COURSE Syllabus

Course Name:
Introduction to Renewable Energy

Course Number: 04024269

General Course Information:

Course title	Introduction to Renewable Energy
Course number	04024269
Credit hours (theory, practical)	3 Hours
Contact hours (theory, practical)	3 Hours (Theory)
Prerequisites/corequisites	None
Academic Program	Communications and Electronics Engineering
Program code	EE
Awarding institution	Isra University (IU)
Faculty	Engineering
Department	Communications and Electronics Engineering
Level of course	Fourth Year
Academic year /semester	
Awarded qualification	B. Sc.
Other departments (s) involved in teaching the course	Renewable Energy Engineering Department
Language of instruction	English
Date of production/revision	

Course Coordinator:

Coordinator's Name: Dr. Zakaria Al-Omari
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Other Instructors:

Instructor's Name: -
Office No.: -
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Office Hours: -
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Course Description:

Introduction and overview of renewable energy resources. Physics of sunlight and photovoltaics. Photovoltaic system components. Photovoltaic system calculation and aspects. Photovoltaic system performance. Solar thermal systems. Wind energy fundamentals. Wind turbines operation and control. Energy storage. OFF-grid/stand-alone systems.

مقدمة ونظرة عامة على موارد الطاقة المتجددة. فيزياء ضوء الشمس والخلايا الكهروضوئية. مكونات النظام الكهروضوئي. حساب النظام الكهروضوئي ومظاهره. أداء النظام الكهروضوئي. أنظمة الطاقة الشمسية الحرارية. أساسيات طاقة الرياح. تشغيل والتحكم في توربينات الرياح. تخزين الطاقة. أنظمة خارج الشبكة / قائمة بذاتها.

Text Book: ***Author(s), Title, Publisher, Edition, Year, Book website.***

Chapters written by IREEDER Project members.

References: ***Author(s), Title, Publisher, Edition, Year, Book website.***

1. Vaughn C. Nelson, Kenneth L. Starcher, Introduction to Renewable Energy (Energy and the Environment) 2nd Edition, https://www.amazon.com/Introduction-Renewable-Energy-Environment/dp/1498701930.
2. John A. Duffie, William A. Beckman, Solar Engineering of Thermal Processes, Fourth Edition (https://onlinelibrary.wiley.com/doi/book/10.1002/9781118671603).
3. James F. Manwell, Jon G. McGowan, Anthony L. Rogers, Wind Energy Explained: Theory, Design and Application, 2nd Edition (https://www.wiley.com/en-us/Wind+Energy+Explained%3A+Theory%2C+Design+and+Application%2C+2nd+Edition-p-9780470686287).
4. Huggins, Robert Energy Storage, Fundamentals, Materials and Applications, (https://www.springer.com/gp/book/9783319212388).
5. Louie, Henry Off-Grid Electrical Systems in Developing Countries, (https://www.springer.com/gp/book/9783319918891).
6. Handschin, Edmund, Petroianu, Alexander Energy Management Systems, Operation and Control of Electric Energy Transmission Systems, https://www.springer.com/gp/book/9783642840432.
7. Mertens, Konrad. Photovoltaics: fundamentals, technology, and practice. John Wiley & Sons, 2018 (https://textbook-photovoltaics.org/contact.html, https://www.wiley.com/en-us/Photovoltaics%3A+Fundamentals%2C+Technology+and+Practice-p-9781118634165.

Course Educational Objectives (CEOs):

1.	To present the fundamental principles and architecture of Renewable Energy systems.
2.	To discuss, examine, and evaluate the key technological components of Renewable Energy.
3.	To review key technological applications of Renewable Energy**.**

Intended Learning Outcomes (ILOs):

Intended Learning Outcomes (ILOs)		Relationship to CEOs	Contribution to PLOs	Bloom Taxonomy Levels*	Descriptors**
A	**Knowledge and Understanding:**				
A1	To describe the challenges, problems, and potential solutions associated with the use of various Renewable Energy sources	1, 2, 3	1, 2	1	K
A2	To understand the fundamental principles and technologies of renewable energy components and systems, and other related topics such as energy	1, 2, 3	1, 2	1	K

	storage systems, hybrid energy systems, and distribution (smart) grids.				
B	**Intellectual skills:**				
B1	To describe the use of renewable sources and the various components used in energy production with respect to applications (e.g. heating, cooling, desalination, power generation)	1, 2, 3	1, 2	2	K
B2	To gain specific knowledge in special fields such as solar, wind, fuel cell, and battery storage.	1, 2, 3	1, 2	2	K
C	**Subject-specific skills:**				
C1	To use different software/laboratory equipment for modeling/designing/analyzing a Renewable Energy system.	1, 2, 3	1, 2	3	S

