Undergraduate Handbook

Department of Renewable Energy Engineering

Philadelphia University
Amman – Jordan

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Contact Information

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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

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^2, 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 started 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	Specialty
1	**Wagah Faraman**	Professor	Photovoltaics.
2	**Ibrahim Omar Rahoma**	Professor	Solar Thermal
3	**Munzer Ebaid**	Professor	Thermofluid
4	**Mohammed Qassim Al-Odat**	Professor	Renewable Energy Systems
5	**Mohammad Massadeh (Scholarship)**	Assistant Professor	
6	**Ahlam Damaty**	Lecturer	Electrical engineering

Renewable Energy Engineering Curriculum

Overview

Due to limited supply of hydrocarbon fuel and the global worming 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 Curriculum 2021-2022

Philadelphia University
Faculty of Engineering and Technology

Renewable Energy Engineering Department
(2021-2022)
Total Credit Hours (160) Hrs.

First: University Requirements (27) Cr.H.
A. First Field: University Compulsory Requirements: (18) Cr.H.

Course No.	Course Title	Cr.H.	Prerequisite
0111100	Military Science	3	---
0111101	National Education	3	---
0114103	Connectivity & Communications Skills (Arabic Language Skills1)	3	114099
0130107	Connectivity & Communications Skills (English Language Skills 1)	3	130099
0130108	Connectivity & Communications Skills (English Language Skills 2)	3	130107
0330103	Entrepreneurship and Creativity	1	---
0115102	Leadership and social responsibility	1	---
0170101	Life skills	1	---

B. University Elective Courses (9) Cr.H.
The student studies 9 credit hours from the table below:

Course No.	Course Title	Cr.Hr.	Prerequisite
0170102	Thinking Skills (1)	3	---
0111133	Human Vision & Civilization (1)	3	---
0140111	Language skills (1)	3	---
0140112	Language skills (2)	3	---
0670101	Development and the environment	3	---
0330111	Introduction to Project Management	3	---
0420140	Human legal	3	---
0420143	legal culture	3	---
0320104	economic culture	3	---
0750101	digital culture	3	---
0750102	Data analysis skills	3	---
0910102	Healthy culture	3	---

Notes: -
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.

Codes used in Curriculum:
(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	---
610263	Programming Language	3	---
640253	Engineering Skills	3	130108
610550	Engineering Entrepreneurship	3	640253

Third: Department Requirements (106) Cr.H.
A. Compulsory Requirements: (80) Cr.H.

Course No.	Course Title	Cr.H.	Prerequisite
610218	Electrical Circuits	3	211102
610216	Electrical Circuits Lab.	1	610218(*)
620213	Solid Mechanics	3	620211
620434	Machine Design (1)	3	620213
620211	Statics	3	250102+211101
620212	Dynamics	3	620211
650242	Electronics	3	610218
610332	Instrumentation& Measurement	3	650242
610310	Electrical Machines		610218
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	620320

Course No.	Course Title	Cr.H.	Prerequisite
611341	Introduction to Renewable Energy	3	211102
610414	Automatic Control	3	610332+650260
611430	Electrical Power System	3	610310
611312	Energy Economics and Management	3	611341
611411	Energy Legislations	3	611312
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
611531	Wind Energy Systems	3	611341 +620373
611526	Solar Energy Lab.	1	611421(*) +611422(*)
611536	Wind Energy Lab.	1	611531(*)
610530	Power Electronics	3	650242
611532	Energy Storage Systems and Fuel Cells	3	611341+212101
611540	Engineering Project (2)	2	611499+611440
611499	Engineering Training	3	(115) Cr.Hr

B. Compulsory Support Requirements: (17) Cr. Hr.

Course No.	Course Title	Cr.H.	Prerequisite
620172	Engineering Workshop (2)	1	620171
212102	General Chemistry Lab. (1)	1	212101
250205	Linear Algebra & Vector Calculus	3	250102
250202	Calculus (3)	3	250102
650260	Engineering Analysis (1)	3	250102
610262	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
611542	Geothermal Energy	3	611341 +620420
611543	Hydraulic and Waves Energy	3	611341+620320
611544	Special Topics in Renewable Energy	3	Dept. Approval
611546	Smart Grids	3	611430
630522	Modeling and Simulation	3	610262+611301

