

# Undergraduate Handbook

Department of Renewable Energy Engineering



Philadelphia University  
Amman – Jordan

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# Contact Information

**Department of Renewable Energy Engineering  
Philadelphia University**

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Amman, 19392

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*Important websites*

**Admission and Registration information**

<http://www.philadelphia.edu.jo/admissions>

<http://www.philadelphia.edu.jo/arabic/admission.asp>

**Department of Renewable Energy Engineering**

<http://www.philadelphia.edu.jo/faculties/faculty-of-engineering/renewable-energy-engineering>

**Deanship of Student affairs**

[http://www.philadelphia.edu.jo/university/index.php?option=com\\_content&task=view&id=134&Itemid=144](http://www.philadelphia.edu.jo/university/index.php?option=com_content&task=view&id=134&Itemid=144)

# Introduction

## History

Philadelphia University was established in 1989 as a private, accredited university in Jordan. The faculty of Engineering was established in 1991. The faculty of Engineering comprises the following departments:

- Computer Engineering
- Electrical Engineering
- Mechanical Engineering
- Communications and Electronics Engineering
- Mechatronics Engineering
- Architectural Engineering
- Civil Engineering
- Renewable Energy Engineering
- Alternative Energy Technology

The faculty of Engineering is housed in several buildings with a total area of 5400m<sup>2</sup>, and has 37 specialized and highly equipped laboratories. The total number of engineering students is around 1000 students.

## Mission Statement

As a distinguished academic institution, Philadelphia University commits itself to becoming a full partner in the development of both Jordanian society and other societies at the regional and global levels. The role of science, technology, information and means of communication is becoming absolutely vital to the well-being of humanity. In the coming few years, this role is bound to become a decisive engine of growth. High-quality relevant education, supported by problem-oriented, inter-disciplinary and inter-institutional research, is the only means of leading any society to become an active and productive partner in human civilization.

The speed of globalization and the collapse of cultural and economic barriers require modern education, e-learning and interactive systems to be rooted in democratic interaction, human rights, complete freedom of thought and greater creativity by the younger sectors of society.

As the rapid development of knowledge, science and technology could widen the cultural divide between generations and society, modern approaches to education and lifelong interactive learning will be indispensable in alleviating the effects of this trend.

Carrying a revered name, with deep roots in history, of a major city of the Despoils on the King Road linking old civilizations, Philadelphia University is committed to moving forward, through the twin engines of quality and modernity, along the information highway. It hopes to make a strong bond between knowledge, learning and modern civilization.

The keynote here is proper, fast-developing and morally charged education. Young men and women are the vehicle that launches societies into a future propelled by quality education to prosperity and innovation. Philadelphia University and its sister institutions will be instrumental in bringing this about.

# Renewable Energy Engineering Department

## Overview

The Renewable Energy Engineering Department at Philadelphia University start Accepting students in academic year 2017/2018 . The department has 3 faculty members with unique experience in various areas of renewable energy engineering, who graduated from globally ranked foreign institutions. The faculty to student ratio in the department is about 1:25, which will provide the students with more time to share with their respective faculty members to enhance the quality of learning. The department has 2 laboratories that are dedicated to exposing students to the latest technologies in the subjects taught. Each laboratory is supervised by a faculty member, and is run by an experienced engineer.

## Mission

Renewable Energy Engineering Program mission statement is:

- 1- Prepare Renewable Energy graduates for a career with a wide range of opportunities in design, development and, management.
- 2- Promote intellectual, ethical and technological aspects of the student.
- 3- Actively contribute, improve and sustain an environment of continuous learning with the professional ability for engineering application in local market taking in to account all possible technical and economic constraints.

## Facilities

### Department Laboratories

The following laboratories are the corner stone of the department where students get exposed to the latest equipments used in the design, implementation and troubleshooting of modern Technology related to renewable Energy Resources.

#### Solar Energy Lab (611526)

#### Wind Energy Lab (611536)

## **Technology Incubators**

*“Economic and social development cannot be achieved in the absence of initiative and creativity, or in the presence of fear of change”*

### **His Majesty King Abdullah II**

The Jordan Innovation Center (JIC) at Philadelphia University is a new type of Business Incubators to be launched in Jordan to provide support and development of new innovative technical and business ideas. It supports innovative projects in any discipline provided that it has a potential for commercial use.

A Business Incubator provides “a unique and highly flexible combination of business development processes, infrastructure and people, designed to nurture and grow new and small businesses by supporting them through the early stages of development and change.” (UKBI)

Business Incubators are a powerful economic development tool used extensively in Europe and the USA with around 4000 in existence worldwide today. The JIC at Philadelphia University intends to replicate this success within the Jordanian economy.

The Renewable Energy Engineering Department at Philadelphia University has direct interactions with the Business Incubator at the university.

