



**Faculty of Engineering**  
**Department of Renewable Energy Engineering**

**Study Plan of the Bachelor's Degree  
In Renewable Energy Engineering  
Academic Year: 2021 / 2022**

Plan Hours (162) credit hours  
Type of Program      Humanity       $\sqrt$ Scientific/ technical      Learning Style Blended/ Electronic      Medicine

Learning Style	Percentage of study plan hours/number	Actual ratio
Electronics	10%-20% maximum	%17
Blended (Scientific programs)	30%-50% maximum	%48.5
Face to Face ( Scientific programs)	30% minimum	%34.5

Note: The learning styles of the courses are distributed at all academic levels in the program

**Vision of the Department:**

Entrepreneurship and distinction in renewable energy engineering in teaching, research and application locally and regionally.

**Mission of the Department:**

Contribute to achieving comprehensive and sustainable development by preparing cadres of creative engineers who are able to compete and lead.

**Mission of the Program:**

Offering distinguished academic programs in the field of renewable energy engineering supported by knowledge, skills and professional ethics through qualified cadres who are able to keep pace with local and international standards in accordance with e-learning integration standards.

**Educational Program Objectives**

Graduates of the Renewable Energy Engineering program will be expected within a few years of graduation:

1. Take on significant positions within the renewable energy sectors, both on a local and global scale, with a firm commitment to improving society. This commitment should be accompanied by a thorough understanding of professional and ethical engineering principles, as well as a dedication to community service.
2. Display adeptness in communication by expressing ideas and concepts concisely, with a proven record of delivering compelling presentations to sizeable audiences.
3. Exhibit a commitment to ongoing professional development, essential for securing initial employment opportunities and achieving a thriving career trajectory that adapts successfully to all technological advancements.
4. Work jointly with academic institutions to carry out advanced scientific research, leading to innovative discoveries that help tackle intricate engineering problems, while being proficient in working collaboratively within cross-functional teams.

**Student Outcomes (SOs):**

The Renewable Energy Engineering Program is outlined so that its students will be able to:

1. Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Communicate effectively with a range of audiences.
4. Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. Acquire and apply new knowledge as needed, using appropriate learning strategies.



## Framework

### Framework of the bachelor's degree in Renewable Energy Engineering (162 Cr. Hrs.)

Sequence	Classification	Credit Hours	Percent %
1st	University Requirements	27	17
2nd	Faculty Requirements	26	16
3rd	Department Requirements	109	67
Total		162	100%

## Course Numbering

6	0	4	x	x	x	x	
Faculty Code	Dept. Code		Cognitive Domains	Course Level		sequence	
Engineering	Renewable Energy Engineering			year	semester		

## Cognitive Domains

Number	Cognitive Domain	Credit Hours
01	Mathematics and Sciences	30
02	Basic Engineering Sciences	16
03	Engineering Mechanics	23
04	Thermal and Fluids	15
05	Electrical Engineering	8
06	Renewable energy sources	14
07	Transform and store energy	9
08	Energy Economics and Management	9
09	Graduation Project and Field Training	6



## I. University Requirements: (27 Credit Hours)

### A. Compulsory Requirements: (18 Credit Hours)

Learning style			Course No.	Course Title	Cr. Hr.	Prerequisite
*F	*B	*E				
		√	5051104	Communication Skills -Arabic Language (1)	3	5051108
		√	5051105	Communication Skills -English Language (1)	3	5051109
		√	5051108	Arabic Language Pre-requisite	0	-
		√	5051109	English Language Pre-requisite	0	-
		√	5051110	Computer Basics Pre-requisite	0	-
		√	50511205	Life skills and social responsibility	3	-
		√	50511206	National Education	3	-
		√	50511305	Leadership and Creativity	3	-
		√	50511308	Military Sciences	3	-
<b>Total</b>					<b>18</b>	

\*F: Face to Face

\*B: Blended

\*E: Electronics

### B. Elective Requirements: (9 Credit Hours) from the following list:

Learning style			Course No.	Course Title	Cr. Hr.	Prerequisite
F	B	E				
		√	50521106	Communication Skills -Arabic Language (2)	3	5051104
		√	50521107	Communication Skills -English Language (2)	3	5051105
		√	50521203	Principles of Psychology	3	-
		√	50521204	Human Rights	3	-
		√	50531101	Islamic Culture	3	-
		√	50531205	Quds and Hashemite Custodianship	3	-
		√	50541103	Computer skills	3	5051110
		√	50541204	Environment and Society	3	-
		√	50541206	Health of Individuals and Society	3	-
		√	50541308	Foreign language	3	-
		√	50541309	Digital culture	3	5051110
<b>Total</b>					<b>9</b>	



