Australian University

Department of Petroleum Engineering

Bachelor of Technology in
Renewable Energy Engineering

Program Description

November 6, 2024

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Prelude

The “Bachelor of Technology in Renewable Energy Engineering” aligns with the Kuwait Vision 2035 initiative, contributing to the nation’s long-term goal of transitioning to a more sustainable and diversified economy. Vision 2035 emphasizes the development of sustainable infrastructure, economic diversification, and environmental responsibility—all of which are addressed within this program's curriculum.

This forward-thinking degree not only equips students with advanced technical expertise but also integrates the strategic priorities of Kuwait Vision 2035. Students are encouraged to apply their skills in ways that directly support Kuwait’s commitment to a cleaner, more sustainable energy sector, such as by reducing reliance on non-renewable resources and fostering innovation in renewable technologies. By developing competencies in solar, wind, hydro, energy storage, and smart grid technologies, graduates will be well-prepared to contribute to projects that advance Kuwait's position as a leader in sustainable energy in the MENA region.

Furthermore, the program includes modules on policy, economic impact, and environmental sustainability, giving graduates the tools to navigate and influence the regulatory frameworks essential for renewable energy projects in Kuwait and beyond. This holistic approach aligns with Vision 2035’s objectives, empowering graduates to lead in the creation of a resilient and eco-friendly energy landscape for Kuwait, positioning them as pivotal players in the nation’s transition towards a sustainable future.

Table of Abbreviations

ABET	Accreditation Board for Engineering and Technology
AU	Australian University
CDIO	Conceive, Design, Implement, Operate
CEL	College Elective
CH	Credit Hours
CM	College Mandatory
CoH	Contact Hours
Co-R	Co-Requisite
DEL	Department Elective
DM	Department Mandatory
EA	Engineers Australia
Math	Mathematics
PBL	Project Based Learning
Pre-R	Pre-Requisite
UEL	University Elective
UM	University Mandatory

List of Tables

General Introduction

In this document, a full 2+2-year program to acquire a Diploma in Renewable Energy Engineering followed by a Bachelor of Technology in Renewable Energy Engineering is detailed.

The students must complete 60 credit hours (CH) in the first two years to acquire the Diploma of Renewable Energy Engineering. Upon completion of the Diploma program, the students may continue and receive the Bachelor of Technology in Renewable Energy Engineering if they complete complementary 60 CH during an additional two years of study. In other words, a Bachelor of Technology in Renewable Energy Engineering graduate completes 120 CH in total. These credit hours span over university, college and department requirements as either mandatory or elective courses.

In what follows, the “Diploma of Renewable Energy Engineering Program” will refer to the first two years of study, the “Bachelor of Technology in Renewable Energy Engineering Program” will refer to the second two years of study, and the “Renewable Energy Engineering 2+2 Program” will refer to the full 2+2 years of study combining both Diploma and Bachelor programs

1. General Program Structure

As illustrated in Table 1 below, the Renewable Energy Engineering program incorporates the 2+2-year model, in which students will complete a total of 120 CH to acquire two degrees:

- A Diploma of Renewable Energy Engineering: 60 CH distributed over two years of study.
- A Bachelor of Technology in Renewable Energy Engineering: complementary 60 CH distributed over an additional 2 years of study.

Table 1. Degrees of the Renewable Energy Engineering Program

Degree	Duration of Study	Credit Hours
Diploma of Renewable Energy Engineering	2 Years	60 CH
Bachelor of Technology in Renewable Energy Engineering	+2 Years	60 CH

A student is eligible to enroll in the Diploma program only when all the foundation requirements in Math and English are met. Otherwise, the student enrolls first into the AU English Language program and/or prerequisite Math courses.

The 120 CH of the Renewable Energy Engineering 2+2 program span over university, college and department requirements as either mandatory courses or electives.

2. Course Information

2.1. Course Code

In this document, a nine characters code is used to identify any course as illustrated in Table 2.

Table 2. Course Code Definition

Degree Type	-	Major	Level	Subject	Sequence
Two characters	-	*Four characters*	*1 digit*	*1 digit*	*1 digit*

Where the "Degree Type" defines the nature of the degree under which the course is taken whether it is technology based "TE" (for Diploma or Bachelor of Technology programs) or Science base "SC" (for Bachelor of Science programs). Since the "Degree Type" in this document is always defined as "TE", it will be omitted; the "Major" is one of the codes of Table 3; the "Level" describes the level of the course, which is considered as the year of study during which the student is expected to complete the course; the "Subject" identifies the specialized field of the course. For instance, Table 4 identifies the subject codes for the courses offered under Renewable Energy Engineering major. Finally, the "Sequence" is a simple sequence number under a particular level and a particular subject. In this sequence, the numbers 7, 8 and 9 are reserved for lab-based courses.

Table 3. Major Codes

Major	Code
Arts and Humanities	AHUM
Artificial Intelligence Engineering	AIEN
Accounting	BACC
Architectural Engineering	ARCH
Aviation	AVIA
Banking and Finance	BFIN
Biomedical Engineering	BIOM
Chemistry	CHEM
Chemical Engineering	CHEE
Civil Engineering	CIVL
Computer Engineering	COMP
Digital Marketing and Communications	BDMC
Economics	BECO
Electrical Engineering	ELEC
English	ENGL
Events Management	BEVM
General Engineering	ENGI
Geoscience	GEOS
Human Resources	BHRM
International Business & Entrepreneurship	BINT
Management	BMGT
Management Information Systems	BMIS
Maritime	MARI
Marketing	BMKT
Mathematics	MATH
Mechanical Engineering	MECH
Petroleum Engineering	PETR
Physics	PHYS
Renewable Energy Engineering	RENG
Statistics	STAT
Universal	UNIV

Table 4. Subject Codes - Renewable Energy Engineering

Subject Areas in Renewable Energy Engineering	Code
Renewable Energy Engineering Fundamentals	0
Solar Energy	1
Hydropower	2
Geothermal Energy	3
Energy Efficiency and Sustainability	4
Environmental and Social Impact	5
Electrical and Power Systems	6
Project	9

2.2. Course Type

In addition to the course code, the letters UM, CM, DM, UEL, CEL, DEL indicate the nature of the course as a mandatory or elective course and as to whether it is a university, college, or department requirement. This is detailed as follows:

- UM: University Mandatory Course.
- CM: College Mandatory Course.
- DM: Department Mandatory Course.
- UEL: University Elective Course.
- CEL: College Elective Course.
- DEL: Department Elective Course.

A UM, CM, or DM course is a mandatory course that the student must complete as a graduation requirement. On the other hand, UEL, CEL and DEL are elective courses. For each of these categories is associated a list of elective courses that a student can select from the amount of elective credit hours required by a particular program of study.

2.3. Course Pre-Requisite and Co-Requisites

A number of courses have stated Pre-Requisite (Pre-R) requirements, which are prior requirements for entry to the course. Also, some courses have stated Co-Requisite (Co-R) requirements, which are concurrent requirements for entry to the course. A student has the right to complete the Co-Requisite requirements of a particular course prior or during the same semester of study of this course.

In lists of course Pre-Requisites and Co-Requisites, "or" conditions are spelled out explicitly, but "and" conditions are indicated with a comma ",". For example: "MATH100, PHYS120" means "MATH100 and PHYS120".

2.4. Course Credit and Contact Hours

Each course is identified by its credit hours (CH) which is mainly used for the study plan and the calculation of the semester and cumulative Grade Point Average (GPA) of the student. On the other hand, the course contact hours (CoH) identify the weekly contact hours that are required to cover the learning material of the course. This indicates the number of hours that will be in the student semester schedule once he/she enrolls in the course.