# Faculty Members

The Renewable Energy Engineering Department includes the following full time faculty members:

	Name	Academic Rank	contact
	<b>Firas Obeidat</b>	Assistant Professor <b>(Department chair)</b>	<b>Specialty:</b> Renewable Energy System. <b>Tel:</b> 4799000 Ext: 2128 <b>Email:</b> <a href="mailto:fobeidat@philadelphia.edu.jo">fobeidat@philadelphia.edu.jo</a>
1	<b>Ali Abdul Halim Badran</b>	Professor	<b>Specialty:</b> Thermal Power <b>Tel:</b> 4799000 Ext: 2338 <b>Email:</b> <a href="mailto:abadran@philadelphia.edu.jo">abadran@philadelphia.edu.jo</a>
2	<b>Munzer Ebaid</b>	Professor	<b>Specialty:</b> Thermofluid <b>Tel:</b> 4799000 Ext: 2338 <b>Email:</b> <a href="mailto:mebaid2@philadelphia.edu.jo">mebaid2@philadelphia.edu.jo</a>
3	<b>Ibrahim Omar Rahoma</b>	Professor	<b>Specialty:</b> Thermal Power <b>Tel:</b> 4799000 Ext: 2450 <b>Email:</b> <a href="mailto:irahoma@philadelphia.edu.jo">irahoma@philadelphia.edu.jo</a>
4	<b>Mohammad Massadeh (Scholarship)</b>	Assistant Professor	
5	<b>Zaid Al-Atary</b>	Lecturer	<b>Specialty:</b> renewable enrgy <b>Tel:</b> 4799000 Ext: 2450 <b>Email:</b> <a href="mailto:zalatari@philadelphia.edu.jo">zalatari@philadelphia.edu.jo</a>
6	<b>Ahlam Damaty</b>	Lecturer	<b>Specialty:</b> electrical engineering <b>Tel:</b> 4799000 Ext: 2339 <b>Email:</b> <a href="mailto:adamati@philadelphia.edu.jo">adamati@philadelphia.edu.jo</a>

# Renewable Energy Engineering Curricula

## Overview

Due to limited supply of hydrocarbon fuel and the global warming problem, there is currently an increasing demand on renewable Energy. The aim of the renewable energy department is to graduate qualified Engineers in renewable energy such as the solar, wind, geothermal and biogas powers that will satisfy the need of local and regional market in the field of renewable energy. Students at renewable energy department / Faculty of Engineering / Philadelphia university will be qualified to obtain B.S degree in Renewable Energy Engineering. Students will study courses in electrical engineering, power conversion, mechanical engineering, and renewable energy resources and essentials.

The Renewable Energy Engineering curricula at Philadelphia University consist of 160 credit hours (CHs). Out of the 160 CHs, there are 27 CHs that are university requirements, 29 CHs (26 that are faculty compulsory requirements plus 3 CHs faculty optional requirements), and 104 CHs that are department requirements. Each is divided into sub-requirements as shown in the tables that follow. Grades at Philadelphia University are given in percentages (out of 100). A student is supposed to pass the courses with an accumulative grade point average of **60%** to graduate. A detailed grade description can be found at the admissions office website.

### Program Educational Objectives

The graduates of the renewable energy department on completion of the program are expected to:

- 1- Apply the basic concepts of mathematics, science and engineering in the solution of wide range of renewable energy engineering technical and practical problems.
- 2- Possess the ability to experiment, design, develop, operate and service technical system that integrate contemporary engineering practices and modern tools and to overcome environmental and sustainability constraints.
- 3- Promote an environment for personal professional development in leadership skills, accountability, multi-disciplinary team work, communication skills decision making and ethical practices.
- 4- Pursue postgraduate studies and engage in professional engineering practices in work markets at all levels with emphasis on continuous career development.
- 5- Engage in innovational and entrepreneurial project to generate sustainable technical and economic development in local communities.



# Renewable Energy Engineering Curricula 2018-2019

Philadelphia University  
Faculty of Engineering and Technology

Renewable Energy Engineering Department  
(2018-2019)  
Total Credit Hours (160) Hrs.