(*) *Concurrent*

Course Description

Course No.	Course Title	Cr. H.	Prerequisite	Course Description
610218	Electrical Circuits	3	General Physics (2)	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 and RC. Introduction to AC Circuits
610216	Electrical Circuits Lab.	1	Electrical Circuits	DC circuits. KVL and KCL. Mesh and Nodal Circuits Analysis. Circuit Theorems. Transient Analysis of RL and RC Circuits. Power Measurement.
610310	Electrical Machines	3	Electrical Circuits	Transformers. DC Motors. DC Generators. Single-Phase and Three-Phase Induction motors. Three-Phase Synchronous Generators. AC Series Motor. Repulsion Motor.
611332	Instrumentation and Measurement	3	Electronics (1)	Applications of Electrical and Mechanical Sensors. Data Acquisition and Applications of Logic Controllers in Power Systems. Identify the Physical Information Needed to Control and Record Data. Methods of Calibration and Correction.
610414	Automatic Control	3	Instrumentation and Measurement + Engineering Analysis (1)	Introduction to Feedback Systems. 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 Systems. Computer Control Systems.
611499	Engineering Training	3	115 Cr. Hrs.	The Student must Spend Eight Weeks after Completing 90 Credit Hours in the Industry (Inside or Outside Jordan) Under the Supervision of a faculty Member in the Department. The Student is Required to Submit Periodic Reports, Final Reports and Final Exams. This will be in a separate semester that is not synchronized with the

				study
611440	Engineering Project (1)	1	100 Cr. Hrs.	The Student Must be Associated with one or more Faculty Members from the Department where a Project is Assigned to him. The Student will Study the Project, Analyze it and Submit a Proposal for its Implementation in the Next Stage.
610530	Power Electronics	3	Electronics (1)	Introduction to High-Power Semiconductor Devices. AC-DC converters: Single-phase half-wave rectifiers (uncontrolled, controlled). Single phase and bi-phase full-wave Rectifiers: Uncontrolled, fully controlled, half-controlled. Three-phase bridge rectifiers: Uncontrolled, fully controlled. DC-DC converters: Step-down, step-up, step-down/up. DC-AC converters: Single-phase inverters: PWM inverter; Three-phase inverter.AC-AC converters: Single-phase cycloconverter, single-phase transformer tap changer. The Applications of the different Converters.
611540	Engineering Project (2)	2	Engineering Project (1) + Engineering Training	The Student Carries Out the Project Suggested by the Department Based on the Results Obtained from Engineering Project (1).
611301	Engineering Statistics	3	Engineering Analysis (1)	Data Processing. Probability Theory. Random Variables. Probability Distribution. Modeling Theory. Statistics Estimation. Tests Hypothesis. Statistics Analysis.
611312	Energy Economics and Management	3	Introduction to Renewable Energy	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	3	Energy Economics and Management	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.
611422	Photovoltaic Energy Systems	3	Introduction to Renewable Energy + Electronics (1)	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.	1	Solar Thermal Energy + Photovoltaic Energy Systems	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	Environmental Impact of Energy	3	Energy Economics and Management	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.
611531	Wind Energy Systems	3	Introduction to Renewable Energy +Properties of	Historical Applications of Wind Energy. Electrical Power From The Wind and the Batteries. Wind Energy System (Rotor Blades, the Tower, Mechanical Drive,