3. Diploma of Renewable Energy Engineering

3.1. Program Educational Objectives

The Diploma of Renewable Energy Engineering graduates are able to:

1. Secure successful careers in the field of Renewable Energy Engineering.
2. Apply and develop skills to cope with the current and emerging technologies and the community needs towards innovation and development.
3. Communicate effectively as individuals or in diverse groups to address and solve engineering problems.
4. Troubleshoot and operate different Renewable Energy Engineering systems effectively.
5. Demonstrate principles of soft and technical skills.

3.2. Student Outcomes

Upon completion of the Diploma of Renewable Energy Engineering, the students will be able to:

1. Apply mathematics, science, engineering fundamentals and standard hardware/software tools to solve well-defined problems.
2. Conduct tests and experiments in the practice area and analyze and interpret data.
3. Provide support in performing tasks and procedures and assist in designing engineering systems and components.
4. Understand and apply relevant standards and codes of practice with an emphasis on health and safety aspects in the workplace.
5. Recognize the impact of engineering practice in global, economic, environmental and societal contexts.
6. Apply common communication techniques in well-defined technical and non-technical engineering environments and select appropriate technical literature.
7. Function effectively as individuals and in diverse teams and use a foreign language if applicable.

3.3. Courses distributions

The Diploma of Renewable Energy Engineering consists of 60 CH distributed over university mandatory and elective courses, college mandatory, as well as department mandatory courses. The corresponding recommended study plan over 4 semesters is detailed in Table 5 where fresh students are required to enroll in a minimum of 15 CH from semester 1 courses.

Table 5. Diploma of Renewable Energy Engineering: Recommended Study Plan

	Course Code	Course Name	Pre-R	Co-R	Credit Hours	Contact Hours	Course Type
Semester 1	ENGL110	Technical Writing for Engineering			3	3	CM
	MATH100	Calculus I			3	3	CM
	PHYS100	Physics I			3	3	CM
	CHEM100	Chemistry I			3	3	CM
	MECH120	Engineering Drawings			1	3	CM
	ENGI100	Introduction to Engineering			1	2	CM
	CHEM109	Chemistry I Lab		CHEM100	1	2	CM
				Semester Total	**15**	**19**	
Semester 2	MATH101	Calculus II	MATH100		3	3	CM
	PHYS101	Physics II	PYHS100		3	3	CM
	ELEC100	Electrical Circuits	MATH100		3	3	DM
	AIEN120	Computer Programming	MATH100		3	3	CM
	MECH100	Workshop I			1	3	CM
	AIEN129	Computer Programming Lab		AIEN120	1	2	CM
	PHYS109	Physics Lab	PHYS100	PHYS101	1	2	CM
				Semester Total	**15**	**19**	
Semester 3	RENG200	Introduction to Energy Systems and Sustainability			3	3	DM
	ELEC200	Electrical Circuits Analysis	MATH101, ELEC100		3	3	DM
	MECH230	Thermodynamics I	PHYS101		3	3	DM
	MECH240	Material Science	CHEM100, CHEM109		3	3	DM
	MECH250	Fluid Mechanics	PHYS101, MATH101		3	3	DM
	ELEC209	Electrical Circuits Analysis Lab		ELEC200	1	2	DM
				Semester Total	**16**	**17**	
Semester 4	RENG210	Applied Photovoltaics	RENG200, ELEC200		3	3	DM
	RENG260	Electronics & Instrumentation in Renewable Energy	ELEC200		3	3	DM
	RENG290	Project 1 (PBL)	ELEC200, RENG200		3	3	DM
	RENG210	Applied Photovoltaics Lab		RENG219	1	2	DM
	RENG269	Electronics & Instrumentation in Renewable Energy Lab		ELEC220	1	2	DM
		University Elective 1 (Table 7)			**3**	**3**	**UEL**
				Semester Total	**14**	**16**	
				Program Total	**60**	**71**	

4. Bachelor of Technology in Renewable Energy Engineering

4.1. Program Educational Objectives

The Bachelor of Engineering Technology in Renewable Energy Engineering graduates are able to:

1. Secure successful careers in the field of Renewable Energy Engineering.
2. Apply and develop skills to cope with the current and emerging technologies and the community needs towards innovation and development.
3. Communicate effectively individually or in diverse groups to address and solve engineering problems.
4. Troubleshoot and operate different Renewable Energy Engineering systems effectively.
5. Demonstrate principles of soft and technical skills.
6. Conceive, design, implement and operate proficiently collaborative Renewable Energy Engineering projects and solutions.
7. Pursue competently higher education or entrepreneurship.

4.2. Student Outcomes

Upon completion of the Bachelor of Engineering Technology in Renewable Energy Engineering, the students will be able to:

1. Apply mathematics, science, engineering concepts and standard hardware/software tools to solve broadly defined problems.
2. Design and conduct tests and experiments in the practice area and analyze and interpret data for continuous process improvements.
3. Define tasks and procedures and design engineering systems and components to meet the required specifications.
4. Provide leadership in applying relevant standards and codes of practice with an emphasis on health and safety aspects in the workplace.
5. Acknowledge the impact of engineering expertise in global, economic, environmental, and societal contexts.
6. Apply relevant communication techniques in various engineering environments and conduct a proper technical literature review.
7. Function effectively as individuals and lead in diverse multidisciplinary teams and use a foreign language if applicable.

4.3. Courses Distributions

A Diploma of Renewable Energy Engineering graduate is equipped with all the knowledge, competencies and skills detailed in section 3 above and has already completed 60 CH of studies. Hence, Diploma graduates can complete two more complementary years of study to acquire the "Bachelor of Technology in Renewable Energy Engineering".

The Bachelor of Technology in Renewable Energy Engineering consists of 60 CH distributed over college elective requirements, school mandatory and elective requirements, and department mandatory and elective requirements.

Table 6 details the recommended study plan of the Bachelor of Technology in Renewable Energy Engineering over four semesters. As shown in this table, the department elective courses as well as the Graduation Project courses, require the completion of a minimum of 30 CH in the bachelor program as a summative pre-requisite in addition to any specialized pre-requisite(s) they may require. This is due to the fact that those courses are all specialized advanced level 4 courses.

5. Program Tree

A holistic representation of the Bachelor of Technology in Renewable Energy Engineering 2+2 Program is given in Figure 1 in the form of a program tree illustrating graphically all the program's mandatory and elective requirements as well as the pre-requisite and co-requisite requirements.

Table 6. Bachelor of Technology in Renewable Energy Engineering: Recommended Study Plan

	Course Code	Course Name	Pre-R	Co-R	Credit Hours	Contact Hours	Course Type
Semester 1	MATH310	Linear Algebra and Differential Equations	MATH101		3	3	CM
	RENG340	Circular Economy and Sustainable Product Design			3	3	DM
	RENG361	Power Electronics and Renewable Energy Integration	RENG260		3	3	DM
	RENG301	Renewable Energy Systems and Conversions	MECH230		3	3	DM
	RENG390	Project 2 (PBL)	RENG290		3	3	DM
	RENG368	Power Electronics Lab		RENG361	1	2	DM
				Semester Total	**16**	**17**	
Semester 2	MATH320	Numerical Analysis	MATH310		3	3	DM
	RENG362	Renewable Energy & Smart Grid	RENG301		3	3	DM
	RENG391	Project 3 (PBL)	RENG390		3	3	DM
	RENG367	Renewable Energy & Smart Grid Lab		RENG362	1	2	DM
		University Elective 2 (Table 7)			**3**	**3**	**UEL**
				Semester Total	**13**	**14**	
Semester 3	RENG410	Advanced Solar Systems	RENG362		3	3	DM
	RENG463	Energy Storage	RENG362		3	3	DM
	RENG441	Optimization of Energy Systems	RENG340		3	3	DM
	RENG490	Graduation Project – Part I[1]	28CH		3	1	DM
	RENG419	Solar Energy Systems Lab		RENG410	1	2	DM
		College Elective (Table 8)	28CH		**3**	**3**	**CE;**
				Semester Total	**16**	**15**	
Semester 4	RENG442	Energy Auditing	RENG410, RENG441		3	3	DM
	RENG450	Environmental Impact Assessment of Energy Systems	RENG441		3	3	DM
	RENG491	Graduation Project – Part II[1]	RENG490		3	1	DM
		Department Elective 1 (Table 9)	28CH		**3**	**3**	**DEL**
		Department Elective 2 (Table 9)	28CH		**3**	**3**	**DEL**
				Semester Total	**15**	**13**	
				Program Total	**60**	**59**	

[1] A Graduation Project is conducted throughout two consecutive academic semesters (excluding Summer semesters). Students meet with their academic supervisor at least one hour per week.