## 2. Faculty Requirements: (26 Credit Hours)

### A. Compulsory Requirements: (26 Credit Hours)

Learning style			Course No.	Course Title	Course No.	Course Title	Cr. hr.	Prerequisite
F	B	E						
	√		50221101	Calculus (1)	3	3	-	-
	√		50221202	Calculus (2)	3	3	-	50221101
	√		50551101	General Physics (I)	3	3	-	-
√			50551102	General Physics Lab (I)	1	-	2	50551101*
√			60221101	Engineering Drawing	2	-	4	-
	√		60222102	Introduction to Engineering	1	1	-	-
	√		60224203	Engineering Economy	3	3	-	50221101
√			60331204	Engineering Workshop	1	-	2	-
	√		60372201	Communication Skills and Profession Ethics	3	3	-	5051105
	√		60375102	Project Management	3	3	-	60224203
	√		60363203	Programming for engineers	3	3	-	5051110
			<b>Total</b>		<b>26</b>	<b>22</b>	<b>8</b>	

\* Or Co-requisite

## 3. Department Requirements (109 Credit Hours)

### A. Compulsory Requirements: (80 Credit Hours)

Learning style			Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
F	B	E						
	√		60232204	Materials Science	3	3	-	50551103
√			60241201	Statics	3	3	-	50551101
√			60242102	Strength of Materials	3	3	-	60241201
√			60242203	Dynamics	3	3	-	60241201
√			60243104	Fluid Mechanics	3	3	-	60242203
√			60243105	Fluid Mechanics Lab.	1	-	2	60243104*
	√		60443101	Thermodynamics	3	3	-	50551101



	√		60443102	Heat Transfer	3	3	-	60443101
√			60443103	Heat Transfer Lab	1	-	2	60443102*
	√		60453101	Measurement Devices	3	3	-	60243104
√			60453102	Measurement Devices Lab.	1	-	2	60453101*
√			60453103	Automatic Control	3	3	-	60243104
√			60453104	Automatic Control Lab.	1	-	2	60453103*
√			60453107	Electric Circuits	3	3	-	50551201
√			60453108	Electric Circuits Lab.	1	-	2	60453107*
√			60453105	Electric machines	3	3	-	60453107
√			60453106	Electric machines Lab.	1	-	2	60453105*
√			60453205	Mechanical design	3	3		60242102
	√		60462106	Types and sources of energy	3	3	-	50551201
	√		60463101	Renewable Energy	3	3	-	50551201
√			60464102	Solar energy	3	3	-	60463101
√			60464103	Solar energy Lab.	1	-	2	60464102*
	√		60464104	Wind Energy	3	3	-	60463101
√			60464105	Wind Energy Lab.	1	-	2	60464104*
√			60474101	Power electronics	3	3	-	60453107
√			60474202	Production and conversion of energy	3	3	-	60462106
	√		60475103	Energy storage	3	3	-	60474202
	√		60482202	Environment and Energy	3	3	-	60463101
	√		60485101	Energy management and protocols	3	3	-	60482202
	√		60485103	Energy efficiency and economy	3	3	-	60482202
√			60494302	Engineering Practical Training	3	3	-	Completion of 115 Cr. Hrs.
√			60495102	Graduation Project (1)	1	1	-	Completion of 118 Cr. Hrs+ Completion of Engineering Practical Training
√			60495203	Graduation Project (2)	2	2	-	60495102
<b>Total</b>					<b>80</b>	<b>72</b>	<b>16</b>	



\* Or Co-requisite

**B. Elective Requirements: (9 Credit Hours)**

Learning style			Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
F	B	E						
	√		60464207	Fuel cells and hydrogen	3	3	-	60463101
	√		60464208	Bioenergy	3	3	-	60463101
	√		60464209	Solar thermal systems	3	3	-	60464102
	√		60464210	Design of renewable energy systems	3	3	-	60463101
	√		60464211	Design of wind power systems	3	3	-	60464104
	√		60474205	Energy Saving Design	3	3	-	60474202
	√		60475204	Energy transfer and storage systems	3	3	-	60475103
	√		60484204	Simulation and prediction	3	3	-	60453103
	√		60484205	Control and protection of energy systems	3	3	-	60453103
	√		60484206	Green Buildings	3	3	-	60463101
	√		60464212	Special Topics in renewable energy	3	3	-	Department approval +15hrs
				<b>Total</b>	<b>9</b>	<b>9</b>	<b>-</b>	

**4. Ancillary Courses (20 Credit Hours):**

Learning style			Course No.	Course Title	Cr. hr.	Theoretical	Practical	Prerequisite
F	B	E						
√			50222209	Ordinary Differential Equations (I)	3	3	-	50221202
	√		50223111	Numerical Analysis (I)	3	3	-	50221101
	√		50551103	General Chemistry	3	3	-	-
√			50551104	General Chemistry Lab.	1	-	2	50551103*
	√		50551201	General Physics (2)	3	3	-	50551101
√			50551202	General Physics Lab. (2)	1	-	2	50551201*
	√		50231101	Principles of Statistics	3	3	-	-







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	√	50212104	Linear Algebra (I)	3	3	-	50221101
<b>Total</b>				<b>20</b>	<b>18</b>	<b>4</b>	