			Engineering Materials	Electrical System, etc). Physical Principles of Wind Energy Conversion. Basic Concepts of Wind Energy Converters (Turbines). Aerodynamics of Turbines. 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.
611536	Wind Energy Lab.	1	Wind Energy Systems	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	3	General Physics (2)	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 systems	3	Introduction to Renewable Energy	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	3	Introduction to Renewable Energy + Heat Transfer (1)	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	3	Introduction to Renewable Energy + Fluid Mechanics (1)	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 ofCircuit and Hydraulic Systems. Performance Improvements for the Systems in Industrial Processes.
611544	Special Topics in Renewable Energy	3	Department Approval	Special Topics in Renewable Energy Engineering.
620211	Statics	3	Calculus 2 + General Physics (1)	Introduction to Mechanics of Rigid Bodies. Basic Principles in Forces and Vectors Analysis, forces Systems, Equivalent forces Systems, Static Equilibrium, Simple Structures Analysis, Friction, Geometric Properties, Centroids and Moments of Inertia.
620212	Dynamics	3	Statics	Kinematics of Particles. Rectilinear and Curvilinear Motion in Various Coordinate Systems. Kinetics of Particles. Newton's Second Law. Central Force Motion. Work-

				Energy Equation. Principle of Impulse and Momentum. Impact, Conservation of Energy and Momentum. Application to a System of Particles. Kinematics of Rigid Bodies. Relative Velocity and Acceleration. Instantaneous Center, Analysis in Terms of a Parameter. Plane Kinetics of Rigid Bodies With Application of Newton's Second Law. Energy and Impulse-Momentum. Vibrations.
620213	Solid Mechanics	3	Statics	Axial Loading. Material Properties Obtained from Tensile Tests. Stresses And Strains Due to Axial Loading. Thermal Stresses. Elementary Theory of Torsion, Solid and Hollow Shafts. Thin-Walled Tubes. Rectangular Cross-Section. Stresses in Beams Due to Bending, Shear and Combined Forces. Composite Beams, Analysis of Plane Stress, Mohr's Circle. Combined Stresses. Thin-Walled Pressure Vessels. Deflection of Beams, Buckling of Columns. Energy Methods.
620323	Thermodynamics (1)	3	Calculus 2 + General Physics (2)	Thermodynamic Concepts and Definitions. Pure Substances. Equation of States, Table of Properties. Work And Heat. The First Law. Internal Energy And Enthalpy. Conservation of Mass. The Second Law. Heat Engines and Refrigerators, Reversible Processes. Carnot Cycle. Entropy, Clausius Inequality. Principle of the Increase Of Entropy. Efficiencies.
620320	Fluid Mechanics (1)	3	Dynamics + Engineering Analysis (1)	Introduction. Fluid Properties. Basic Units. Fluid Statics. Pressure and Its Measurements. Forces on Plane and Curved Submerged Surfaces. Buoyancy & Floatation. Fluids in Motion. Flow Kinematics and Visualization. Basic Control Volume Approach. Differential And Integral Continuity Equation. Pressure Variation in Flowing Fluids. Euler's and Bernoulli's Equations. Applications of Bernoulli Equation. Momentum Principle and Its Applications. Navier-Stokes Equations. Energy Equation, Hydraulic and Energy Grade Lines. Dimensional Analysis and Similitude. Surface Resistance and Introduction to Boundary Layer Theory. Flow in Conduits,

				Laminar and Turbulent Flows. Frictional and Minor Losses, Piping Systems.
620420	Heat Transfer (1)	3	Thermodynamics (1) + Engineering Analysis (1)	Introduction to Modes of Heat Transfer; One-Dimensional Steady State Conduction, Unsteady State Thermal Conduction. Lumped Heat Capacity System. Convection Heat Transfer. Empirical and Practical Relations for Convection Heat Transfer. Free Convection Heat Transfer. Condensation and Evaporation. Introduction to Heat Exchangers. Introduction to Thermal Radiation.
620427	Thermal Lab.	1	Heat Transfer (1)	Experiments Related to the Subjects Covered in Heat Transfer Course.
620429	Fluid Mechanics Lab.	1	Fluid Mechanics (1)	Experiments Related to the Subjects Covered in Fluid Mechanics I Course.
650242	Electronics (1)	3	Electrical Circuits	Semiconductor Circuit Analysis. Full Wave and Half Wave Semiconductor Diodes Rectifiers. Zener Diodes, Clippers, Clampers. Bipolar Junction Transistor (BJT), Biasing Circuits. Common Emitter Amplifier. Common Collector Amplifier. Common Base Amplifier. Design of BJT Amplifier. Field Effect Transistor (FET): JFET& MOSFET.JFET Amplifiers. Design of JFET Amplifier. Introduction to OP-AMP &Its Applications.
610262	Engineering Analysis (2)	3	Linear algebra and vector calculus	Methods of solving nonlinear equations numerically. Correlation. Numerical calculus. Direct Methods of Solving Linear Equation Systems. Using Advanced computer Programs to Solve Problems on the Mentioned Subjects.
611430	Electrical Power Systems	3	Electrical Machines (1)	This course starts with fundamentals of electrical power, power systems components and equipment, and fundamental analysis of electrical power systems. Then some advanced issues are presented including faults, protection, and stability of power systems. Understanding those issues is essential for the successful integration of renewable energy resources with the power grid.
611532	Energy Storage	3	Introduction to Renewable	This course introduces students to energy storage systems and provides a broad