Approved on Feb. 25<sup>th</sup> 2020

First: University Requirements (27) Cr.H.			
A. First Field: University Compulsory Requirements: (15) Cr.H.			
Course No.	Course Title	Cr.H.	Prerequisite
114101	Arabic Language Skills (1)	3	114099
111100	Military Science	3	---
130101	English Language Skills (1)	3	130099
130102	English Language Skills (2)	3	130101
111101	National Education	3	---
111000	Student Community Service	0	---
B. University Elective Courses (12) Cr.H.			
The student studies 12 credit hours from the table below:			
Course No.	Course Title	Cr.Hr.	Prerequisite
140111	Language Skills (1)	3	---
140112	Language skills (2)	3	---
111133	Human Vision & Civilization (1)	3	---
420143	Legal Culture	3	---
420140	Human Rights	3	---
330111	Introduction to Project Management	3	---
731102	Social Networking Skills	3	---
910102	Health Education	3	---
780101	Connectivity&Communications Skills	3	---
610230	Entrepreneurship and Creativity	3	---
240152	Environmental Culture	3	---
111112	Introduction to Psychology	3	---
<b>Notes:</b> - All students must take level examinations in Arabic Language, English language and Computer skills. Student who fails to pass in any examinations (less than 50 %) must successfully pass the remedial course which He / She did not pass.			
<b>Codes used in Curriculum:</b> (610) Electrical Eng.                      (620) Mechanical Eng. (611) Renewable Energy Eng.        (615) Alternative Energy Technology (630) Computer Eng.                    (640) Mechatronics Eng. (650) Communications & Electronics Eng. (660) Architectural Eng. (670) Civil Eng.			

Second: Faculty Requirements: (27) Cr. Hr.			
Course No.	Course Title	Cr.H.	Prerequisite
250101	Calculus (1)	3	---
250102	Calculus (2)	3	250101
211101	General Physics (1)	3	---
211102	General Physics (2)	3	211101
212101	General Chemistry (1)	3	---
660131	Manual Engineering Drawing	1	---
660132	Computer Engineering Drawing	1	660131
620171	Engineering Workshop (1)	1	660132
630263	Programming Language	3	---
640253	Engineering Skills	3	130102
610550	Entrepreneurship	3	640253

Third: Department Requirements (106) Cr.H.			
A. Compulsory Requirements: (82) Cr.H.			
Course No.	Course Title	Cr.H.	Prerequisite
620172	Engineering Workshop (2)	1	620171
212102	General Chemistry Lab. (1)	1	212101
610211	Electrical Circuits (1)	3	211102
610216	Electrical Circuits Lab.	1	610211(*)
620213	Solid Mechanics	3	620211
620434	Machine Design (1)	3	620213
620211	Statics	3	250102+211101
620212	Dynamics	3	620211
650242	Electronics (1)	3	610216
610332	Instrumentation & Measurement	3	211102
620320	Fluid Mechanics (1)	3	620212+650260
620429	Fluid Mechanics Lab.	1	620320(*)
620323	Thermodynamics (1)	3	211102+250102
620420	Heat transfer (1)	3	620323+650260
620427	Thermal Lab.	1	620420(*)
620373	Properties of Engineering Materials	3	620429

Course No.	Course Title	Cr.H.	Prerequisite
610414	Automatic Control	3	610332+650260
611311	Energy Conversion and efficiency	3	620420
611341	Introduction to Renewable Energy	3	211102
611312	Energy Economics and Management	3	611311
611411	Energy Legislations	3	611311
611421	Solar Thermal Energy	3	611341 +620420
611422	Photovoltaic Energy System	3	611341 +650242
611440	Engineering Project (1)	1	(100) Cr.Hr
611511	Environmental Impact of energy	3	611312
611521	Solar Thermal Energy Technology	3	611421
611531	Wind Energy Systems	3	611341 +620373
611532	Design of Wind Energy Systems	3	611531
611526	Solar Energy Lab.	1	611421 +611422(*)
611536	Wind Energy Lab.	1	611531(*)
610530	Power Electronics	3	650242
611540	Engineering Project (2)	2	611499+611440
611499	Engineering Training	3	(115) Cr.Hr
B. Compulsory Support Requirements: (15) Cr. Hr.			
Course No.	Course Title	Cr.H.	Prerequisite
250205	Linear Algebra & Vector Calculus	3	250102
250202	Calculus (3)	3	250102
650260	Engineering Analysis (1)	3	250102
630262	Engineering Analysis (2)	3	250205
611301	Engineering Statistics	3	650260
C. Elective Requirements: (9) Cr. Hr.			
Course No.	Course Title	Cr.H.	Prerequisite
611541	Bioenergy Systems	3	611341
611545	Green Building Design	3	611411
611543	Hydraulic and Waves Energy	3	611341+620320
630522	Modeling and Simulation	3	630262+611301
611542	Geothermal Energy	3	611341 +620420
611544	Special Topics in Renewable Energy	3	Dept. Approval
(*) Concurrent			

# Course Description

## **(250101) Calculus I**

General Introduction. Differentiation. Mean value theorem. Integration- the fundamental theorem and applications. Techniques of integration. Sequences. Infinite and power series. Conic section. Polar coordinators. Vector functions. Differentiation. Curves. Arc length. Applications in mechanics.

## **(250102) calculus II**

Infinite and power series, Conic Sections, Polar Coordinates, Vector functions, Arc-Length, Applications in mechanics, Functions of several variables, Partial differentiation, The Gradient, Directional derivatives, Tangent lines, Tangent planes, The Normal line, Maxima and minima, The Second partial test, Lagrange method, Multiple integrals (double and triple). Line and surface integrals, Theorems of Green, Gauss and Stokes.