\* Or Co-requisite



## Advisory Study Plan

## First Year

First Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
50551101	General Physics (I)	B	3	-	-
50551102	General Physics Lab. (I)	F	1	-	50551101
50221101	Calculus (I)	B	3	-	-
50551103	General Chemistry	B	3	-	-
50551104	General Chemistry Lab.	F	1	-	50551103
---	Compulsory/ Elective University Requirement	E	3	-	-
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>17</b>		

Second Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
50211202	Calculus (2)	B	3	50221101	-
60221101	Engineering Drawing	F	2	-	-
50551201	General Physics (2)	B	3	50551101	-
50551202	General Physics Lab. (2)	F	1	-	50551201
60241201	Statics	F	3	50551101	-
60331204	Engineering Workshops	F	1	-	-
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>16</b>		



## Second Year

First Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60222102	Introduction to Engineering	B	1	-	-
50212104	Linear Algebra (I)	B	3	50221101	-
60453107	Electric Circuits	F	3	50551201	-
60453108	Electric Circuits Lab.	F	1	-	60453107
60242203	Dynamics	F	3	60241201	-
60242102	Strength of Materials	F	3	60241201	-
60462106	Types and sources of energy	B	3	50551201	-
<b>Total</b>			<b>17</b>		

Second Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60372201	Communication Skills and Profession Ethics	B	3	50511105	-
50222209	Ordinary Differential Equations (I)	F	3	50211202	-
60243104	Fluid Mechanics	F	3	60242203	-
60243105	Fluid Mechanics Lab.	F	1	-	60243104
60232204	Materials Science	B	3	50551103	-
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>16</b>		



## Third Year

First Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
50223111	Numerical Analysis (I)	B	3	50221101	-
60453101	Measurement Devices	B	3	60243104	-
60453102	Measurement Devices Lab.	F	1	-	60453101
60453105	Electric machines	F	3	60453107	-
60453106	Electric machines Lab	F	1	-	60453105
60443101	Thermodynamics	B	3	50551101	-
60463101	Renewable Energy	B	3	60462106	-
<b>Total</b>			<b>17</b>		

Second Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60363203	Programming for engineers	B	3	50511110	-
50231129	Principles of Statistics	B	3	-	-
60443102	Heat Transfer	B	3	60443101	-
60443103	Heat Transfer Lab	F	1	60443102	-
60453103	Automatic Control	F	3	60243104	-
60453104	Automatic Control Lab.	F	1	-	60453103
60453205	Mechanical design	F	3	60242102	-
<b>Total</b>			<b>17</b>		



## Fourth Year

First Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60474101	Power electronics	F	3	60453107	-
60464102	Solar energy	F	3	60463101	-
60464103	Solar energy Lab.	F	1	-	60464102
60474202	Production and conversion of energy	F	3	60462106	-
60464104	Wind Energy	B	3	60463101	-
60464105	Wind Energy Lab.	F	1	-	60464104
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>17</b>		

Second Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60224203	Engineering Economy	B	3	50221101	-
60482202	Environment and Energy	B	3	60463101	-
60475106	Energy Storage	B	3	60474202	-
---	Compulsory/ Elective University Requirement	E	3	-	-
---	Elective Department Requirement	B	3	-	-
<b>Total</b>			<b>15</b>		



## Fifth Year

Summer Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60494302	Engineering Practical Training	F	3	Completion of 115 Cr. Hrs.	-
<b>Total</b>			<b>3</b>		