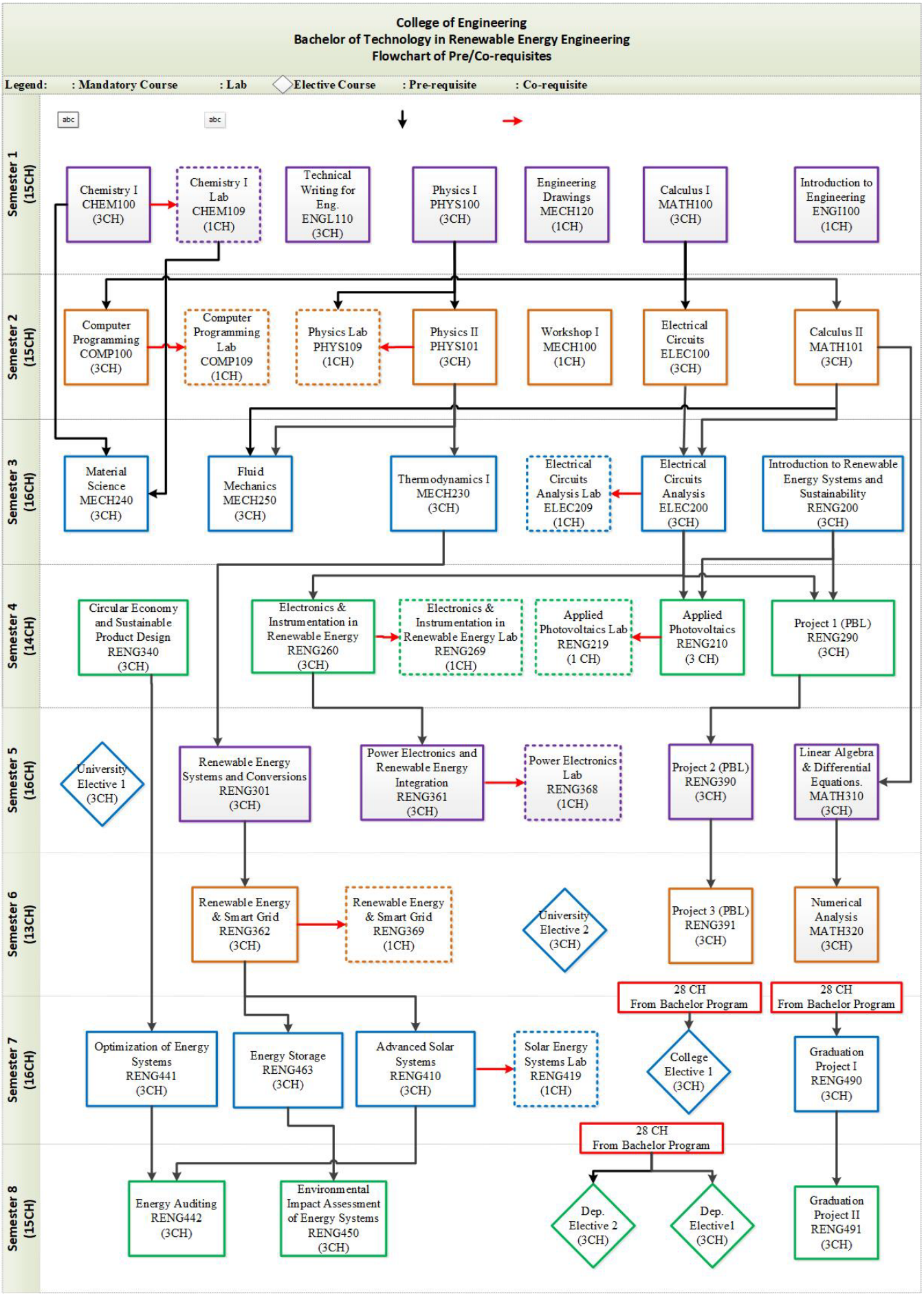

Figure 1. Bachelor of Tech. in Renewable Energy Engineering 2+2 Program Tree

6. Elective Courses

During their 2+2 study, the Renewable Energy Engineering students are obliged to select:

- 6CH University Electives: 1 course 3CH in the diploma and 1 course × 3CH in the Bachelor program.
- 3CH College Elective: 1 course × 3CH during the Bachelor of Technology studies.
- 6CH Department Electives: 2 course × 3 CH during the Bachelor of Technology studies.

6.1. University Electives Courses

The University electives are generally selected from university wide elective courses list or from colleges within AU. University electives are available for both the Diploma and Bachelor of Technology programs. A student who completed a university elective in the Diploma program is not allowed to re-take the same course in the Bachelor of Technology program. Table 7 lists all the university electives offered by AU and the applicability of these courses as university electives for Renewable Energy Engineering students (Diploma and Bachelor).

The Diploma of Renewable Energy Engineering students select only one of these courses. Same applies for the Bachelor of Technology in Renewable Energy Engineering students.

Table 7. University Electives

Course Code	Course Name	Credit Hours	Contact Hours	Available for the Program
AHUM100	Arabic Language	3	3	Yes
AHUM101	Science and Society	3	3	Yes
AHUM102	Arab Gulf Society	3	3	Yes
AHUM103	History of Kuwait	3	3	Yes
AHUM104	Human and Environment	3	3	Yes
AHUM105	Introduction to Psychology	3	3	Yes
AHUM106	Philosophy	3	3	Yes
AHUM110	Music	3	3	Yes
AHUM111	Theatre Art	3	3	Yes
AHUM303	Social Organization	3	3	Yes
AHUM304	Social and Cultural Change	3	3	Yes
ARCH101	Interior Design	3	3	Yes
AVIA101	General Principle of Human Factor	3	3	Yes
AVIA130	Basic Aerodynamics	3	3	Yes
AVIA320	Leadership in Organization	3	3	Yes
AVIA332	Non-Destructive Testing Techniques (NDT)	3	3	Yes
BACC110	Financial Accounting	3	3	Yes
BMGT110	Management Principles	3	3	Yes
BMGT350	Business Law	3	3	Yes
BMGT351	International Law	3	3	Yes
BMIS110	Business Computer Applications	3	3	Yes
BMKT120	Branding	3	3	Yes
BMKT121	Advertising	3	3	Yes
BMKT120	Branding	3	3	Yes
BMKT150	Marketing and Technology	3	3	Yes
BMKT160	Sales Strategies	3	3	Yes
ENGL300	Advanced English	3	3	Yes
MATH300	Numbers History and Game Theory	3	3	Yes
STAT200	Probability and Statistics	3	3	No
UNIV110	Entrepreneurship I	3	3	Yes
UNIV310	Entrepreneurship and Enterprise	3	3	Yes

6.2. College Elective Courses

The College elective courses are generally selected from college wide elective courses list or from departments within the college. College electives are available for the Bachelor of Technology students only. Table 8 lists all the college of engineering electives and their applicability for the Bachelor of Technology in Renewable Energy Engineering students.

The Bachelor of Renewable Energy Engineering students select only one college elective.