## **(211104) Applied Physics**

This module is a first year physics course which will introduce the students to the basic language and ideas of physics that occur in all branches of science and technology. In addition it provides them with a clear and logical presentation of the basic concepts and principles of physics, and to strengthen their understanding through a broad range of interesting applications to the real world. Topics include: space and time; vectors; straight-line kinematics; circular motion; experimental basis of Newton's laws and some application; work and energy; electric charge and force; electric field; Gauss's law; electric potential and electrostatic energy; capacitance and dielectrics; current and resistance; elements of circuit analysis and Kirchhoff's laws; magnetostatics; and sources of magnetic field.

## **(212101) General Chemistry (1)**

Pre or co-requisites: none, credit hours: 3, compulsory course to the students studying at the faculties of science, Engineering, pharmacy and nursing.

This course involves studying the fundamental theories of chemistry and covers atomic nature of matter, stoichiometry, periodic table, aqueous solutions and concentrations, oxidation – reduction reactions, atomic structure, chemical bonding, law of gases, acids and bases.

## **(130102) English Skills II.**

This is a continuation of English skills I with emphasis on continued improvement of general English skills and critical skills within the context of reading and writing skills development. Students are expected to read, understand and analyze original texts in a wide range of topics. They are also expected to write well-organized paragraphs and short essays.

## **(630262) Engineering Analysis II**

Matrices, Determinants, Solution of Linear and nonlinear equations. Direct and iterative solutions. Interpolation and curve fitting. Numerical integration and differentiation. Numerical Solution of differential equations. Fourier series and Fourier Transform.

## **(630263) Programming Language**

C and C++ Programming Environment: Compiled language, program creation, structure of programs, Problem solving techniques, Elements of C++ programming language, Operands of C++, Expressions, Program design process, Control structures, Looping, Functions, C++ stream input/output, Structured types, Data abstraction and classes, Arrays, Pointers, dynamic data and reference types, File processing, Templates.

**(640253) Engineering Skills**

Introduction to technical reports, logical structures of technical reports, coherence on log reports. Way to use teamwork, editing for style and usage, scopes and aims of engineering ethics. Moral reasoning and ethical theories, engineering as social experimentation, the engineer responsibility to safety, responsibility to employers, rights of engineers.

**(620131) Engineering drawing**

Instruments and their use, Graphic geometry, Lettering, Orthographic and isometric drawing and sketching, Sectional views, Introduction to descriptive geometry, Surface intersections and developments, Computer (ACAD).

**(620171) Workshop (1)**

Development of basic skills in fields of hand filing, Turning, Welding, Piping and plumbing, Carpentry, Sand casting, Glass works, Sheet metal fabrication, Metal forming.

**(620172) Workshop (2)**

Household electric circuits, Florescent lamps circuits, parallel and series circuits, switches and fuses installations, electronic welding, electronic devices maintenance and circuit-boards design.

**(620211) Statics**

Introduction to mechanics of rigid bodies, Basic concepts: force and displacement vectors, Force systems, Equivalent force systems, Static equilibrium, Analysis of simple structures, Friction, Geometric properties: centroids and moments of inertia.

**(620212) Dynamics**

Review of dynamics of particles, Two and Three-dimensional dynamics of rigid bodies; Force and acceleration, Work and Energy, Impulse and momentum.

**(620213) Solid Mechanics**

Introduction to mechanics of deformable bodies; concepts of stress and strain, Classification of material behavior, Stress-strain relations and generalized Hook's Law, Members under axial load, Torsion of circular rods and tubes, Bending and shear stresses in beams, Combined stresses in beams, Stress analysis and Mohr's circle, Thin wall cylinders, Deflection of beams, Buckling of columns.

**(620320) Fluid Mechanics (1)**

Hydrostatics, Steady and unsteady flow, Continuity equation, Flow of incompressible ideal flow, Potential flow, Bernoulli equation, One dimensional Euler's equation, Energy equation, Impulse-Momentum principles, Dimensional analysis, Introduction to boundary layer, Fluid flow in pipes, Pipe friction.

**(620323) Thermodynamics (1)**

Basic course in engineering thermodynamics, Properties and behavior of pure substance, First law, Second law, Entropy, System and control volume analysis.

**(620324) Thermodynamics (2)**

Availability and irreversibility, Vapor and air-standard power and refrigeration cycles, Thermodynamic relations, Ideal and real gases and generalized charts, Non-reacting mixtures and solutions, Chemical reactions and combustion.

