

# Academic Programs Booklet

College of Engineering

# 2024



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# College of Engineering

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# College of Engineering

## List of MSc Programs

- 1- MSc. in Renewable Energy Engineering

## List of College Requirement Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite
		LEC	PRAC	CRD		
EEM601	Statistical Data Analysis and Research Methods	4	0	4	MR	
REE601	Renewable Energy Systems Fundamentals	4	0	4	MR	
REE602	Photovoltaic Energy Systems	4	0	4	MR	
REE603	Wind Energy Systems	4	0	4	MR	
REE604	Solar Thermal Energy	4	0	4	MR	
REE605	Special Topics in Renewable Energy Engineering	4	0	4	MR	
EEE699	Thesis	0	36	12	MR	Completion of 20 Credits

# MSc in Renewable Energy Engineering

## Program Components

Course Type	CRD
University Requirement (UR)	0
College Requirement (CR)	0
General Studies Compulsory (GSCC)	0
Major Requirement (MR)	24
Major Elective (ME) <sup>1</sup>	0
General Studies Elective (GSE) <sup>2</sup>	0
Thesis	12
<b>Total Credit (CRD)</b>	<b>36</b>

## Detailed Study Plan

### Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
EEM601	Statistical Data Analysis and Research Methods	4	0	4	MR	--	YES
REE601	Renewable Energy Systems Fundamentals	4	0	4	MR	--	YES
REE602	Photovoltaic Energy Systems	4	0	4	MR	--	YES

### Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
REE603	Wind Energy Systems	4	0	4	MR	--	YES
REE604	Solar Thermal Energy	4	0	4	MR	--	YES
REE605	Special Topics in Renewable Energy Engineering	4	0	4	MR	--	YES

### Year 2 - Semester 3 - 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
EEM699	Thesis	0	36	12	MR	Completion of 20 credits	No

## Course Description

### Major Requirement Courses Descriptions (MR):

Course Code:	<b>EEM601</b>	Course Title:	STATISTICAL DATA ANALYSIS AND RESEARCH METHODS
Course Description:	<p>This applied course is designed for graduate students. The goals of the course are to develop the skills necessary to identify an appropriate statistical technique, estimate models, analyze data, and interpret results for independent research and to critically evaluate contemporary research using advanced quantitative methods. The course will include descriptive and inference statistics, hypothesis testing, confidence intervals, processing and analysis of research data using different parametric and nonparametric statistical methods, regression analysis for linear and nonlinear models, and introduction to the design of experiments. Research methods, research ideas through literature survey, planning and designing specific methods for conducting research, analyzing data using scientific methodology and presenting research results in a systematic and objective way.</p>		

Course Code:	<b>REE601</b>	Course Title:	RENEWABLE ENERGY SYSTEMS FUNDAMENTALS
Course Description:	<p>Gaining an understanding of the principles of renewable energy technologies is key to understanding the technological basis of the systems and their applications. This is particularly important regarding the overall energy mix of a specific country. This course provides the fundamentals of renewable energy technologies and their impact on global and national energy systems. The purpose is to introduce the basis for assessing the performances of solar, wind, wave, tidal, hydro-electricity, biomass, waste, and geothermal technologies. A basic introduction to the relevant market, financial management, policies, regulations, and incentives will be experienced.</p>		

Course Code:	<b>REE602</b>	Course Title:	PHOTOVOLTAIC ENERGY SYSTEMS
Course Description:	<p>History of PV technology; Types of PV Systems, Principles of operation of photovoltaic systems; PV systems performance characteristics as a function of environmental conditions; Site assessment for PV systems installation, selection of an appropriate system design; Installation of basic subsystems; Inspection and maintenance of PV Systems; Safety considerations during installation and exploitation of PV systems. PV systems: standard PV systems, PV concentrator</p>		

Course Code:	<b>REE603</b>	Course Title:	WIND ENERGY SYSTEMS
Course Description:	<p>The following topics will be covered in the course: Statistical methods of wind analysis, Wind Resources Assessment and Site Selection, Wind Machine Technologies and wind turbines performance analysis. The course deals with the basic characteristics of wind energy, site characterization, fundamental principles of wind energy utilization, and discusses the design of basic parts including aerodynamics, mechanical and electrical design aspects. Special emphasis will be given to the theory of design of turbine blades. Off-shore and onshore wind plants. integration into the power systems will also be</p>		

	addressed in this course. Furthermore, environmental impacts of wind power utilization will be discussed
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Course Code:	<b>REE604</b>	Course Title:	SOLAR THERMAL ENERGY
Course Description:	Management and storage of heat, mechanical, and electrical energy are treated. The following forms of storage: Thermal energy storage: heat reservoirs, phase transition utilization and chemically bound heat are presented. Mechanical energy storage: Spin Wheels, pumps, turbines and heat recovery and Electrochemical storage of electrical energy		