Table 8: College of Engineering Elective Courses - Renewable Energy Engineering Program

Course Code	Course Name	Credit Hours	Contact Hours	Available for the Program
AIEN100	Introduction to Computing, and Data Science	3	3	Yes
AIEN210	Introduction to Artificial Intelligence and Machine Learning	3	3	Yes
AIEN300	Internship	3	N/A[2]	No
AIEN302	Computer Networks	3	3	Yes
BIOM200	Fundamentals of Biomedical Engineering	3	3	Yes
BIOM300	Internship	3	N/A[2]	No
CHEE300	Internship	3	N/A[2]	No
CHEE321	Management of Technology Innovation	3	3	Yes
CIVL100	Statics	3	3	Yes
CIVL210	Strength of Materials	3	3	Yes
CIVL300	Internship	3	N/A[2]	No
ELEC220	Instrumentation and Measurement	3	3	Yes
ELEC230	Digital Logic	3	3	Yes
ELEC300	Internship	3	N/A[2]	No
ENGI401	Engineering Economics	3	3	Yes
MATH311	Theory of Differential Equations	3	3	Yes
MATH321	Computational Linear Algebra	3	3	Yes
MATH340	Mathematical Modelling	3	3	Yes
MATH410	Introduction to Dynamical Systems and Chaos	3	3	Yes
MATH411	Numerical Ordinary Differential Equation	3	3	Yes
MECH230	Thermodynamics I	3	3	No
MECH250	Fluid Mechanics	3	3	No
MECH300	Internship	3	N/A[2]	No
PETR200	Introduction to Petroleum Engineering	3	3	Yes
PETR202	Oilfield Chemistry and Corrosion Control	3	3	Yes
PETR203	Storage and Transportation of Crude Oil and Gas	3	3	Yes
PETR300	Internship	3	N/A[2]	No
PHYS350	Introduction to Nanotechnology	3	3	Yes
PHYS360	Basic Photovoltaics	3	3	Yes
PHYS400	Modern Physics	3	3	Yes
RENG200	Introduction to Energy Systems and Sustainability	3	3	No
RENG300	Internship	3	N/A[2]	Yes

[2] The student has to complete a total of 150 hours.

6.3. Department Elective Courses

Table 9 lists all of the department electives offered for the Renewable Energy Engineering major. Department electives are available for the Bachelor of Technology students.

Students of the Bachelor of Technology in Renewable Energy Engineering select only two department electives: 2 x 3CH = 6CH.

Table 9: Department Elective Courses

Course Code	Course Name	Pre-R	Co-R	Credit Hours	Contact Hours
RENG402	Wind Energy Systems	RENG463		3	3
RENG403	Bioenergy and Biomass Systems	RENG340		3	3
RENG404	Water Desalination by Renewable Energy	RENG340		3	3
RENG430	Geothermal Energy Systems	RENG463		3	3
RENG443	Fuel Cell and Hydrogen Production	RENG441		3	3
RENG445	Sustainable Building Design	RENG340		3	3
RENG451	Water-Energy Nexus	RENG340		3	3

7. University Courses Description

7.1. University Elective Courses

Refer to Table 7. Courses description of these courses are provided by the relevant college.

8. College of Engineering Courses Description

8.1. College Mandatory Courses

AIEN120 - Computer Programming (3 CH; 3 CoH; Pre-R: MATH100; Co-R: N/A; CM)

This course covers problem-solving methods and algorithm development using the high-level programming language Python after a brief introduction to computational concepts. Python is a language with a simple syntax and a powerful set of libraries. The course covers basic data types and collections (lists dictionaries tuples and sets) control flow recursion information hiding and encapsulation using classes and objects and introduce the analysis of program performance. The examples and problems used in this course are drawn from diverse areas such as text processing and simple graphics creation.

AIEN129 - Computer Programming Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: AIEN120; CM)

This lab course provides supplemental material and activities to develop programming skills and enhance the theoretical knowledge of students about programming concepts using the high-level programming language Python. In this Lab, students learn to work with the command line, work with different kinds of data, and participating in several important programming practices (e.g., debugging, testing, and designing programs; read technical documentation and sample code; install and explore third-party modules and APIs).

CHEM100 - Chemistry I (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

A basic understanding of chemistry is of paramount importance to a student considering a career in engineering. Chemistry impacts all of our lives, from the food we eat, the clothes we wear, the burning fuel for heat and transportation, the novel medicines for treatment of deadly diseases, and the impacts of global warming on living organisms. The following topics will be discussed in this course: fundamental aspects of matter and measurements, stoichiometry, electronic structure of atoms, the periodic table properties, chemical bonding, molecular geometry, and the properties of gases and liquids along with intermolecular forces.

CHEM109 - Chemistry I Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: CHEM100; CM)

This is a laboratory-based course to introduce students to the basic chemistry concepts discussed in the Chemistry I course in a laboratory environment. Students will perform experiments on density, limiting reagent, empirical and molecular formula, acid-base titration, solution preparation, and dilution. This course will also develop students' skills in the research and reporting of laboratory techniques.

ENGI100 – Introduction to Engineering (1 CH; 2 CoH; Pre-R: N/A; Co-R: N/A; CM)

The Introduction to Engineering course at AU is specifically designed for multidisciplinary engineering students seeking a solid foundation in ethics and its application in engineering practice. The course delves into the ethical considerations and professional responsibilities that engineers encounter throughout their careers. Through the examination of real-world case studies, students develop critical thinking skills and gain an understanding of ethical dilemmas in engineering. The course also introduces engineering practices, emphasizing project management, teamwork, communication, and problem-solving techniques within an ethical framework. Through interactive discussions and practical exercises, students cultivate a strong understanding of the ethical principles that guide engineering practice and acquire essential skills for ethical decision-making in their future engineering endeavors.

ENGL110 - Technical Writing for Engineering (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course is designed to meet the needs of students in the Engineering Departments to research and write extensively. It aims to equip students with the necessary skills and strategies to research and source reliable academic and engineering articles and read these sources to effectively identify and synthesize relevant information and incorporate these ideas in a review report. Within the review report, students will be expected to critically analyze the pertinent issues appropriate to their chosen topic and support their research question while adhering to the academic requirements of text structure, format and referencing.

MATH000 - Pre-Calculus (0 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course is designed for students who do not achieve the required score in the Math placement test. It includes essential training in algebraic operations, solution of equations and inequalities, coordinate geometry, functions and trigonometry. Upon successful completion of this course, students will have adequate competencies and skills to advance to Calculus I.

MATH100 – Calculus I (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course covers the fundamental concepts of calculus: limiting behaviors, difference quotients and the derivative, definite integral, antiderivatives and indefinite integrals, and the Fundamental Theorem of Calculus. Students review and extend their knowledge of trigonometry and basic analytic geometry. Important objectives of the calculus sequence are to develop and strengthen the students' problem-

solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

MATH101 - Calculus II (3 CH; 3 CoH; Pre-R: MATH100; Co-R: N/A; CM)

This course covers the techniques of integration, applications of the definite integral, improper integrals, an introduction to differential equations, convergence of sequences and series, Taylor series, parametric equations, and polar coordinates. Student should be able to apply and evaluate definite and indefinite integrals; analyze and evaluate limits; understand the definition of improper integrals and compute their values; determine the convergence or divergence of infinite sequences and series; find the Taylor polynomial of order n at a specified center for a function, with error term; identify, differentiate and integrate a power series for a function; analyze curves given in parametric form and in polar coordinates.

MATH310 – Linear Algebra and Differential Equations (3 CH; 3 CoH; Pre-R: MATH101; Co-R: N/A; CM)

This course is a combination of basic linear algebra that covers linear equations, matrices determinant, eigenvalues and eigenvectors. In addition to analytic solutions, qualitative behavior of solutions to first and second order differential equations, Laplace transform to solve initial value problem, system of ordinary differential equations and some applications.

MECH100 - Workshop I (1 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course covers engineering workshop safety, hand tools, and fundamental aspects of different welding techniques. It includes the implementation and practicing of such safety rules and the identification of engineering hand tools and demonstration of their correct use to engineering standards.