**\*\*Practical training for eight consecutive weeks**

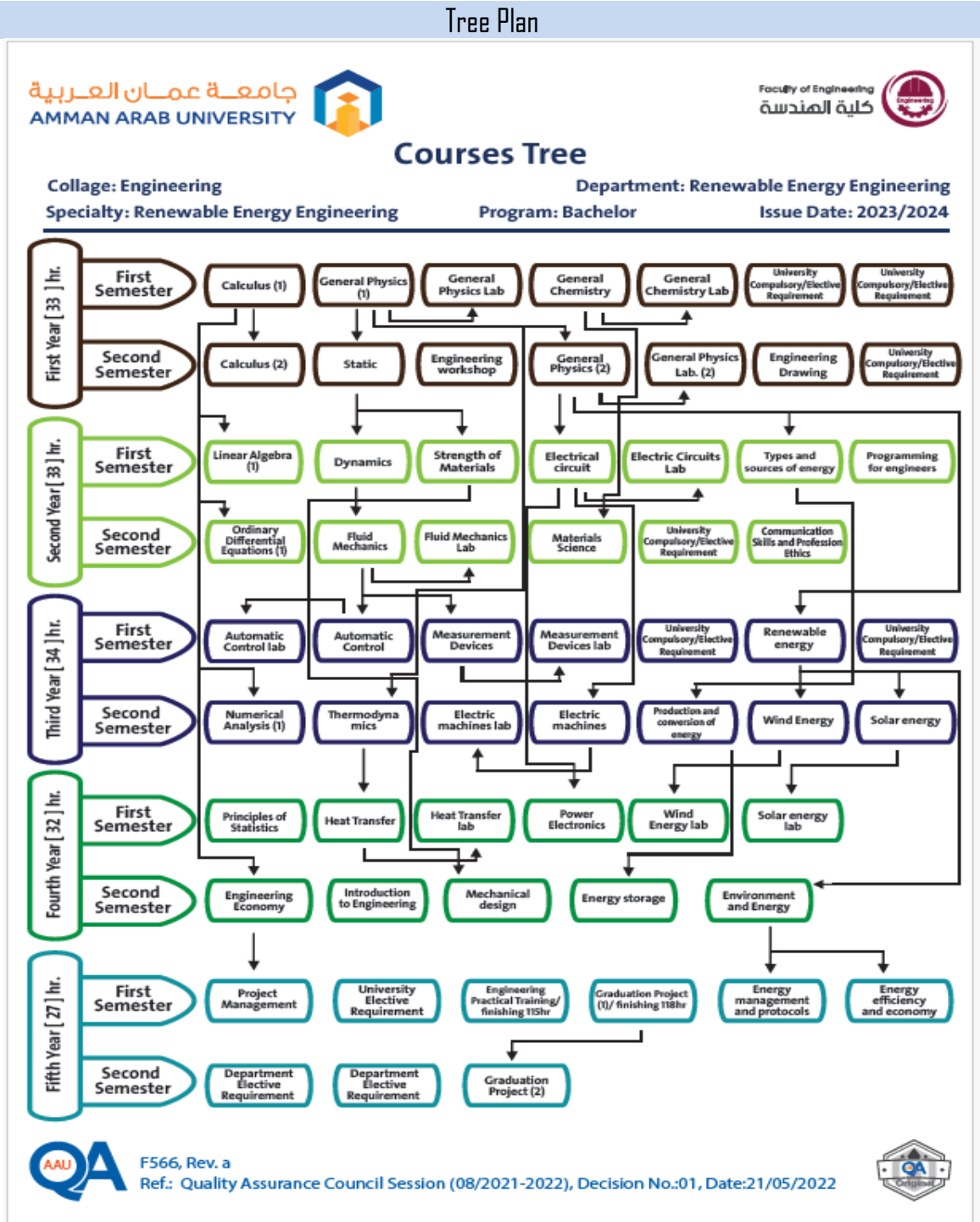
First Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60375102	Project Management	B	3	60224203	-
60495102	Graduation Project (1)*	F	1	Completion of 118 Cr. Hrs.	-
60485103	Energy efficiency and economy	B	3	60482202	-
---	Elective Department Requirement	B	3	-	-
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>13</b>		

\* Finishes the Engineering Practical Training successfully

Second Semester					
Course No.	Course Title	Learning Style	Cr. hrs.	Prerequisite	Co-requisite
60495203	Graduation Project (2)	F	2	60495102	-
60485101	Energy management and protocols	B	3	60482202	-
---	Elective Department Requirement	B	3	-	-
---	Compulsory/ Elective University Requirement	E	3	-	-
<b>Total</b>			<b>11</b>		



Tree Plan





### Description of Courses offered by the

**Course Number Course Title Credit Hours (Prerequisite)**  
**50551101 General Physics (I) 3 Credit hrs. Prerequisite: None**

Physics and Measurement, Vectors, Motion in one Dimension, Motion in Two Dimensions, The Laws of Motion Circular Motion, and other applications of Newton's Laws, Work and Energy, Linear Momentum and Collisions,

Rotation of rigid object about a fixed axis, Rolling Motion and angular Momentum, Torque.

**50551102 General Physics Lab (I) 1 Credit hrs. Prerequisite: 50551101\***

Collection and Analysis of Data, Measurements and Uncertainties, Vectors: Force Table, Kinematics of Rectilinear Motion, Force and Motion, Newton's laws, Collision in Two Dimensions, Rotational Motion & Simple Harmonic Motion: Simple Pendulum, The Behavior of Gases with Changes in Temperature and Pressure, Measuring the coefficient of viscosity of liquid, Specific Heat Capacity of Metals.

**50211104 Calculus (I) 3 Credit hrs. Prerequisite: None** Limits, continuity, and their applications: chain rule, Implicit differentiation, related rates, increase decrease, concavity. Extrema. Newton's method, Roll's theorem, Mean-Value Theorem, definite and indefinite integrations, fundamental theorem of calculus, Area and volume, inverse functions, Exponential and logarithmic functions with their derivatives, conic sections.

**50211202 Calculus (2) 3 Credit hrs. Prerequisite: 50211104**

Inverse trigonometric and hyperbolic functions. Techniques of integration, by parts, trigonometric integrals, trigonometric substitutions, partial fractions, quadratic expressions, general substitutions. Improper integrals. Infinite series, convergence and divergence, convergence tests, Maclaurin and Taylor series. Polar coordinates: definition, arc length, area, conic sections.