Course Code:	<b>REE605</b>	Course Title:	SPECIAL TOPICS IN RENEWABLE ENERGY ENGINEERING
Course Description:	<p>Depending on the request of the majority of the M.Sc. Candidates and the availability of a specialized instructor one of the advanced topics in renewable energy will be offered such as:</p> <p><b>ENERGY STORAGE SYSTEMS:</b> Management and storage of heat, mechanical, and electrical energy are treated. The following forms of storage: Thermal energy storage: heat reservoirs, phase transition utilization and chemically bound heat are presented. Mechanical energy storage: Spin Wheels, pumps, turbines and heat recovery and Electrochemical storage of electrical energy: Important battery technologies and hydrogen technologies are detailed.</p> <p><b>ENERGY ECONOMICS, POLICIES, AND REGULATIONS:</b> A variety of theoretical and empirical topics related to energy demand, energy supply, energy prices, renewable vs depletable resources and environmental consequences of energy consumption and production, all from an economic perspective are discussed. How key economic principles are used in various energy-environment models to inform energy and climate policy are demonstrated. Key factors to consider include legal and licensing provisions, tariff regulations, financial support, quality standards and eventual grid interconnection to the main grid are considered.</p> <p><b>ENERGY CONSERVATION TECHNIQUES:</b> Skills to identify and understand energy efficiency and conservation methods used to reduce energy consumption in the built environment are detailed. Students will analyze residential and commercial facilities for opportunities to employ energy saving measures. Students will become familiar with the use of energy monitoring and measuring equipment used for energy auditing. Students will also learn how to calculate energy savings and determine environmental impacts of these energy saving methods.</p> <p><b>INSTALLATION OF RENEWABLE ENERGY SYSTEMS: Rules and Practices:</b> Techniques and rules that have to be followed step by step and to be respected in installing standalone as well as grid tied systems. A certificate will be delivered to the candidate that may authorize him/her to open a business in installing locally renewable energy systems.</p> <p><b>GEOHERMAL ENERGY:</b> To provide an understanding of the physical principles, technologies and systems associated with renewable energy generation from geothermal sources. To provide an understanding of the position of these sources of energy in the current and future global energy requirements and the technical challenges in meeting the future energy demand.</p> <p><b>WAVE ENERGY:</b> This course deals with the marine renewable energy resources, markets and technologies The course provides students with good understanding of the</p>		

	<p>fundamentals of wind turbines, tidal turbines and wave energy converters performances and a hands-on experience with the assessment of the performance of these technologies. OTHER FORMS OF RENEWABLE ENERGY SYSTEMS: Other forms of renewable energy systems like Biomass, Fuel Cells, Biofuels systems will be offered. The different types/technologies of each resource are explained.</p>
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Course Code:	<b>EEM699</b>	Course Title:	<b>Master's Thesis</b>
Course Description:	<p>The last semester of the Master program provides the student with an opportunity to undertake extensive investigation of an advanced or specialized topic relating to his/her MSc program; to provide the opportunity to plan and execute a significant project of research, investigation or development.</p>		

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## University Requirements Courses Descriptions

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**Course Code:** ARAB110

**Course Title:** Arabic Language Skills

This course focuses on basic Arabic skills including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

**Course Code:** HIST122

**Course Title:** Modern History of Bahrain and Citizenship

Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

**Course Code:** HRLC107

**Course Title:** Human Rights Principles

This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

**Course Code:** ISLM101

**Course Title:** Islamic Culture

An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.

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## College Requirement Courses Descriptions

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**Course Code:**CHEMY101      **Course Title:**General Chemistry I

Significant figures, chemical formulas and equations; mass relations, limiting reactants and theoretical yield; Physical behaviour of gases; electronic structure, periodic table, covalent bonding; Lewis structures, Molecular structures, hybridization; molecular orbitals, solutions; colligative properties. Related practical work.

**Course Code:** BIOLS102      **Course Title:** General Biology I

Properties of life; atoms, molecules and chemical bonds; biomolecules; cell structure and function; bioenergetics (intermediary metabolism); cell reproduction; Mendelian genetics; structure of DNA; RNA and protein synthesis; molecular genetics.

**Course Code:**PHYCS101      **Course Title:** General Physics I

Units and measurements; brief review of vectors; Newton's laws of motion; projectile motion; work and energy; impulse and momentum; rotational dynamics; equilibrium of a rigid body; periodic motion.

**Course Code:**MATHS121      **Course Title:** Calculus and Analytic Geometry I

Limits and continuity. Derivatives and integrals. Applications of derivatives which include mean value theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus. Derivatives and integrals of exponential, logarithmic and inverse Trigonometric functions.