Code	Course Title	Credits and SWL			Contact Hours			
		CH	ECTS	SWL	Lec	Tut	Lab	TT
	Ain Shams University Requirements	14	17	425	12	6	0	18
	Faculty of Engineering Requirements	42	76	1900	34	23	14	71
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6
MDP112	Machine Construction	3	5	125	2	2	0	4
MDP211	Machine Elements Design	4	8	200	3	2	2	7
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5
MEP111	Thermal Physics	2	4	100	1	2	0	3
MEP211	Thermodynamics	4	6	150	3	2	1	6
MEP212	Heat Transfer	4	8	200	2	2	3	7
MEP311	Combustion	3	6	150	2	2	1	5
MEP221	Fluid Mechanics and Turbomachinery	4	7	175	3	2	1	6
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5
MEP426	Solar Energy	3	5	125	2	2	0	4
MEP427	Wind Energy	3	5	125	2	2	0	4
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4
EPM113	Electrical Measurements	3	5	125	2	2	1	5
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5
EPM115	Fundamentals of Electromagnetic Fields	3	6	150	2	2	0	4
EPM117	Energy Resources and Renewable Energy	3	5	125	2	2	0	4
EPM151	Industrial Electronics	3	5	125	2	2	0	4
EPM221	Electrical Machines (1)	3	5	125	3	1	1	5
EPM222	Electrical Machines (2)	3	6	150	3	1	1	5
EPM231	Electrical Power Engineering	3	5	125	3	1	1	5
EPM232	Automatic Control Systems	3	6	150	2	2	0	4
EPM251	Power Electronics for Energy Applications (1)	3	5	125	2	2	1	5
EPM311	Fundamentals of Photovoltaic	3	6	150	2	2	0	4
EPM334	Economics of Generation, Transmission and Operation	3	5	125	2	2	0	4
EPM354	Power Electronics for Energy Applications (2)	3	5	125	2	2	1	5
EPM454	Renewable Energy Resources Interfacing	3	6	150	3	1	0	4
EPM463	Power System Protection	4	7	175	3	2	0	5
	Energy Elective (1) – Pool A	3	5	125	2	2	0	4
	Energy Elective (2) – Pool A	3	5	125	2	2	0	4
	Energy Elective (3) – Pool A	3	5	125	2	2	0	4
	Energy Elective (4) – Pool B	3	5	125	2	2	0	4
	Energy Elective (5) – Pool B	3	5	125	2	2	0	4
EPM493	Energy Graduation Project (1)	3	6	150	1	4	0	5
EPM494	Energy Graduation Project (2)	3	6	150	1	4	0	5
<b>Total</b>		<b>170</b>	<b>300</b>	<b>7500</b>	<b>125</b>	<b>100</b>	<b>38</b>	<b>263</b>

Pool of Power generation Concentration Elective Courses								
Pool A								
EPM335	Fundamentals of Power Systems Analysis	3	5	125	2	2	0	4
EPM436	Computer Application in Electrical Power Systems	3	5	125	2	2	0	4
MEP312	Fundamentals of Internal Combustion Engines	3	5	125	2	2	1	5
MEP313	Thermal Power Plants	3	5	125	2	2	1	5
Pool B								
EPM435	Advanced Control on Power Systems	3	5	125	2	2	0	4
MEP414	Biomass and waste Conversion Technology	3	5	125	2	2	0	4
MEP423	Hydro-Tidal and Wave Energy	3	5	125	2	2	0	4
Pool of Energy Management Concentration Elective Courses								
Pool A								
EPM336	Electrical Distribution Systems Installations	3	5	125	2	2	0	4
EPM412	Microprocessor-Based Automated Systems	3	5	125	2	2	1	5
EPM413	Energy Management Essentials	3	5	125	2	2	0	4
EPM455	Electric Drives	3	5	125	2	2	0	4
EPM456	Power Quality for Energy Applications	3	5	125	2	2	0	4
Pool B								
MDP433	Quality Control	3	5	125	2	2	0	4
MDP434	Quality Systems and Assurance	3	5	125	2	2	0	4
MEP341	Refrigeration and Air Conditioning	3	5	125	2	2	0	4
MEP434	Water Desalination and Distillation	3	5	125	2	2	0	4