MECH120 - Engineering Drawings (1 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course covers demonstration and practice in surface identification and projection techniques, orthographic multi-views projection, missing views, dimensioning, sectioning, axonometric projection, fits and tolerances, instrument drawing and computer-aided applications.

PHYS100 - Physics I (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CM)

This course is the first of a two-semester sequence in Physics. It is an introduction to physics (mechanics) for students who have high school algebra, geometry, and trigonometry at their fingertips, and have had, or are taking Calculus I course. It is designed to develop students' knowledge and understanding of some basic laws and principles of physics and their practical applications to Engineering. Likewise, it includes the following topics: physical units and quantities, vectors, motion in one and two dimensions, circular motion, forces and Newton's laws and their applications, work, force and energy, conservation of energy, linear momentum and collisions, rotational motion, energy and momentum in rotating systems, equilibrium, and oscillatory motion.

PHYS101 - Physics II (3 CH; 3 CoH; Pre-R: PHYS100; Co-R: N/A; CM)

This course seconds the introductory calculus-based Physics I course. In all engineering disciplines, there are fundamental concepts in electromagnetism that constitute the basis of a practicing engineer knowledge. This course will introduce the student to the fundamental concepts needed to analyze simple electrical and electronic systems in a way that at the end of the course, the student will have a fundamental understanding to design and analyze simple electronic systems.

PHYS109 – Physics Lab (1 CH; 2 CoH; Pre-R: PHYS100; Co-R: PHYS101; CM)

This exploratory experimental course in physics is designed for students in all Engineering disciplines to provide hands-on training in the use of some laboratory equipment and techniques to enhance their knowledge in Physics. The focus in this lab-course is to convey useful skills to the students through the application and observation of the concepts and physical laws that are introduced in the lecture. Students will be prepared to perform set of experiments in the laboratory. These experiments emphasize on different topics in mechanics, electricity and magnetism, which are the core aspects of the Physics courses taken by students at the first and second engineering semesters. Specifically, these experiments are a combination of kinematics, dynamics, conservation of energy, ohm's law, RC circuits, as well as electrical currents and potentials. Every lab-session will begin with a short recitation relevant to the experiment's procedures and concepts to ensure the relation between theory and experiments.

8.2. College Elective Courses

AIEN100 - Introduction to Computing, and Data Science (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This introductory course is integrative across different disciplines. The course covers introductory level of concepts such as history of computing, structure of a computer, algorithms, databases, data storage, data manipulation, data abstractions, data visualization, high performance computing, and cloud computing. The course will introduce the programing language Python to solve computational tasks from these mathematical subjects. Several skills, such as presentation, and storytelling with data, will be fostered. Students will acquire a working knowledge of data science through hands-on projects and case studies in a variety of business, engineering, social sciences, or life sciences domains. Issues of ethics and security are highlighted.

AIEN210- Introduction to Artificial Intelligence and Machine learning (3 CH; 3 CoH; Pre-R: AIEN120; Co-R: N/A; CEL)

This course gives a basic introduction to machine learning (ML) and artificial intelligence (AI). Through an algorithmic approach, the students are given a practical understanding of the methods being taught, through making their own implementations of several of the methods. The course covers supervised classification based on e.g., artificial neural networks (deep learning), as well as unsupervised learning (clustering), regression, optimization (evolutionary algorithms and other search methods) and reinforcement learning, in addition to design of experiments and evaluation. Students also receive an introduction to philosophical fundamental problems and ethical questions related to ML/AI, as well as the field's history.

AIEN330 - Introduction to Networking (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This course covers networking basics, switching & routing technologies. It introduces the architecture, structure, functions, components, and models of the Internet and data networks. Topics to be covered in this course are the principles of IP addressing (IPv4 and IPv6), fundamentals of Ethernet concepts, networking media, Switching and routing protocols. It also covers This course covers the configuration of basic data networks such as simple LANs and virtual LANs.

BIOM200 - Fundamentals of Biomedical Engineering (3 CH; 3 CoH; Pre-R: MATH101, PHYS101; Co-R: N/A; CEL)

Using a systems approach, this course introduces the students to the relationship between the structure and the function of the human body. It covers basic physiological and anatomical concepts using examples from cells, tissues, and organs. Biomaterials classification and selection for given applications is presented. Relationships between material properties and the internal structures is explained, and processes used to modify these structures to improve their properties are also discussed.

CHEE321 – Management of Technology Innovation (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This course provides an introduction to the topic of nanotechnology. This includes: the effect of size on material properties, nanoparticles in nature, carbon nanostructures, synthesis, nanoparticle devices, and applications of nanoparticles.

CIVL100 – Statics (3 CH; 3 CoH; Pre-R: MATH100, PHYS100; Co-R: N/A; CEL)

This course is intended to provide engineering students with the basics required for the analysis of structural systems. The following topics are covered: systems of forces and couples in plane and space, equilibrium of rigid bodies, friction, center of gravity, moments of inertia, distributed forces, trusses, beams, frames, shear force and bending moment diagrams.

CIVL210 – Strength of Materials (3 CH; 3 CoH; Pre-R: CIVL100; Co-R: N/A; CEL)

This course covers essential topics of stresses and strains, including stress-strain relationships, elastic and inelastic behavior, stress states of elementary and combined cases, axially loaded members, thermal stress, Mohr's circle, torsion, bending, shear stresses in flexural members, and buckling of columns. The analysis of systems includes both statically determinate and indeterminate systems under flexural, torsional, and axial load effects.

ELEC230 - Digital Logic (3 CH; 3 CoH; Pre-R: AIEN120; Co-R: N/A; CEL)

This course covers the fundamentals and principles of digital logic circuits, this includes numbering systems, logic gates, combinational and sequential circuits, Boolean algebra, K-map, computer models, and memory organization.

ENGI401 - Engineering Economics (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This course will be offered in two parts: microeconomics and macroeconomics. In the microeconomics part, students are introduced to functioning of the market system; concepts of supply and demand, the role of prices in resource allocation; production decisions by firms; analysis of differences between competition and monopoly, and the implications for economic efficiency; theories of labor markets and wage determination. In the macroeconomics part, students are introduced to the principles of determination of the level of employment, national income, real output, inflation, and international balance of payments. The course also analyzes the principles which govern trade relations among countries. These topics are integrated by a discussion of governmental regulations and fiscal policies to stabilize economic activity.

MATH311 - Theory of Differential Equations (3 CH; 3 CoH; Pre-R: MATH210; Co-R: N/A; CEL)

This course is offered for all engineering students. This course covers nonlinear differential equations, systems of first order differential equations, the theory of first order differential equations, stability of equilibria, boundary value problem and some applications. Also, the course covers series solutions of

ODEs, interpretation of solutions, Fourier analysis and solution of linear partial differential equations using the method of separation of variables.

MATH321 - Computational Linear Algebra (3 CH; 3 CoH; Pre-R: MATH210; Co-R: N/A; CEL)

This course is offered for all students of engineering. Solving a large system of equations by hand can be time consuming and hence it is done using computer, for example MATLAB. This course covers solving system of linear equations using direct and iterative methods, the linear-least squares problem, error analysis, matrix eigenvalue problem.

MATH340 - Mathematical Modelling (3 CH; 3 CoH; Pre-R: MATH210; Co-R: N/A; CEL)

This course is offered for students of mechanical, civil and electrical engineering. This course covers a selection of mathematical models that are used among engineering that can be described using differential equations and linear systems, analysis of models, development of solution algorithm and sensitivity of models to perturbations in data. Computer simulation for visualization and interpretation of physical phenomenon governed by these models.