	Systems and Fuel cells		Energy + General Chemistry (1)	understanding and appreciation of the scientific principles that underpin the operation of such systems. The emphasis is on grid-scale energy storage as a means of addressing the intermittency of renewable energy. The course also focuses on fuel cells as an emerging technology that utilizes the storage technology of hydrogen. This part of the course aims toward introducing students to fuel cells and developing the basics of thermodynamics, electrochemistry, and other disciplines needed to explain fuel cell behavior.
611546	Smart Grid	3	Electrical Power Systems	This course introduces the concepts of various components of Smart Grid, and their impacts on the energy industry, including renewables integration, PEV penetration, and demand side management.
611421	Solar Thermal Energy	3	Introduction to Renewable Energy + Heat Transfer (1)	This course covers the fundamentals, systems and applications of solar thermal energy conversion that can be applied to a wide array of industrial, district applications, and power generation which provide benefits in avoided fuel costs for water and steam production. The course covers the physical materials used for solar energy conversion to useful thermal energy; the function and performance of non-concentrating and concentrating solar thermal energy systems, and applications of solar thermal energy to buildings (heating/cooling), industrial processes, power generation, passive heating and cooling, drying, and desalination.
620434	Machine Design (1)	3	Solid Mechanics	Introduction to design process, Design considerations, Tolerances, Fits and surface finish, Selection of materials, Mechanical properties of engineering materials, Stress analysis in machine elements and deflection, failure of machine elements, Fatigue analysis, shaft design, limits and fits , Power screws and threaded fasteners, Welded joints types and analysis, Mechanical springs.
620373	Properties of Engineering Materials	3	Fluid Mechanics (1)	Metal structures and crystallization, Materials used in engineering applications, Plastic deformation on the macro and micro-structure levels, Diffusion in Solids,

				Mechanical properties, Mechanical and Material failure, Heat treatment processes, Phase diagrams, Iron-Iron carbide equilibrium diagrams, Heat treatment of steel. Metal Alloys Applications and Processing.
630522	Modeling and Simulation	3	Engineering Analysis (2) + Engineering Statistics	Physical Model. Symbolic Model. Methodological Modeling: Analysis And Formulations of Solution Strategy and Verification, Certificate Validation. Intermittent Simulation. Simulation Continuation. Oriented Approach Process, Random Number And Random Variables. Simulation Language. Analysis And Study Induction and PredictionMethods Using Computer for Available Data.
650260	Engineering Analysis (1)	3	Calculus (2)	Basic Concepts and ideas, First Order Differential Equations. Second and higher order Differential Equations, Power Series Method, Laplace Transform.
620171	Engineering Workshop (1)	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	Engineering Workshop (2)	1	620171	Household electric circuits, Florescent lamps circuits, parallel and series circuits, switches and fuses installations, electronic welding, electronic devices maintenance and circuit-boards design.
610550	Engineering Entrepreneurship	3	Engineering Skills	The course is a requirement for level 5 Engineering students. It introduces the students to the concept of entrepreneurship and how it is related to engineering practices, also the fundamentals of engineering economics.
640253	Engineering Skills	3	English Language Skills (2)	Problem solving skills; Engineering skills (personal and analytical); Technical writing; Communication skills (oral presentation skills); Engineering ethics and responsibility; Project management.
610263	Programming Language	3	--------	The course is a requirement for all engineering students. It introduces the basic principles of structured programming. Students will learn and practice the

				application of these programming principles to solve engineering problems using the C++ programming language.