## Proposed Study Plan

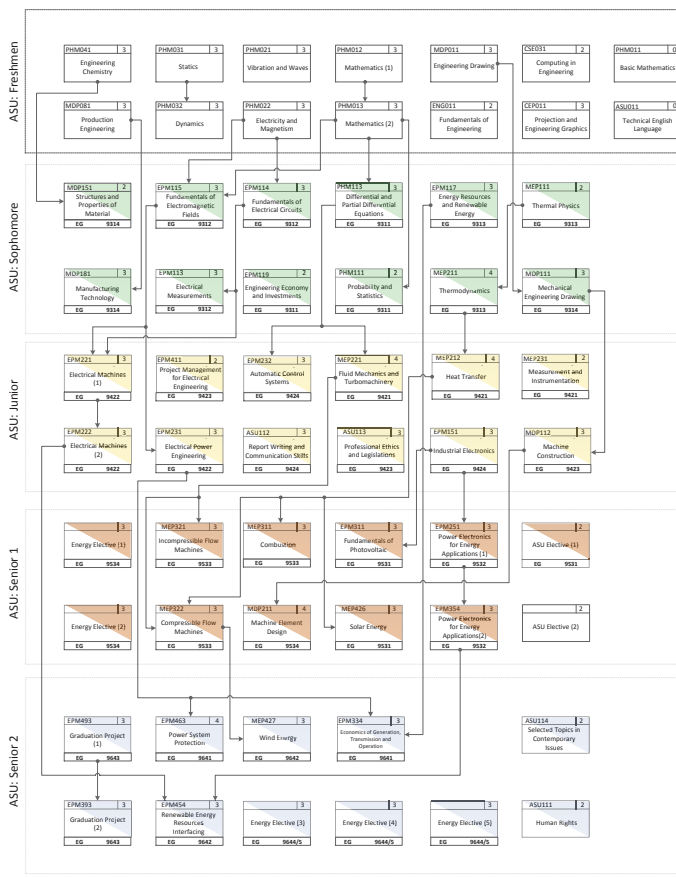
Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
<b>Semester 1</b>									
PHM012	Mathematics (1)	3	5	125	3	2	0	5	Eng/Math
PHM021	Vibration and Waves	3	5	125	3	1	1	5	Eng/Math
PHM031	Statics	3	5	125	2	2	1	5	Eng/Math
MDP011	Engineering Drawing	3	6	150	1	3	2	6	
PHM041	Engineering Chemistry	3	5	125	2	1	2	5	Eng
CSE031	Computing in Engineering	2	4	100	2	0	0	2	
Total		17	30	750	13	9	6	28	
<b>Semester 2</b>									
PHM013	Mathematics (2)	3	5	125	3	2	0	5	PHM012
PHM022	Electricity and Magnetism	3	5	125	3	1	1	5	Eng/Math
PHM032	Dynamics	3	5	125	2	2	1	5	PHM031
CEP011	Projection and Engineering Graphics	3	6	150	1	3	2	6	
MDP081	Production Engineering	3	5	125	2	0	3	5	Eng
ENG011	Fundamentals of Engineering	2	4	100	2	1	0	3	
Total		17	30	750	13	9	7	29	
<b>Semester 3</b>									
MDP151	Structures and Properties of Materials	2	4	100	2	1	1	4	PHM 041
PHM113	Differential and Partial Differential Equations	3	5	125	3	2	0	5	PHM013
EPM114	Fundamentals of Electrical Circuits	3	6	150	2	2	1	5	PHM022
EPM115	Fundamentals of Electromagnetic Fields	3	6	150	2	2	0	4	PHM013 PHM022
EPM117	Energy Resources and Renewable Energy	3	5	125	2	2	0	4	
MEP111	Thermal Physics	2	4	100	1	2	0	3	
Total		16	30	750	12	11	2	25	
<b>Semester 4</b>									
EPM119	Engineering Economy and Investments	2	4	100	2	1	0	3	
PHM111	Probability and Statistics	2	4	100	2	2	0	4	PHM013
EPM113	Electrical Measurements	3	5	125	2	2	1	5	EPM114
MDP181	Manufacturing Technology (1)	3	5	125	3	0	2	5	MDP081
MDP111	Mechanical Engineering Drawing	3	6	150	1	3	2	6	MDP011
MEP211	Thermodynamics	4	6	150	3	2	1	6	MEP111
Total		17	30	750	13	10	6	29	
<b>Semester 5</b>									
EPM221	Electrical Machines (1)	3	5	125	3	1	1	5	EPM114 EPM115
EPM232	Automatic Control Systems	3	6	150	2	2	0	4	PHM113
MEP212	Heat Transfer	4	8	200	2	2	3	7	MEP211
EPM411	Project Management for Electrical Engineering	2	4	100	2	1	0	3	
MEP221	Fluid Mechanics and Turbomachinery	4	7	175	3	2	1	6	PHM112
Total		16	30	750	12	8	5	25	