MATH410 - Introduction to Dynamical Systems and Chaos (3 CH; 3 CoH; Pre-R: MATH210; Co-R: N/A; CEL)

This course is offered for students of mechanical, civil and electrical engineering. Almost all phenomena are described by a dynamical system. Understanding the behavior of the model is very crucial. Hence, this course covers dynamical systems and its phase space, basin attraction, elementary bifurcation theory, stability theory, Lyapunov methods, bifurcation of fixed points, chaotic systems and maps, iterated function systems, the contraction mapping theorem.

MATH411 - Numerical Ordinary Differential equations (3 CH; 3 CoH; Pre-R: MATH210; Co-R: N/A; CEL)

This course is offered for students of mechanical, civil and electrical engineering. Solving an ordinary differential equation analytically can be challenging and sometimes impossible. Hence, numerical solution techniques are needed. This course covers numerical integrations, Gaussian and Romberg integration, and numerical solution of ordinary differential equations, initial value problem one step and multistep methods (convergence and absolute stability) and boundary value problems.

PETR200 - Introduction to Petroleum Engineering (3 CH; 3 CoH; Pre-R: CHEM100; Co-R: N/A; DM)

The aim of this course is to provide introduction to petroleum engineering in order to handle related courses in subsequent years which will be understood within a broader petroleum engineering context. This course covers basic knowledge of history of oil and gas industry, nature of oil and gas, worldwide distribution of oil and gas along with world oil production and producing countries. The course provides introduction to geology at exploration stage, introduction to drilling, completions and production, basics of reservoir description along with petroleum economics and health and safety practices in the oilfield. It also provides introduction to petrochemical, refining and processing practices in oil and gas industry. The course will also introduce students to oil and gas industry standards and practices.

PETR202 - Oilfield Chemistry and Corrosion Control (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This course will give students a thorough introduction to the fundamental principles of oilfield chemistry and corrosion. The course should cover an introduction to the nature of the multiphase flows

in oil pipelines, including the hydrocarbons, water, dissolved gases and other substances that drive the internal deterioration of steel pipelines. In addition, corrosion mechanisms, as well as the physical, chemical and metallurgical factors that govern the corrosion behavior and modes along with the methods and measures used to evaluate and control corrosion in pipelines will be discussed.

PETR203 - Storage and Transportation of Crude Oil and Gas (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; CEL)

This course will give students an introduction to the different methods and technologies of storing and transporting petroleum products and natural gas. The course should cover the basics of pipeline construction, pipeline operations, pipeline maintenance, and the treatment facilities required for oil and gas transport and storage.

PHYS350 - Introduction to Nanotechnology (3 CH; 3 CoH; Pre-R: PHYS101, CHEM100; Co-R: N/A; CEL)

The course is designed to provide the students with basic understanding of the nanotechnology field and its role in developing materials, machines, circuits, building, construction, energy, fluids, communications, medicine, and many more systems and fields. Extensive knowledge on the applications of the nanomaterials, nanodevices, and techniques will be discussed. The course aims to identify nanotechnology fundamentals and to understand the materials properties at the nanoscale; especially, properties of important and famous nanomaterials. It also provides a comprehensive understanding of the nanotechnology fabrication and characterization techniques. Students will become familiar with the application of nanotechnology in several systems related to their major of study such as nano-based solar cells, nanoparticles for structure reinforcement, nano-biotechnology, nano-based fluid treatments, nano-machines, and many more applications. In general, students will be able to distinguish between the different types of nanomaterials and their effective use in the different fields of study. The course will also discuss the types of several nano-techniques used to fabricate nano systems and their applications.

PHYS360 - Basic Photovoltaics (PV's) (3 CH; 3 CoH; Pre-R: PHYS101, CHEM100; Co-R: N/A; CEL)

The course mainly benefits Electrical and Mechanical Engineering students to understand the working mechanism of solar cells including the most effective employment of this technology. This will come in handy for students furthering their education in energy field or and/or working in the energy sector. Moreover, the course establishes the fundamental knowledge necessary to develop the photovoltaic technology in both scientific and industrial sectors. The course aims to provide engineers with information needed to understand the principles of photovoltaics system operation. The physics and operation of solar electricity conversion, how solar cells are manufactured, and how solar cells are evaluated will be addressed in this course. Also, it familiarizes students with emerging photovoltaic technologies and various issues related to photovoltaic system such as efficiencies, losses, characterization, manufacturing, and life-cycle analysis. Other topics covered include photovoltaic technology evolution in the context of markets, policies, society, and environment.

PHYS400 - Modern Physics (3 CH; 3 CoH; Pre-R: PHYS101, MATH310; Co-R: N/A; CEL)

The 20th century was known as the century of technology. The physics that is evolved in this century is responsible of all the developed technologies up till today. In the past 100 years, space, semiconductors, energy, time, quantum principle, and communications were comprehended and used in much deeper levels. This unique course provides Electrical and Mechanical Engineering students

with the fundamental understanding of the physics' modern principles, in a broad view between simplicity and complexity, to complement their knowledge acquired in the engineering courses. This course aims to introduce engineering students to a range of Modern Physics' topics such as Special Relativity, Quantum Mechanics, Atomic Physics, Solid State Physics, Nuclear Physics, and Cosmology. The course involves solving general problems of special relativity, understanding the basis for quantum mechanics and be able to solve Schrodinger's equation for simple potentials. The course provides the ability to apply solid state physics to describe how semiconductors work. Calculation the energy required/released in nuclear reactions will be also discussed.

AIEN/BIOM/CHEE/CEVL/ELEC/MECH/PETR/RENG300 – Internship (3 CH; 150 Hours; Pre-R: 30CH; Co-R: N/A; CEL)

This course covers the professional experience, through training in the execution of real-life engineering projects. Practical training aims at developing practical skills for the student so that he/she might develop an awareness of job requirements and become qualified to practice a specialization in a sound and systematic way.

9. Department Courses Description

9.1. Department Mandatory Courses

ELEC100 - Electrical Circuits (3 CH; 3 CoH; Pre-R: MATH100; Co-R: N/A; DM)

This course covers the fundamentals of direct and alternating currents (DC and AC) and the analysis of simple DC and AC series, parallel and series/parallel circuits. Topics to be covered in this course are basic electrical components (Resistors, Capacitors and Inductors), DC/AC voltage and current sources, impedances, admittances, phasors, source transformation, Ohm's and Kirchhoff's Laws.

ELEC200 - Electrical Circuits Analysis (3 CH; 3 CoH; Pre-R: MATH101, ELEC100; Co-R: N/A; DM)

This course covers the analysis of DC and AC electrical circuits using techniques such as superposition theorem, mesh and nodal analysis as well as Thevenin and Norton theorems. It also covers AC power, frequency-dependent circuits and DC transients.

ELEC209 - Electrical Circuits Analysis Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: ELEC200; DM)

This course introduces students to the major circuits components and equipment used in a laboratory environment. It develops the skills required to properly implement and troubleshoot DC and AC circuits. Electrical circuit analysis software used to simulate and troubleshoot complex electrical circuits are also covered.

MATH320 – Numerical Analysis (3 CH; 3 CoH; Pre-R: MATH310; Co-R: N/A; DM)

This course covers the basic techniques for the efficient numerical solution of problems in science and engineering. Topics spanned root finding, interpolation, approximation of functions, integration, differential equations, direct and iterative methods in linear algebra. In addition to solving first order differential equations

MECH230 – Thermodynamics I (3 CH; 3 CoH; Pre-R: PHYS101; Co-R: N/A; DM)

The course covers principles of thermodynamics. Basic principles include material properties both extensive and intensive, phase change and relevant phase diagrams, equation of state for ideal and real gases, and tables of properties. It also covers the concept of mass, energy, heat, work, and entropy, and introduces the first and second laws of thermodynamics in addition to the entropy balance and their applications on different thermodynamic systems, such as turbines, pumps and compressors. It further covers the application of energy equation for closed/open and reversible/irreversible systems to understand the energy transfer within these systems.