**50551103 General Chemistry 3 Credit hrs.**

This course covers concepts and principles in general chemistry, chemical calculations, chemical reactions in aqueous solutions, periodic table and electron structure of the atom, chemical bonding types, physical properties of solutions, speed of chemical reactions, equilibrium in chemical solutions.

**50551104 General Chemistry Lab. 1 Credit hrs. Prerequisite: 50551103\***

Physical properties, specifying the element and molecule form the molecule weight. Calculating water crystallization, calculating equilibrium heat and formation heat. Solution titration, Chemical reaction speed, chemical cell voltage.







**50551201 General Physics (2) 3 Credit hrs. Prerequisite: 50551101**

Continuation of University Physics I. Topics include mechanics of materials, basic thermodynamics, fundamentals of electricity and magnetism

**50551202 General Physics Lab. (2) 1 Credit hrs. Prerequisite: 50551201\***

Covers such topics as electricity, magnetism, electromagnetic waves, optics, and modern physics.

**50212106 Linear Algebra (I) 3 Credit Hours Prerequisite: 50211202**

Matrices and matrix operations, transpose and inverse of a matrix, determinants and their properties, vector spaces and subspaces, linearly independent and linearly dependent, row space and column space, null space of a matrix, inner product space, system of linear equations, methods of solving system of linear equations.

**50222218 Ordinary Differential Equations (I) 3 Credit Hours Prerequisite: 50211202**

Solutions of first order differential equations with applications, solutions of second order differential equations with applications, systems of differential equations, series solutions, Laplace transform.

**50223121 Numerical Analysis (I) 3 Credit Hours Prerequisite: 50211202**

Elementary introduction to numerical analysis, linear and nonlinear equations, numerical methods for linear problems which do not contain exact solutions or too difficult to solve analytically, error analysis, solutions of nonlinear problems: Fixed-point iteration, Taylor polynomial, Bisection method, Newton-Raphson method, etc.

**50231129 Principles of Statistics 3 Credit Hours Prerequisite: 50211202**

Describing Statistical Data by tables, graphs and numerical Measures, Measures of Central Tendency and Deviation, Counting methods, The Variance, binomial and Normal distribution, probabilities Laws, Random Variables, Sampling distributions, testing of statistical hypotheses for two populations, correlation and regression, correlation coefficient.

**60221101 Engineering Drawings 2 Credit hrs. Prerequisite: None**

Instruments of Drawing. Graphic geometry (Lines, Letters, Numbers, Tangency Construction). Intersections. Types of Projection. Dimensioning. Plane Sectioning.

**60222102 Introduction to Engineering 1 Credit hrs. Prerequisite: None**

History of engineering. Difference between science and engineering. Development of engineering. Types of engineering. Functions of engineering. Jordanian Engineering Association. The effect of technology to engineering.





Topics include goal setting and career assessment, ethics, public safety, the engineering method and design process.

**60331204 Engineering Workshops 1 Credit hrs. Prerequisite: None**

It includes theoretical and practical topics covering four workshops: Welding workshop (including types of welding, general conditions to be provided, types of welding wires, qualification, prevention and public safety). Electrical workshop (including types of electrical circuits, household electrical wires, estimation of electric current and resistance). Blacksmithing workshop (tools and their types in perforating, filing and turning, leveling and sharpening metals). Carpentry workshop (including types of woods, machines and tools used in cutting, drilling, fixing and joining woods together).

**60372201 Communication Skills and Profession Ethics 3 Credit hrs. Prerequisite: 50511105**

General ideas about the writing styles and forms, writing in business, industry and government, adequacy and excellence. Analyzing the communication context, basic writing techniques, types of written communication, revising for excellence, college writing and professional writing, major types of on-job writing, writing categories, report writing procedures, preparing own resumes, practical experience on how to perform and attend interviews of work.

**60224203 Engineering Economy 3 Credit hrs. Prerequisite: 50221101**

Principles of engineering Economy. Types of economies. Demand & supply theory. Exclusive projects and alternatives. Cash flow diagram. Types of cash flows in any project. Simple & compound interest. Equivalence relations. Relation between present and future amounts. Present value analysis. Future value analysis. Annual value analysis. Capital cost analysis. Return on investment analysis. Selection of best projects. Major elements of feasibility studies.

**60363203 Programming for Engineers 3 Credit hrs. Prerequisite: 50511110**

Definition of a computer science and their systems, components, basic elements, software and equipment. Learn the basic programs such as (Microsoft Office, and learning Drawing Software (AutoCAD); Learn the skills to draw 2D engineering drawings.

**60375102 Project Management 3 Credit hrs. Prerequisite: 60224203**

Definition of project, definition of management & definition of project management, Project lifecycle & main and secondary project management domains. The project manager nomination and responsibilities, Techniques for project planning and scheduling, Gantt Chart & CPM method. Project progress measurement and project tracking by using earned value techniques.