Code	Course Title	Credits and SWL			Contact Hours				Pre-requisites
		CH	ECTS	SWL	Lec	Tut	Lab	TT	
<b>Semester 6</b>									
EPM151	Industrial Electronics	3	5	125	2	2	0	4	
EPM222	Electrical Machines (2)	3	6	150	3	1	1	5	EPM221
EPM231	Electrical Power Engineering	3	5	125	3	1	1	5	EPM115
MDP112	Machine Construction	3	5	125	2	2	0	4	MDP111
ASU112	Report Writing and Communication skills	3	4	100	2	2	0	4	
MEP231	Measurement and Instrumentation	2	5	125	1	0	3	4	
Total		17	30	750	13	8	5	26	
<b>Semester 7</b>									
	ASU Elective (1)	2	3	75	2	1	0	3	
EPM311	Fundamentals of Photovoltaic	3	6	150	2	2	0	4	EPM151
EPM251	Power Electronics for Energy Applications (1)	3	5	125	2	2	1	5	EPM151
MEP311	Combustion	3	6	150	2	2	1	5	MEP212
MEP321	Incompressible Flow Machines	3	6	150	2	2	1	5	MEP221
	Energy Elective (1)	3	5	125	2	2	0	4	
Total		17	31	775	12	11	3	26	
<b>Semester 8</b>									
MDP211	Machine Elements Design	4	8	200	3	2	2	7	MDP112
EPM354	Power Electronics for Energy Applications (2)	3	5	125	2	2	1	5	EPM251
MEP426	Solar Energy	3	5	125	2	2	0	4	MEP212
MEP322	Compressible Flow Machines	3	6	150	2	2	1	5	MEP212 MEP221
	ASU Elective (2)	2	2	50	2	0	0	2	
	Energy Elective (2)	3	5	125	2	2	0	4	
Total		18	31	775	13	10	4	27	
<b>Semester 9</b>									
ASU113	Professional Ethics and Legislations	3	4	100	2	2	0	4	
ASU114	Selected Topics in Contemporary Issues	2	2	50	2	0	0	2	
EPM463	Power System Protection	4	7	175	3	2	0	5	EPM231
EPM334	Economics of Generation, Transmission and Operation	3	5	125	2	2	0	4	EPM117 EPM231
EPM493	Energy Graduation Project (1)	3	6	150	1	4	0	5	
MEP427	Wind Energy	3	5	125	2	2	0	4	MEP322
Total		18	29	725	12	12	0	24	
<b>Semester 10</b>									
ASU111	Human Rights	2	2	50	2	1	0	3	
EPM454	Renewable Energy Resources Interfacing	3	6	150	3	1	0	4	EPM222 EPM354
EPM494	Energy Graduation Project (2)	3	6	150	1	4	0	5	EPM493
	Energy Elective (3)	3	5	125	2	2	0	4	
	Energy Elective (4)	3	5	125	2	2	0	4	
	Energy Elective (5)	3	5	125	2	2	0	4	
Total		17	29	725	12	12	0	24	

# Energy and Renewable Energy Program course tree in Relation to UEL Dual Degree Modules

## UEL Modules

<b>Year # 1</b>	EG9311 Applied Mathematics for engineering problems	
	EG9312 Electrical circuits, measurements And electromagnetic fields	
<b>Year # 2</b>	EG9313 Energy Resources and Thermodynamics	
	EG9314 Materials and Mechanical manufacturing Engineering	
<b>Year # 3</b>	EG9421 Heat transfer and fluid mechanics	
	EG9422 Electrical Machines and power Engineering	
<b>Year # 4</b>	EG9423 Theory of machines and machine construction	
	EG9424 Fundamentals of electronics and control	
<b>Year # 5</b>	EG9531 Solar Energy	
	EG9532 Power Electronics and automation system	
<b>Year # 6</b>	EG9533 Combustion Engines and flow machines	
	EG9534 Machine Design and electromechanical industrial application	
<b>Year # 7</b>	EG9641 Economics of generation and distribution network protection	
	EG9642 Renewable energy and network interfacing	
<b>Year # 8</b>	EG9643 Graduation Project	
	EG9644 Energy Management technical studies	
	EG9645 Energy generation technical studies	



## Program Technical Electives