MECH240 – Material Science (3 CH; 3 CoH; Pre-R: CHEM100, CHEM109; Co-R: N/A; DM)

This course introduces students to the properties of engineering materials, their classifications, and the selection process for given applications. In this course, relationships between material properties and the internal structures of materials, and the processes used to modify these structures and improve the material properties will be explained. Students should be able to analyze failures of materials, explain failure mechanisms, and determine measures to protect against such failures. Students will be able to describe and choose standard methods of testing for given situations, indicate expected results and limitations of each method.

MECH250 – Fluid Mechanics (3 CH; 3 CoH; Pre-R: PHYS101, MATH101; Co-R: N/A; DM)

This course covers the fundamentals of fluid mechanics, including fluid properties and hydrostatic forces on floating and submerged bodies. It also presents methods of analyzing fluid systems and components using the concept of a control volume combined with the conservation of mass, energy, and momentum equations. Students analyze incompressible flows in pipe systems and the Moody diagram, turbine and pumping systems, and jet forces on blades and plates, as well as turbo-machinery in general.

RENG200 – Introduction to Energy Systems and Sustainability (2 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; DM)

This course provides an overview of the fundamental concepts, technologies, and applications of various energy systems, encompassing both renewable and non-renewable sources. Students will explore a wide range of energy sources, including solar, wind, hydropower, bioenergy, geothermal, fossil fuels, and nuclear energy. The course emphasizes the role of these energy systems in meeting global energy demands, their environmental impacts, and the challenges and opportunities associated with transitioning to more sustainable energy practices. Special focus will be placed on the integration of sustainability principles and the importance of balancing energy needs with environmental and societal considerations.

RENG210 – Applied Photovoltaics (3 CH; 3 CoH; Pre-R: RENG200, ELEC200; Co-R: N/A; DM)

This course provides a comprehensive introduction to photovoltaic (PV) technology, with a strong emphasis on the practical application, design, installation, and maintenance of solar energy systems. Students will learn about the fundamental principles of solar energy conversion, PV system components, and different types of solar cells and modules. The course covers key aspects of PV system design, including site assessment, system sizing, electrical configuration, and performance optimization.

RENG219 – Applied Photovoltaics Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: RENG210; DM)

This lab course provides hands-on experience in the installation, testing, troubleshooting, and maintenance of photovoltaic (PV) systems. Students will work with actual PV modules, inverters, charge controllers, batteries, and other system components to gain practical skills in setting up and optimizing solar energy systems. The lab exercises will cover a range of topics, including measuring solar irradiance, analyzing PV module performance, wiring and connecting PV system components, and conducting system efficiency tests.

RENG260 – Electronics & Instrumentation in Renewable Energy (3 CH; 3 CoH; Pre-R: ELEC200; Co-R: N/A; DM)

This course offers a comprehensive study of electronics and instrumentation with a focus on applications in renewable energy engineering. It covers the characteristics, analysis, and applications of semiconductor devices, including diodes, transistors, field-effect transistors, and operational amplifiers, emphasizing their role in renewable energy systems such as solar and wind power. The course also delves into the principles of instrumentation and measurement techniques, providing insights into process control, signal conditioning, and the use of various measurement devices in renewable energy applications.

RENG269 – Electronics & Instrumentation in Renewable Energy Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: RENG260; DM)

This lab course provides hands-on experience in the implementation, testing, and troubleshooting of electronic circuits and instrumentation systems used in renewable energy applications. Students will work with diodes, transistors, operational amplifiers, and various measurement devices, simulating and constructing electronic circuits relevant to solar, wind, and other renewable energy technologies.

RENG290 - Project 1 (PBL) (3 CH;3 CoH; Pre-R: ELEC200, RENG200; Co-R: N/A; DM)

This is a project-based learning (PBL) course during which the students work in groups under the supervision of one or more academic staff to Conceive, Design, Implement and Operate (CDIO) a solution to an engineering problem. This course allows students to exercise daily engineering ethics and work practices such as professional documentation, meetings, communication styles, etc. The students are required to present their final solution in the form of technical report, presentation and a functional prototype.

RENG301 – Renewable Energy Systems and Conversions (3 CH; 3 CoH; Pre-R: MECH230; Co-R: N/A; DM)

This course provides an in-depth study of energy conversion processes specifically related to renewable energy systems. Students will explore how energy is harnessed, converted, stored, and utilized from renewable sources such as solar, wind, hydropower, geothermal, and biomass. The course integrates key principles of heat transfer, thermodynamics, and fluid mechanics as they apply to renewable energy technologies, emphasizing efficiency, sustainability, and environmental impact.

RENG340 – Circular Economy and Sustainable Product Design (3 CH; 3 CoH; Pre-R: N/A; Co-R: N/A; DM)

This course focuses on the principles of the circular economy and their application to sustainable product design and development. Students will explore how a circular economy approach aims to minimize waste, reduce resource consumption, and promote the reuse, recycling, and remanufacturing of products and materials. The course covers design strategies that prioritize sustainability, including life cycle assessment (LCA), eco-design, and cradle-to-cradle product design.

RENG361 - Power Electronics and Renewable Energy Integration (3 CH; 3 CoH; Pre-R: RENG260; Co-R: N/A; DM)

This course covers the principles and applications of power electronics in renewable energy systems, focusing on how power electronic devices are used to convert, control, and regulate electrical energy from renewable sources like solar, wind, and energy storage systems. The course explores the operation of inverters, rectifiers, and converters, emphasizing their role in integrating renewable energy systems into the electrical grid and managing power flow.

RENG368 - Power Electronics Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: RENG361; DM)

This lab course is designed to supplement the material of RENG360 course, to assist students in obtaining a hands-on experience and a better understanding of the operation of power electronics devices such as rectifier circuits, DC to DC converters, inverters, power generation, solar power generation, battery charger, and motor control.

RENG362 - Renewable Energy & Smart Grid (3 CH; 3 CoH; Pre-R: RENG301; Co-R: N/A; DM)

This course covers the renewable energy resources models, the main challenges due to smart grid implementation, and the main components of electrical smart grids. It provides students with an overview of distributed energy systems and renewable energy resources such as solar and wind energy, with an emphasis on alternative energy sources, their technology and applications. The course also covers the fundamentals, design, analysis, and development of smart off- and on-grid systems.

RENG367 - Renewable Energy & Smart Grid Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: RENG362; DM)

This lab course is designed to supplement the material of RENG360 course, to assist students in obtaining a hands-on experience and a better understanding of renewable energy and energy efficiency technologies. It focuses on various types of smart-grid devices that are used in the power industry as well as the state-of-the-art renewable energy sources, relevant devices and circuits.

RENG390/RENG391 - Project 2/3 (PBL) (3 CH; 3 CoH; Pre-R: RENG290/RENG390; Co-R: N/A; DM)

This course is designed to complement other courses in a Project Based Learning (PBL) teaching approach under the framework of Conceive, Design, Implement and Operate (CDIO). PBL is a teaching method in which students learn by actively engaging in real-world and meaningful projects. PBL courses are self-driven learning with the guidance of a facilitator. The main purpose of PBL courses is to train students to become more time-efficient and to enhance their project management skills towards accomplishing different tasks to successfully implement the requirements of a real-life engineering project. As a result, students develop technical content knowledge as well as critical thinking, collaboration, health and safety, risk assessments, problem solving, creativity and communication skills while maintaining engineering ethics and work practices.

RENG410 – Advanced Solar Systems (3 CH; 3 CoH; Pre-R: RENG362; Co-R: N/A; DM)

This course provides an in-depth exploration of solar photovoltaic (PV) systems, focusing on advanced design, operation, and integration techniques. Students will examine the principles of solar energy conversion, including the physics of photovoltaic cells, module technologies, and system configurations. The course covers the design of grid-tied and off-grid PV systems, energy storage integration, and performance optimization.