**(620420) Heat Transfer**

Introduction to modes of heat transfer; one-dimensional steady state conduction; unsteady state conduction, Lumped heat capacity system; introduction to convection, Flow and thermal boundary layers, Laminar and turbulent boundary layers; convection in internal and external flows; empirical relations for forced convection heat transfer; natural convection systems; condensation and boiling; introduction to thermal radiation

**(620414) Mechanical Vibrations**

Properties of oscillatory motion, Derivation of governing differential equations, Free and damped vibrations, Harmonically excited motion, Rotating and reciprocating unbalance, Support motion, Vibration measurements, Vibration isolation, Transient vibrations, Free and forced vibrations in multi degrees of freedom, Vibration absorbers, Continuous systems.

**(620427) Thermal Lab.**

Experiments Related to the Subjects Covered in Heat Transfer Course.

**(620429) Fluid Mechanics Lab.**

Experiments Related to the Subjects Covered in Fluid Mechanics I Course.

**(610550) Entrepreneurship**

Basic Concepts of macro & micro economics, Economy architecture, production process, The effect of Science and Technology on production, The use of Science and Technology in production, Skills, Free business, Services and commodities production, Methods of project propagation, Marketing studies, Export, import and interior market consumption, Project forming, project requirements, economic appraisal studies, project financing, banking, companies, Cost studies, Project management, Marketing.

**(610111) Fundamentals of Engineering.**

Integrate engineering topics with each other that aim to improve the knowledge of the engineering science. improve the knowledge of the engineering thinking. Analysis of the engineering problems. Remark on the engineering units.

**(610211) Electric circuits(I)**

Dc Circuits: Definitions and Units. Basic Concepts (Charge, Current, Voltage, Power Energy). Circuit Elements (Independent and Dependent Voltage and Current Sources. Resistors. Capacitors. Inductors). KVL and KCL. Mesh and Nodal Circuit Analysis. Network Theorems (Thevenin, Norton, and superposition). Transient Analysis of RL, RC, and RLC Circuits. Introduction to AC Circuits.

**(610216) Electric circuit Lab.**

DC circuits. KVL and KCL. Mesh and nodal circuits analysis. Network theorems transient analysis of RL. RC and RLC circuits. AC circuit analysis.

**(610332) Instrumentation and Measurement**

Measurement and errors. Units and standards. Analog meters. Potentiometers. DC and AC bridge instruments. Transformers. Electronics measuring instruments. Oscilloscope. Frequency and phase measurements. Transducers.

**(610336) Instrumentation and Measurement Lab.**

Sensitivity of wheatstone bridge. Wien bridge. Capacitance measurement. FMinstrumentation for capacitive and inductive transducers. Strain-gage. Thermistor. Platinum thermometer. Temperature-control. Photodiode. Photovoltaic-cell. Spectral and polar responses of phototransducer.

**(610314) Electrical Machines(I)**

Transformers. DC Motors and Generators. Three-Phase Induction motors. SinglePhase Induction Motors. Three-Phase Synchronous Generator and Motor. SinglePhase Synchronous Generator and Motor. AC Series Motor. Repulsion Motor.

**(610316) Electrical Machines (I) Lab.**

Transformers. DC Motors and Generators. Single and Three Phase Induction Motors. Single and Three Phase Synchronous Generators and motors. AC Series Motors.

**(610414) Automatic Control**

Introduction to Feedback System. Review of System Equations. Block Diagram and Signal Flow Graphs. Time Response of Systems and Closed Loop Performance. Routh's Stability Criterion. The Root Locus Method. Frequency-Methods. Compensation Techniques. Introduction to Sampled Control System.

**(610530) Power Electronics**

Steady-state characteristics of SCR devices. Triggering techniques, SCR commutation methods,. Rectifying circuits with different loads. AC voltage controllers. DC-to-DC controllers. Cycloconverters applications. Triac devices and applications.

**(650242) Electronics (1)**

Semiconductor theory. PN junction. Diode circuits and applications. Bipolarjunction transistor characteristics. DC biasing and small signal analysis. Field effect transistor theory and applications.

**(630211) Logic Circuits**

Number Systems: Binary. Octal. Decimal. And Hexadecimal. Boolean Variables and Algebra Minimization of Boolean functions. Combinational Circuits. With MSI Components. Sequential Circuits Analysis and design. MSI Counters and Registers. Memories. Introduction to Computers.

**(630414) Embedded Systems**

It includes system requirements specifications, architectural and detailed design, and implementation, focusing on real-time applications. Learning the concepts will be enforced by a Project to design and develop an embedded system based on a singlechip microcontroller

**(630522) Modeling & Simulation**

Introduction: Physical model. Symbolic model. Mental model. Modeling methodology: analysis, formulations, solution strategy, verification. Validation and certification. Discrete simulation. Continuous simulation. Event activity and processes. Monte Carlo Simulation. Process oriented approach. Random number and random variables. Simulation Language.

**(611301) Engineering Statistics**

Data Processing. Probability Theory. Random Variables. Probability Distribution. Modeling Theory. Statistics Estimation. Tests Hypothesis. Statistics Analysis.