Advisement Plan for Renewable Energy Department

First Year							
First Semester				**Second Semester**			
Course No.	**Course Title**	**Cr. H.**	**Prerequisite**	**Course No.**	**Course Title**	**Cr. H.**	**Prerequisite**
114103	Connectivity and Communication Skills (Arabic Language Skills 1)	3	114099	111101	National Education	3	----
130107	Connectivity and Communication Skills (English Language Skills 1)	3	130099	130108	Connectivity and Communication Skills (English Language Skills 2)	3	130107
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	------	610263	Programming Language	3	----
660131	Manual Engineering Drawing	1	------	660132	Computer Engineering Drawing	1	660131
				212102	General Chemistry Lab (1)	1	212101
Total		**16**		**Total**		**17**	

Second Year							
First Semester				**Second Semester**			
Course No.	**Course Title**	**Cr. H.**	**Prerequisite**	**Course No.**	**Course Title**	**Cr. H.**	**Prerequisite**
650260	Engineering Analysis (1)	3	250102	610262	Engineering Analysis (2)	3	250205
610218	Electrical Circuits	3	211102	250202	Calculus (3)	3	250102
250205	Linear Algebra and vector calculus	3	250102	620212	Dynamics	3	620211
620211	Statics	3	250102 +211101	650242	Electronics (1)	3	610218
111100	Military Science	3	----	610310	Electrical Machines	3	610218
620171	Engineering Workshop (1)	1	----	610216	Electrical Circuits Lab.	1	610218
----	University Compulsory Req.	1	----				
Total			**17**	**Total**		**16**	

Third Year							
First Semester				Second Semester			
Course No.	Course Title	Cr. H.	Prerequisite	Course No.	Course Title	Cr. H.	Prerequisite
620213	Solid Mechanics	3	620211	620320	Fluid Mechanics (1)	3	650260 +620212
610332	Instrumentation and Measurement	3	650242	620429	Fluid Mechanics Lab	1	620320
----	University Compulsory Req.	1	----	620420	Heat transfer (1)	3	620323 +650260
620323	Thermodynamics (1)	3	250102 +211102	----	Selective University Course	3	----
----	University Compulsory Req.	1	----	620434	Machine Design (1)	3	620213
640253	Engineering Skills	3	130108	611341	Introduction to Renewable Energy	3	211102
620172	Engineering Workshop (2)	1	620171				
Total		**15**		**Total**		**16**	

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	611341	610414	Automatic Control	3	610332 +650260
611430	Electrical Power Systems	3	610310	611411	Energy Legislations	3	611312
620373	Properties of Engineering Materials	3	620320	611421	Solar Thermal Energy	3	611341 +620420
611301	Engineering Statistics	3	650260	610530	Power Electronics	3	650242
----	Selective University Course	3	----	----	Selective University Course	3	----
620427	Thermal Lab.	1	620420				
Total		**16**		**Total**		**15**	

Fourth Year			
Summer Semester			
Course No.	Course Title	Cr. H.	Prerequisite
611499	Engineering training	3	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	611312	610550	Engineering Entrepreneurship	3	640253
611422	Photovoltaic Energy Systems	3	611341 +650242	611536	Wind Energy Lab.	1	611531
611531	Wind Energy Systems	3	611341 +620373	611526	Solar Energy Lab.	1	611421 +611422
----	Selective Department Course	3	----	611532	Energy Storage Systems and Fuel Cells	3	611341 +212101
----	Selective Department Course	3	----	----	Selective Department Course	3	----
611440	Engineering Project (1)	1	100 Cr. H.	611540	Engineering Project (2)	2	611440 +611499
Total		**17**		**Total**		**13**	

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.