RENG419 – Solar Energy Systems Lab (1 CH; 2 CoH; Pre-R: N/A; Co-R: RENG410; DM)

This lab-based course provides hands-on experience in designing, testing, and analyzing solar energy systems. Students will work with solar photovoltaic (PV) panels, inverters, and energy storage systems to understand the operation and performance of solar energy technologies. The course focuses on practical skills such as system installation, energy measurement, efficiency testing, and fault diagnosis.

RENG441 – Optimization of Energy Systems (3 CH; 3 CoH; Pre-R: RENG340; Co-R: N/A; DM)

This course provides an in-depth understanding of the principles and techniques used to optimize energy systems for enhanced performance and sustainability. Students will learn how to model, analyze, and improve the efficiency of various energy systems, including renewable energy sources, energy storage, and power distribution networks. The course covers a range of optimization methods such as linear and nonlinear programming, genetic algorithms, and multi-objective optimization.

RENG442 – Energy Auditing (3 CH; 3 CoH; Pre-R: RENG410, RENG441; Co-R: N/A; DM)

This course introduces students to the principles and practices of energy auditing, focusing on methods for assessing energy use in buildings, industries, and other facilities. Students will learn how to conduct energy audits, identify inefficiencies, and propose solutions to improve energy performance and reduce costs. The course covers topics such as energy measurement techniques, energy management systems, and the role of renewable energy in energy auditing. Students will also explore the financial and environmental benefits of energy-efficient practices, as well as the policies and regulations that promote energy conservation. Through practical exercises and case studies, students will develop the skills needed to perform energy audits and make recommendations for improving energy efficiency in real-world settings.

RENG450 – Environmental Impact Assessment of Energy Systems (3 CH; 3 CoH; Pre-R: RENG441; Co-R: N/A; DM)

This course examines the environmental impacts associated with various energy production and consumption systems, with a focus on both conventional and renewable energy technologies. Students will explore how energy systems contribute to air and water pollution, land use changes, greenhouse gas emissions, and ecosystem degradation. The course emphasizes the importance of risk analysis, evaluation and mitigation of the identified environmental aspects of various energy systems". This course will cover a complete EIA practice, starting from materials manufacturing, unit construction, unit operation and disposal of the materials related to RE.

RENG463 – Energy Storage (3 CH; 3 CoH; Pre-R: RENG362; Co-R: N/A; DM)

This course offers an in-depth exploration of energy storage technologies and their critical role in modern energy systems, particularly in the integration of renewable energy sources. Students will study various types of energy storage systems, including mechanical (e.g., pumped hydro, flywheels), electrochemical (e.g., batteries, fuel cells), thermal, and electrical (e.g., supercapacitors). The course will cover the principles of operation, design, performance characteristics, and applications of each energy storage technology.

RENG490 - Graduation Project -Part I (3 CH; 1 CoH; Pre-R: 30CH; Co-R: N/A; DM)

In this course, students are divided into groups to conceive, design and plan a project that allows them to demonstrate professional capabilities expected from graduating engineering technologists. Formal and informal project reporting articulates the analysis of project design and planning issues and critical thinking behind project choices and decisions made. Students report to and work with guidance from a supervisor to scope and define the project, undertake research into project issues, incorporate safety and risk issues, produce a design, a plan and schedule for implementation of the project in the subsequent Graduation Project – Part II course.

RENG491 - Graduation Project - Part II (3 CH; 1 CoH; Pre-R: RENG490; Co-R: N/A; DM)

In this course, the groups of students implement and operate the project previously conceived and designed in Graduation Project - Part I as per their project plan. This allows them to demonstrate professional and ethical capabilities expected of graduating engineering technologists. They work and learn autonomously, communicate progress, prepare reports and presentations. Students conduct research to support their project decision-making and are required to demonstrate critical thinking and document sound analysis and judgment in project working documents and final reporting. They solve technical problems that arise and evaluate project processes, outcomes and related learning experiences, and prepare a formal technical report, dissertation and project presentation.

9.2. Department Elective Courses

RENG402 – Wind Energy Systems (3 CH; 3 CoH; Pre-R: RENG463; Co-R: N/A; DEL)

This course provides a comprehensive study of wind energy systems, focusing on the principles, design, and implementation of wind power generation. Students will explore the mechanics of wind turbines, aerodynamics, and the different types of wind energy converters. The course also covers site assessment, wind resource analysis, and the integration of wind power into the electrical grid. Topics such as wind farm design, operation and maintenance, and the environmental and economic aspects of wind energy are discussed in detail. Students will engage in practical exercises and simulations to understand the complexities of wind energy systems.

RENG403 – Bioenergy and Biomass Systems (3 CH; 3 CoH; Pre-R: RENG340; Co-R: N/A; DEL)

This course provides an in-depth understanding of bioenergy and biomass systems, focusing on the production and utilization of biomass as a renewable energy source. Students will learn about various types of biomass, including agricultural residues, forest products, and organic waste, and their conversion into biofuels, biogas, and other bioenergy forms. The course covers the principles of biochemical and thermochemical conversion processes such as anaerobic digestion, pyrolysis, and gasification. Students will also explore the environmental, economic, and social impacts of bioenergy production, as well as its role in reducing greenhouse gas emissions and promoting sustainability.

RENG404 – Water Desalination by Renewable Energy (3 CH; 3 CoH; Pre-R: RENG340; Co-R: N/A; DEL)

This course provides an in-depth exploration of the principles, technologies, and applications of water desalination powered by renewable energy sources. Students will learn about various desalination techniques, including reverse osmosis, distillation, and electrodialysis, and how renewable energy sources such as solar, wind, and geothermal energy can be integrated into these processes. The course covers the design, operation, and optimization of renewable energy-powered desalination systems, focusing on both small-scale and large-scale applications.

RENG430 – Geothermal Energy Systems (3 CH; 3 CoH; Pre-R: RENG463; Co-R: N/A; DEL)

This course explores the fundamentals of geothermal energy systems, focusing on the principles of geothermal energy extraction and its application in power generation and heating. Students will learn about the geological conditions required for geothermal energy production, as well as the technologies used to harness geothermal resources, such as dry steam, flash steam, and binary cycle power plants.

RENG443 – Fuel Cell and Hydrogen Production (3 CH; 3 CoH; Pre-R: RENG441; Co-R: N/A; DEL)

This course provides a comprehensive overview of fuel cell technologies and hydrogen production methods, focusing on their applications in renewable energy systems. Students will explore the fundamental principles of fuel cells, including their operation, design, and the different types of fuel cells such as proton exchange membrane (PEM), solid oxide fuel cells (SOFC), and alkaline fuel cells. The course also delves into the production, storage, and utilization of hydrogen as a clean energy carrier.

RENG445 – Sustainable Building Design (3 CH; 3 CoH; Pre-R: RENG340; Co-R: N/A; DEL)

This course explores the principles and practices of sustainable building design, with an emphasis on energy efficiency, environmental impact, and the use of renewable energy sources. Students will learn

about the integration of passive and active design strategies, energy-efficient materials, and sustainable construction practices. The course covers topics such as thermal comfort, building orientation, natural lighting, and ventilation, as well as the application of solar panels, wind turbines, and energy storage systems in buildings. Case studies of green buildings and sustainable design projects will be used to illustrate the application of these concepts.

RENG451 – Water-Energy Nexus (3 CH; 3 CoH; Pre-R: RENG340; Co-R: N/A; DEL)

This course examines the interconnection between water and energy systems, exploring how water is used in energy production and how energy is required for water treatment and distribution. Students will study the challenges and opportunities at the water-energy nexus, including the impact of renewable energy technologies on water resources and the role of energy efficiency in water management. Topics include water use in power generation, the energy footprint of water systems, desalination technologies, and the potential of integrated water and energy management. The course emphasizes the importance of sustainable practices in addressing global water and energy challenges.

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