**(611311) Energy Conversion and Efficiency**

Discussing Methods for Maximizing Available Energy. Energy Conversion. Advances in Energy Conversion from a Wide Variety of Currently Available Energy Sources. Describes Energy Sources Such as Fossil Fuels, Biomass including refuse-derived biomass Fuels, nuclear, solar radiation, wind, Geothermal, and Ocean. Then Provides the Terminology and Units Used for Each Energy Resource and Their Equivalence. A Comprehensive Description of the Direct Energy Conversion Methods, Including, Photovoltaics, Fuel Cells, Thermoelectric Conversion, Thermionics and MHD. It Briefly reviews the physics of PV Electrical Generation. Discusses the PV System Design Process. Discusses Five Energy Storage Categories: Electrical, Electromechanical, Mechanical, Direct Thermal, and Thermochemical. The Storage Methods That Can Store and Deliver Energy.

**(611312) Energy Economics and Management**

Principles of Energy Management. Energy Conservation. Energy Auditing and Analysis. Formulation of Energy Management Options. Economic Assessment and Conservation Technology of Energy. Energy Saving in Big Industries. Steam Generation. Electric and Distribution Energy Systems Management. Integral Planning for the Resources. Demand Management. Cogeneration. Total Power Schemes. Thermal Insulation. Energy Storage.

**(611411) Energy Legislations**

Environmental legislations in Jordan and Environmental Management Systems (ISO 14000). Pollution. Land Use. Waste and Resource Recovery. Pesticides and Toxic Substances. Energy. Global Environmental Law. Principles of Environmental Impact Assessment. Writing of Environmental Impact Assessment Reports. Environmental Requirements for New Industries License.

**(611421) Solar Thermal Energy.**

Introduction of Solar Thermal Energy. Residential. Commercial and Industrial Applications. Solar Radiation. Heat Transfer. Plane and Concentrated Collectors. Water Heating Applications. Heating and Cooling the Buildings. Thermal Industrial Applications Water Desalination. Solar Thermal Energy System.

**(611422) Photovoltaic Energy Systems**

Introduction to Renewable and Historical Overview. Functioning of the Photovoltaic Cells Efficiency of Solar Cells. Types of Solar Photovoltaic Cells. Energy Depreciation of Photovoltaic Cells. Photovoltaic System Types. Conversion and Specifications. Charge Regulators. Power Factor. Network-Connected Photovoltaic Systems (On-grid). Network-Connected Home Systems (Possibility for Own Consumption). Network-Connected Solar Power Plants (Farms). Standalone Systems (Off-grid) or Isolated Systems, Hybrid Systems. Independent. Systems for Economic Purposes.

**(611526) Solar energy lab.**

Sun Radiation Measurements. Properties of Photovoltaic Devices. Open Circuit Voltage and Short Circuit Current. Maximum Power Point (MPP). The Efficiency of Solar Cells. Parallel and Series Solar Cells. Shadow, Temperature and Dust Effect. Battery Charging and Control. Off-grid Connection. On-grid Connection.

**(611511) Environment Impact of Energy**

Applications of Chemistry and Engineering Fundamentals to Understand Environmental Concepts Related to Human Activities. Mass and Energy Transfer. Environmental Chemistry for Water and Air Pollution. Pollution Management and Hazard Evaluation.

Introduction to Chemical. Physical and Biological Related to Quality of Water. Air and Earth Environment. Parameters That Effect Energy Consumption and Building Utilization. Basic Resources and Utilization of Energy. Energy Conversions. Distribution and Utilization of Electricity and Heat. Environment Impact of Energy Technology.

**(611521) Solar Thermal Energy Technology**

Solar Energy Technology deals with All Aspects of Solar Energy Systems. Advance Topics in Solar Cell Energy. Design High Efficient Solar Cells. Reliability of Solar Thermal Energy. Monitor the System Efficiency. Maintenance and Perfect of the System.

The Fundamentals of Predicting Availability. Economic Appraisal Strategies. Specific Collector Sub-systems. Including a Proven Analytical Procedure for Predicting Performance. and Analyses of Solar Energy Systems from Dryers to Greenhouses. Passive Solar Buildings to Water Pumps, are Covered in Depth.

**(611531) Wind Energy Systems**

Historical Applications of Wind Energy. Electrical Power From The Wind and the Batteries. Wind Energy System (Rotor Blades, the Tower, Mechanical Drive, Electrical System, etc). Physical Principles of Wind Energy Conversion. Basic Concepts of Wind Energy Converters (Turbines). Aerodynamics of Turbines. Using Computer Software for Wind Energy Analysis.