**60232204 Materials Science 3 Credit hrs. Prerequisite: 50551103**

Historical Perspective. Classification of Materials. Atomic Structure and Interatomic Bonding. The Structure of Crystalline Solids. Imperfections in Solids. Mechanical Properties of Metals. Failure. Phase Diagrams. Polymer structures, mechanical behavior and thermal Properties.

**60241201 Static 3 Credit hrs. Prerequisite: 50551101**

Introduction to static forces and Newton's laws, SI units. Statics of particles, resultant of forces in 2D (planar) and 3D (space) equilibrium and free-body concept. Statics of rigid bodies, moments, force couples and equivalent force systems. Equilibrium of rigid bodies. Centers of gravity and centroids. Analysis of statically determinate structures including trusses, beams, frames etc. Distributed forces. Axial force, shear force and bending moment diagrams, Moment of inertia of combined shapes.

**60242102. Strength of Materials 3 Credit hrs. Prerequisite: 60241201**

Concepts and types of stresses and strains. Stress-Strain diagram, mechanical properties of materials (modulus of elasticity, Poisson's ratio, and shear modulus. Axial (stress, strain, deformation, and compatibility). Internal forces for beams (axial, shear, and bending moment diagrams). Bending and Shear stress and strain. Torsion stresses, strains, and deformations. Compound stresses and strains. Maximum and minimum stresses, strains, and Mohr circle. Buckling of compression members (Euler differential equation). Deflection of beams by double integration method.

**60242203 Dynamics 3 Credit hrs. Prerequisite: 60241201**

Study the motion of translation and rotational bodies with and without acting forces, Newton's second law, and central movement of forces, the equation of energy, work, momentum, collision, conservation of energy and momentum, applications on the motion systems, acceleration and relative speed, nonlinear center

**60243104 Fluid Mechanics 3 Credit hrs. Prerequisite: 60242203**

Main topics covered are; 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. Euler's and Bernoulli's equations, applications of Bernoulli equation, hydraulic and energy grade lines, momentum principle and its applications, Navier-Stokes equations, dimensional analysis and simulation, surface resistance and introduction to boundary layer theory. Flow in conduits, laminar and turbulent flows, frictional and minor losses and piping systems



**60243105 Fluid Mechanics Lab 1 Credit hrs. Prerequisite: 60243104**

Center of pressure on a plane surface, stability of a floating body, Venturi and orifice meters, impact of jets, flow over a rectangular notch, flow over a weir, head loss through pipes, critical depth and specific energy, flow under a sluice gate, roughness of open channel, hydraulic jump, performance of impulse and reaction turbines, performance characteristics of a centrifugal pump

**60443101 Thermodynamics 3 Credit hrs. Prerequisite: 50551101**

Properties and behavior of a pure substance, work and heat, first law and second law analysis of closed & open systems, Availability and Irreversibility. Vapor and air-standard power and refrigeration cycles. Thermodynamic relations. Ideal and real mixtures and solutions.

**60443102 Heat Transfer 3 Credit hrs. Prerequisite: 60443101**

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.

**60443103 Heat Transfer Lab 1 Credit hrs. Prerequisite: 60443102**

Heat transfer by radiation, the unsteady-state heat transfer by conduction and convection, Heat conduction along a simple bar, a composite bar, Effect of cross-section area, Radial heat conduction, Effect of surface contact, and Effect of insulation, heat transfer by free and forced convection, and melting and solidification of paraffin wax.

**60453101 Measurement Devices 3 Credit hrs. Prerequisite: 60243104**

Statistical concepts and calculations for theoretical and experimental data. The main basic circuit used to convert measured value to electrical signal and the measuring instrument needed to measure a main physical variable such as flow, pressure, temperature, linear and angular velocities, forces and torques

**60453102 Measurement Devices Lab 1 Credit hrs. Prerequisite: 60453101\***

This course covers the following topics: Linear measurements, Angular measurements, Screw thread measurements, electric resistance and current, Flow and pressure measurements.

**60453103 Automatic Control 3 Credit hrs. Prerequisite: 60243104**

Concept of Control Systems, Open-loop and Closed-loop Systems; Mathematical Modeling of Physical Systems; Transfer Function and System Modeling Diagrams; Response Characteristics of Control Systems; Specifications of System Performance; Stability Analysis of Linear Control Systems; Routh's Stability Criterion; Time-domain Analysis of Control Systems; Design of Controllers and Compensators.





**60453104 Automatic Control Lab. 1 Credit hrs. Prerequisite: 60453103\***

Experiments that are related to: First and second order system analysis control experiments. Servo systems. Stability of dynamical systems. System identification. Design and tuning of a PID controller in closed loop systems. Simulation of systems using Simulink/Matlab.