***Bloom Taxonomy Levels**

Level #	**1**	**2**	**3**	**4**	**5**	**6**
Level Name	**Knowledge**	**Comprehension**	**Application**	**Analysis**	**Evaluation**	**Synthesis**

**** Descriptor (National Qualification Framework Descriptors): K: Knowledge, S: Skill, C: Competency.**

Program Learning Outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program. A graduate of the (Renewable Energy Engineering) program will demonstrate:		**Descriptors****		
		K	**S**	**C**
1.	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	√		
2.	An ability to 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.	An ability to communicate effectively with a range of audiences.		√	
4.	An ability to 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.	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.		√	
6.	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.		√	
7.	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.		√	√

**** Descriptors according to the national qualifications framework (K: knowledge, S: skill, C: Competency)**

Weekly Schedule *(please choose the type of teaching)*

√ Face to Face

□ **Hybrid** *(**2 Lectures** Face–To–Face **+1 Lecture** Asynchronous)*

□ **Hybrid (***1 Lectures* *Face – To - Face* ***+1 Lecture*** *Asynchronous)*

□ **Online** *(**2 Lectures** Synchronous **+1 lecture Asynchronous**)*

Topic Outline and Schedule:

Week	First Lecture (……)	Second Lecture (……)	Third Lecture (……)	Ach. ILOs	Ach. PLOs	Descriptors**
1	Introduction	Introduction and Overview of Renewable Energy Resources (RESs)	Introduction and Overview of Renewable Energy Resources (RESs)	A1, A2	1	K
2	Introduction and Overview of Renewable Energy Resources (RESs)	Introduction and Overview of Renewable Energy Resources (RESs)	Introduction and Overview of Renewable Energy Resources (RESs)	A1, A2	1	K
3	Physics of sunlight and photovoltaics	Physics of sunlight and photovoltaics	Physics of sunlight and photovoltaics	A1, A2, B1	1, 2	K
4	Photovoltaic system components	Photovoltaic system components	Photovoltaic system components	A1, A2, B2	1, 2	K
5	Photovoltaic system calculation and aspects	Photovoltaic system calculation and aspects	Photovoltaic system calculation and aspects	A1, A2, B1	1, 2	K, S
6	Solar thermal systems	Solar thermal systems	Solar thermal systems	A1, A2, B1, B2	1, 2	K, S
7	Wind Energy Fundamentals	Wind Energy Fundamentals	Wind Energy Fundamentals	A1, A2, B2	1, 2	K
8	Wind Turbines Operation and Control	Wind Turbines Operation and Control	Wind Turbines Operation and Control	A1, A3, B1	1, 2	K, S
9	Wind Turbines Operation and Control	Wind Turbines Operation and Control	Wind Turbines Operation and Control	A1, A3, B1	1, 2	K, S
10	Revision and Midterm Exam	Revision and Midterm Exam	Revision and Midterm Exam			
11	Energy storage	Energy storage	Energy storage	A1, A2, B2	1, 2	K
12	OFF-grid/ Stand-alone systems	OFF-grid/ Stand-alone systems	OFF-grid/ Stand-alone systems	A1, A2, B1	1, 2	K, S
13	Other topics	Other topics	Other topics	A1, A2, B1, B2	1, 2	K, S
14	Revision	Revision	Revision			
15	Final Exam					

* K: Knowledge, S: Skills, C: Competency

Teaching Methods and Assignments:

The development of ILOs is promoted through the following teaching and learning methods:

- Interactive videos
- Practice Labs
- Discussion Forums
- Quizzes
- Other Interactive online activities
- Reports

Course Policies:

A- Attendance policies:

The student must attend 15% of the 48 lecturing hours

B- Absences from exams and handing in assignments on time:

Exams can be retaken based on approval of excuse at the instructor's discretion.

Not handing in assignments on time will incur penalties.

C- Academic Health and safety procedures

D- Honesty policy regarding cheating, plagiarism, and misbehavior:

Cheating, plagiarism, and misbehavior will result in zero grades and further disciplinary actions may be taken.

E- Grading policy:

- 20% Practical project and lab exercises
- 30% Midterm Exam
- 50% Final Exam

Required equipment:

Remote Access to IREEDER Laboratory

Assessment Tools implemented in the course:

- ☐ Written Exam.
- ■ Midterm Exam.
- ■ Final Exam.
- ☐ Quizzes.
- ■ Homeworks.
- ☐ Integrative Projects.
- ☐ Case Study.
- ☐ Written Reports.
- ■ ParticipationLectures.
- ☐ Practice in the Lab.

- ■ Illustrative Presentations.
- ■ Oral Exams.
- □ Others (identify):

Responsible Persons and their Signatures:

Course Coordinator	**Dr. Zakaria Al-Omari**	**Completed Date**	
		Signature	

Received by (Department Head)	**Dr. Zakaria Al-Omari**	**Received Date**	
		Signature	