**(611532) Design of Wind Energy Systems**

Electrical Power from Wind Energy. Electrical Aspects of Wind Turbines. Wind Turbine Design. Wind Turbine Control. Wind Turbine Installation, Siting, System Design, Integration and Operation. Offshore and Onshore Wind Turbines. Wind Turbine Costs. Environmental Impact. Wind Turbine Economics. Using Computer Software for Wind Energy Analysis.

**(611536) Wind Energy Lab.**

Study of the Conversion of Kinetic Wind Energy Into Electrical Energy. Study of the Conversion of Kinetic Wind Energy Into Electrical Energy. Determination of the Typical Parameters of The Aerogenerator (Short Circuit Current, Open-Circuit Voltage, Maximum Power), and I-V Curve. Study of Voltage, Current and Power in Function of Different Loads and the Influence of the Load Variation on the Aerogenerator. Study of the Power Generated By the Aerogenerator Depending on the Incident Angle of the Air. Study of The Aerogenerator Operation in Function of the Blade Configuration (Aerogenerator With 6, 3 Or 2 Blades), and the Optimum Number of Blades. Study of the Efficiency of a Wind Power Unit. Study of the Connection of Loads to Alternating Voltage of 220V. Study of the Inverter Connected to the Grid Simulator.

**(611341) Introduction to Renewable Energy**

Introduction to Renewable Energy Include Photovoltaic, Wind power, Micro Hydropower, Biomass Energy, Waste Power, Solar Thermal Power, Geothermal Power, Ocean Energy (Tidal, Tide-Flow and Wave), and Ocean Energy (OTEC). Comparison of Characteristics and Cost of Renewables. How Sun, Wind, Biomass, Geothermal Resources, and Water Can be Used to Generate More Sustainable Energy. The Fundamentals of Energy, Including the Transfer of Energy, As Well As the Limitations of Natural Resources. Starting With Solar Power. How Energy From The Sun is Transferred and Stored, Used for Heating, Cooling and Lighting, Collected and Concentrated, and Converted Into Electricity.

**(611541) Bioenergy system**

Introduction to Biomass Energy. Bioenergy systems. Organic Materials (Plants etc.). Biomass Energy. Waste power. Transfer of Solid Material to Gas, Gas collection Technologies Burning and Digestion of Wet Wastes. Biomass as a Source of Renewable Energy.

**(611542) Geothermal Energy**

Introduction to Heat Transfer. Geothermal Resources. Heat Transfer Mechanisms. Different Heat Exchange Systems. Thermodynamics Applications. Analysis, Design and Control of Heating and Cooling Systems.

**(611543) Hydraulic and wave energy**

Fluids and Fluid Flow. Hydraulic and Air System Implementations. Installation and Modeling of Principles of Performance. Function and Applications of Hydraulic and Air Component, Valves, Cylinders and Pumps. Linear and Circular Motion Control Circuits. Design Principles and Implementation in Hydraulic and Air Systems. Systems and Devices of Hydraulic Energy Generation. The Transfer and Control of Energy. Drawing and Installation of Circuit and Hydraulic Systems. Performance Improvements for the Systems in Industrial Processes.

**(611544) Special Topics in Renewable Energy**

Special Topics in Renewable Energy Engineering.

**(611458) Engineering Training**

A training period of (8) weeks , after (90) credit hours is , to be spent in the industry (inside or outside Jordan) under the follow-up of an academic member from the department, periodical as well as a final reports and oral examinations are required.

**(611359) Engineering Project I**

Theoretical investigation, practical implementation or both of a project under the supervision of a faculty member. Detailed report as well as oral examination are required.

**(611459) Engineering Project II**

The student should attach himself to one or more faculty members who assign him a project. He analyzes this project and suggests a method to carry out the project in the next stage.

**(611559) Engineering Project III**

Based on the results obtained from the first stage. The student carries out the project suggested by the department.



# *Advisement Plan for Renewable Energy Department*

<b>First Year</b>							
<b>First Semester</b>				<b>Second Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>
114101	Arabic Language Skills (1)	3	114099	111101	National Education	3	----
130101	English Language Skills (1)	3	130099	130102	English Language Skills (2)	3	130101
250101	Calculus (1)	3	-----	250102	Calculus (2)	3	250101
211104	Applied Physics	3	-----	----	Selective College Course	3	----
620131	Engineering Drawing	3	-----	630263	Programming Language	3	----
620171	Engineering Workshop (1)	1	-----	620172	Engineering Workshop (2)	1	620171
<b>Total</b>		<b>16</b>		<b>Total</b>		<b>16</b>	

<b>Second Year</b>							
<b>First Semester</b>				<b>Second Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>
630262	Engineering Analysis (2)	3	250102	640253	Engineering Skills	3	130102
610211	Electric Circuits (1)	3	211104	611301	Engineering Statistics	3	250102
630211	Logic Circuits	3	630263	620212	Dynamics	3	620211
620211	Statics	3	250101	650242	Electronics	3	610211
111100	Military Science	3	----	620213	Solid Mechanics	3	620211
				610216	Electric Circuits Lab.	1	610211
<b>Total</b>			<b>15</b>	<b>Total</b>		<b>16</b>	