**60453105 Electric machines 3 Credit hrs. Prerequisite: 60453107**

Principles of Electromagnetic circuits; Single-phase transformers: ideal, practical transformer, equivalent circuit, auto-transformer; Three-Phase Transformer: Types and Connection; AC Machinery Fundamentals: Construction, rotating magnetic field; Three phase induction motors: Principle of working, starting, Equivalent Circuit, speed control; Synchronous Machines: Construction, Internal Generated Voltage, Equivalent Circuit; Operation Modes: Alone, Parallel; Synchronous Motors: Steady state operation, starting.

**60453107 Electric Circuits 3 Credit hrs. Prerequisite: 50551201**

Basic Components and Electric Circuits: Units and Scales, Current, Voltage, Power, Voltage and Current Sources, Ohm's Law; Voltage and Current Laws: Kirchhoff's Voltage, Kirchhoff's Current Laws; Nodal and Mesh Analysis; Techniques of Circuit Analysis: Superposition, Source Transformations, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer; Energy Storage Elements: Capacitor, Inductor; Basic RL and RC Circuits: The Source Free RL Circuit, The Source Free RC Circuit, The RLC Circuit. , AC Circuits, The Phasor, Phasor Relationships for R, L, and C, Impedance, Admittance; AC Circuit Power Analysis: Instantaneous Power, Average Power, Effective Values of Current and Voltage, Apparent Power and Power Factor, Complex Power; introduction to electronics

**60453108 Electric Circuits Lab. 1 Credit hrs. Prerequisite: 60453107**

DC Circuits: Ohm's law, Kirchhoff's Voltage and Current Laws, Network theorems, Maximum Power Transfer; Transient Circuits: RL, RC, RLC; Resonant Circuits.

**60453205 Mechanical design 3 Credit hrs prerequisite 60242102**

Introduction to design process, Design considerations, Tolerances, Fits and surface finish, Selection of materials, Mechanical properties of engineering materials, Stress analysis of machine elements, deflection equations, failure of machine elements under static loads, Fatigue analysis, shaft design.

**60462106 Types and sources of energy 3 Credit hrs. Prerequisite: 50551201**

Non-conventional energy sources such as oil shale, gas col continental sand, nuclear energy, renewable energies such as solar, wind and waves, fuel cells, advanced energy production systems.

**60463101 Renewable Energy 3 Credit hrs. Prerequisite: 50551201**





Introduction to various types of renewable energy resources as follows: solar energy, wind energy, bio energy, geothermal energy hydropower.

**60464102 Solar energy 3 Credit hrs. Prerequisite: 60463101**

Introduction to the solar energy, Solar radiation; Review of the basics of thermodynamics and heat transfer, Power plant Technologies; Types of CSP systems including CSP parabolic trough systems, CSP dish technology, CSP Fresnel technology and Solar tower; Heat storage systems; Hybridization; Secondary use of CSP systems; Operation and maintenance of CSP systems; Power quality control and grid integration; CSP plant project planning; economic, social and environmental considerations and site assessment.

**60464103 Solar energy Lab. 1 Credit hrs. Prerequisite: 60464102\***

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.

**60464104 Wind energy 3 Credit hrs. Prerequisite: 60463101**

Basic characteristics of wind, site characterization, Statistical methods of wind analysis, wind resources assessment, fundamental principles of wind energy utilization, aerodynamics, mechanical and electrical design aspects. Wind machine technologies and wind turbines performance analysis. Wind power integration into the power systems, environmental impact of wind power utilization

**60464105 Wind energy Lab. 1 Credit hrs. Prerequisite: 60464104\***

Studying the effect of wind speed, wind direction, fin shape, fin inclination angle, and number of fins, on the energy generated from wind turbines by reading both current and voltage. Studying the mechanism of storing energy in batteries and converting current from direct to alternating.

**60474101 Power electronics 3 Credit hrs. Prerequisite: 6045310**

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.

**60474202 Production and conversion of energy 3 Credit hrs. Prerequisite: 60462106**





Basic definition of properties, units, distinguish various sources of energy, understand energy density, heating value of various fuels, and implication of the energy usage on the environment. Mechanical and electrical works conversion and thermal energy, bio-fuel and Fuel cell technologies, internal energy and enthalpy, conservation laws of mass and energy, thermodynamic cycles, exergy analysis, energy transfer, gas power cycles. Vapor and combined power cycles, refrigeration and AC cycles and air thermodynamic cycles. Energy conversion, thermal efficiencies during these energy conversion processes and improving the efficiency of energy conversions.

**60475103 Energy storage 3 Credit hrs. Prerequisite: 60474202**

Methods of storing energy chemically, mechanically, electrically and thermally and ways to connect them to the main network. Evolution in energy transfer and cost versus efficiency.

**60482202 Environment and Energy 3 Credit hrs. Prerequisite: 60463101**

Basic Introduction to Energy: Energy and power, forms of energy, primary energy sources, energy flows, world energy production and consumption. The environmental impact of energy production and consumption include air pollution, water pollution, thermal pollution and solid waste disposal. The remedies related to social issues like global warming, ozone layer depletion, climate change.