<b>Third Year</b>							
<b>First Semester</b>				<b>Second Semester</b>			
<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Cr. H.</b>	<b>Prerequisite</b>
610314	Electric Machines (1)	3	610211	620324	Thermodynamics (2)	3	620323
610332	Instrumentation and Measurement	3	650242	611311	Energy Conversion and efficiency	3	610314
620320	Fluid Mechanics	3	630262	620420	Heat transfer (1)	3	620323
620323	Thermodynamics (1)	3	250102		Selective University Course	3	----
----	Selective University Course	3	----	610316	Electric Machines Lab.	1	610314
611359	Engineering Project (1)	1	620172	610336	Instrumentation and Measurement Lab.	1	610332
				610429	Fluid Mechanics Lab.	1	620320
<b>Total</b>		<b>16</b>		<b>Total</b>		<b>15</b>	

Fourth Year							
First Semester				Second Semester			
Course No.	Course Title	Cr. H.	Prerequisite	Course No.	Course Title	Cr. H.	Prerequisite
611312	Energy Economics and Management	3	611311	610414	Automatic Control	3	620172
611341	Introduction to Renewable Energy	3	611311	611411	Energy Legislations	3	6100312
620414	Mechanical Vibration	3	620212	611421	Solar Thermal Energy	3	611411
630414	Embedded Systems	3	630211	611422	Photovoltaic Energy System	3	650242
----	Selective University Course	3	----	----	Selective University Course	3	----
620427	Thermal Lab.	1	620420				
<b>Total</b>		<b>16</b>		<b>Total</b>		<b>15</b>	

Fourth Year			
Summer Semester			
Course No.	Course Title	Cr. H.	Prerequisite
611458	Engineering training	0	115 Cr. H.

Fifth Year							
First Semester				Second Semester			
Course No.	Course Title	Cr. H.	Prerequisite	Course No.	Course Title	Cr. H.	Prerequisite
611511	Environmental Impact of energy	3	620323	610550	Engineering Entrepreneurship	3	640253+120 Cr.H.
611521	Solar Thermal Energy Technology	3	611531	611532	Design of Wind Energy Systems	3	6100531
611531	Wind Energy Systems	3	620414	610530	Power Electronics	3	650242
----	Selective University Course	3	----	630522	Embedded Systems	3	630211
----	Selective Department Course	3	----	----	Selective Department Course	3	----
611526	Solar Energy Lab.	1	611421	611536	Wind Energy Lab.	1	6100531
611459	Engineering Project (2)	1	120 Cr. H.	611559	Engineering Project (3)	2	611459
<b>Total</b>		<b>17</b>		<b>Total</b>		<b>18</b>	

# Student Advising

The definition of academic advising is based on the interaction between the engineering student and his/her advisor until the required courses within his/her curricula is taken.

The student has to know the following:

- Each student in the Faculty of Engineering is assigned an academic advisor by the department. The advisor is responsible for advising what courses are chosen for registration. This should be performed at the beginning of every semester.
- The student has to take the following points into consideration regarding the registration process:
  - Making sure that he/she passed the relevant prerequisite courses (refer to Computer Engineering Curricula)
  - Following the sequence of registration steps shown in the study plan, which are as follows:
    - University requirements: compulsory courses and electives.
    - Faculty requirements: compulsory and electives.
    - Specialty requirements.
  - Consulting the study plan during the registration process in respect of the number of credit hours a student can take per semester.
  - As the academic advising process is not compulsory, the student can register for classes without taking the advisor's comments into consideration, but he/she will take full responsibility for this action and its consequences since this might delay his/her graduation.
- The student must understand that he/she has to register for a minimum of 12 credit hours and a maximum of 18 in regular semesters.
- The student has the right to withdraw (drop) from a course or more during a certain semester provided that he/she remains registered for at least 9 credit hours. This withdrawal (drop) must be approved by the course professor and the academic advisor. The withdrawal (drop) should take place during a specific period of time that is set by the Admission and Registration Department. There is a specific period within which the student can get a refund for the course fees, after this period the student will lose his/her right to get the refund.
- The student can add/drop courses only in accordance with the admission and registration office time table. The student is allowed to add/drop a limited number of courses as per the regulations set by the Admissions and Registration Department.

# Honors and Awards

Philadelphia University and the Renewable Energy Engineering Department promote and encourage students to excel in their studies through the introduction of various awards and honor lists that reflect the hard work of our students and encourage them to keep it up.

These awards are listed on the University Admission site (<http://www.philadelphia.edu.jo/admission.asp>). Also, an annual honor list is published and engraved on the entrance of the Faculty of Engineering that highlights the names of the honor students from each engineering discipline.