**60485101 Energy management and protocols 3 Credit hrs. Prerequisite: 60482202**

General principles of energy management, Planning for energy management, Energy audit and surveys, energy analysis, analysis of typical applications such as heating cooling and lighting, Integrated building systems, Energy law and regulation in Jordan and worldwide.

**60485103 Energy efficiency and economy 3 Credit hrs. Prerequisite: 60482202**

Energy conservation, energy auditing; Analysis; Formulating energy management options; Economic Assessment and Energy Conservation Technologies - Energy Efficiency in Large Industries; Integrated resource planning; Demand management; Cogeneration; Total power schemes; Economic Assessment of Energy Conservation Technologies Energy production, investment, consumption and returns from it, And analysis of practical applications. Energy production, investment, consumption and returns from it.

**60494302 Engineering Practical Training 3 Credit hrs. Prerequisite: Completion of 115 Cr. Hrs.**

Practical training in a renewable energy engineering project or any other places approved by the department, and according to the regulations drafted by the college of Engineering Training Committee.



**60495102 Graduation Project (1) 1 Credit hrs. Prerequisite: Completion of 118 Cr. Hrs.**

Directed readings in the literature of renewable energy engineering, Introduction to research methods, seminar discussions dealing with special engineering topics of current interest. It is the first phase of the entire project.

**60495203 Graduation Project (2) 2 Credit hrs. Prerequisite: 60495102**

The student or a group of students selects a theoretical or practical project related to the cognitive domains of the renewable energy engineering discipline. At the end of the project, the student should undertake a comprehensive examination and submit a technical report along with an illustrated presentation of the project.

**60464207 Fuel cells and hydrogen 3 Credit hrs. Prerequisite: 60463101**

Physical principles and thermodynamics of electrochemical energy conversion and fuel cells. Fuel cell reaction kinetics and charge transport. Polymer electrolyte membrane and solid oxide fuel cells, their electrochemistry, heat and mass transfer. Performance characteristics and efficiency of fuel cells, and factors affecting them. Introduce different types of Fuel cell and their applications.

**60464208 Bioenergy 3 Credit hrs. Prerequisite: 60463101**

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. Environmental aspects of biofuel production, Economics and life-cycle analysis of biofuel.

**60464210 Design of renewable energy systems 3 Credit hrs. Prerequisite: 60463101**

Design of various renewable energy systems, such as solar, wind, biomass and bioenergy system, geothermal, hydro-power systems, and their applications.

**60464211 Design of wind power systems 3 Credit hrs. Prerequisite: 60464104**

Introduction to the production of electric power from wind energy, requirements for building wind turbines for electricity production, machinery and control study of all components of wind turbines, identification of required wind turbines size and Installation, interconnection between wind turbines and electrical networks, large turbine farms. Studying the commercial, developmental, economic and environmental impacts of wind energy.

**60484204 Simulation and prediction 3 Credit hrs. Prerequisite: 60453103**

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 Prediction Methods Using Computer for Available Data.







**60475204 Energy transfer and storage systems 3 Credit hrs. Prerequisite: 69475103**

Energy classifications, sources and utilization. Growth in energy consumption and economics. Basic principles of the most important types of batteries used in renewable energy systems, including fixed and mobile battery applications. Overview of renewable energy sources, focusing on solar and wind energy systems. Introduction to dc conversion systems of energy (thermal and photovoltaic converters and geothermal and fuel cells). Energy storage.

**60484205 Control and protection of energy systems 3 Credit hrs. Prerequisite: 60453103**

Theoretical principles and techniques of control and protection for Renewable Energy Systems.

**60474205 Energy Saving Design 3 Credit hrs. Prerequisite: 60474202**

Integrated principles, design energy-saving buildings. Application of laws and standards. Modeling, energy, simulation. Daylight and natural ventilation, passive solar buildings. Use of renewable resources, zero net designs. Economic life cycle analysis.

**60484206 Green Buildings 3 Credit hrs. Prerequisite: 60463101**

The use of solar energy in the heating and air conditioning of buildings and include the following topics: solar radiation, heating loads and air conditioning in buildings. Energy efficiency, heating and cooling using solar energy, standard implementation of thermal mass, green building's local regulations and codes.

**60464209 Solar thermal systems 3 Credit hrs. Prerequisite: 60464102**

Introduction of Solar Thermal Energy, Solar thermal energy conversion, Heat exchanger, Solar thermal collector, Solar photovoltaic thermal systems, Solar thermal power plant, Solar water desalination, and Economic assessment of solar thermal energy technologies.

**60464212 Special Topics in renewable energy 3 Credit hrs. Prerequisite: Department approval**

Advanced topics in the field of renewable energy provide students with an opportunity to explore the fields of renewable energy engineering and keep abreast of the latest developments in them to meet the challenges in renewable energy engineering.