



**DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM, BSC.**

Course Syllabus

1. Course number and name

ME 539 Renewable Energy Systems Design

2. Credits and contact hours

(3+0) 3 credit hours, 3 contact hours

3. Course type

Face to face Learning Course (3+0)

4. Instructor's or course coordinator's name

Prof. Tariq Alazab

5. Textbook information

- Renewable Energy Resources, John Twidell and Tony Weir, Taylor and Francis -second edition, 2013
- Boyle, Godfrey. Renewable Energy: Power for a Sustainable Future, Third Edition. Oxford University Press, 2012.

a. Other supplemental materials

- Alternative Energy Systems & Applications by B.K.Hodge, Wiley, 2010 ISBN978-0-470-14250-9
- Renewable Energy Technologies, edited by J.C. Sabonnadiere, Wiley, 2009, ISBN978-1-84821-135-3
- Sustainable Energy Systems and Applications, Springer, 2011, 978-0-387-95860-6
- Instructor's Notes

6. Specific course information

a. Catalog description

The Renewable and Sustainable Energy Systems course provides a graduate-level understanding of the conversion principles and technology behind various renewable energy sources. It also examines the issues involved in the integration of various renewable energy sources and their economics for heat, power, and transportation needs. Based on the technical and sustainability challenges, the future outlook for each of the sources and systems is discussed. This is a required core course for the Master of Professional Studies in Renewable Energy and Sustainability Systems Program.



**DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM, BSC.**

b. Prerequisites or co-requisites

Prerequisite: ME 455 Heat transfer

c. The course is:

Required in Mechanical Engineering Department.

7. Specific goals for the course

a. Course outcomes:

After completion of the course, students are expected to be able to:

1. Understanding of renewable energy sources
2. Knowledge of working principle of various energy systems
3. Capability to carry out basic design of renewable energy systems

b. The following student outcomes are addressed by the course:

8. Learning Outcomes and their Alignment with Program Educational Objective (PEO's), Methods of Delivery, and Assessment Methods:

Learning Outcomes	Program PEOs	Method of Delivery	Assessment Method
Course Outcomes			
Understanding of renewable energy sources	-	Lectures (Example and Problems)	Question in exam
Knowledge of working principle of various energy systems	-	Lectures (Example and Problems)	Question in exam
Capability to carry out basic design of renewable energy systems	-	Lectures (Example and Problems)	Question in exam
Student Outcomes			



**DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM, BSC.**

9. Weekly Teaching Plan

Week No.	Lecture	Topic	Method of Delivery
1	Sun (9-10)	Renewable Energy (Re) Sources	Lecture
	Tue (9-10)	Environmental consequences of fossil fuel use,	Lecture
	Thu (9-10)	Importance of renewable sources of energy,	Lecture
2	Sun (9-10)	Sustainable Design and development,	Lecture
	Tue (9-10)	Types of RE sources, Limitations of RE sources,	Lecture
	Thu (9-10)	Present Indian and international energy scenario of conventional and RE sources.	Lecture
3	Sun (9-10)	Solar energy system, Solar Radiation,	Lecture
	Tue (9-10)	Availability, Measurement and Estimation, Solar	Lecture
	Thu (9-10)	Thermal Conversion Devices and Storage, Solar-Electrical.	Lecture
4	Sun (9-10)	The solar resource Concentrating solar power technologies.	Lecture
	Tue (9-10)	Power Generation, general Solar Photo Voltaic (SVP) system,	Lecture
	Thu (9-10)	PV Systems- Types of Solar Cells,	Lecture
5	Sun (9-10)	Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.	Lecture
	Tue (9-10)	Different configurations, SPV system components and their characteristics,.	Lecture
	Thu (9-10)	First Exam	Exam
6	Sun (9-10)	Stand-Alone and Grid Connected SPV systems	Lecture
	Tue	Other Miscellaneous Applications of Solar Energy.	Lecture



**DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
 MECHANICAL ENGINEERING PROGRAM, BSC.**

	(9-10)		
	Thu (9-10)	Wind power systems	Lecture
7	Sun (9-10)	Introduction	Lecture
	Tue (9-10)	Wind Generation and Control., classification of wind, characteristics	Lecture
	Thu (9-10)	Power in the wind.	Lecture
8	Sun (9-10)	Wind turbine performance	Lecture
	Tue (9-10)	Average power of the wind	Lecture
	Thu (9-10)	Wind turbine energy production	Lecture
9	Sun (9-10)	Offshore wind energy	Lecture
	Tue (9-10)	Hybrid systems	Lecture
	Thu (9-10)	Wind energy potential and installation in Jordan	Lecture
10	Sun (9-10)	Wind farms, wind economics, environmental impact	Lecture
	Tue (9-10)	Principles of Bio-Conversion,	Lecture
	Thu (9-10)	Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.	Lecture
11	Sun (9-10)	Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in Jordan.	Lecture
	Tue (9-10)	Ocean Energy: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.	Lecture
	Thu (9-10)	Second Exam	Exam
12	Sun (9-10)	Hydel and Tidal Power Systems:	Lecture
	Tue (9-10)	Basic working principle,	Lecture
	Thu (9-10)	Classification of hydel systems:	Lecture



**DEPARTMENT OF MECHANICAL AND INDUSTRIAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM, BSC.**

13	Sun (9-10)	Large, small, micro –measurement of head and flow	Lecture
	Tue (9-10)	Energy equation	Lecture
	Thu (9-10)	Types of turbines	Lecture
14	Sun (9-10)	Numerical problems.	Lecture
	Tue (9-10)	Tidal power Basics –Kinetic energy equation – Numerical problems	Lecture
	Thu (9-10)	Wave power –Basics –Kinetic energy equation	Lecture
15	Sun (9-10)	OTHER ENERGY SOURCES/ Hydrogen Production and Storage	Lecture
	Tue (9-10)	Fuel cell :Principle of working- various types – construction and applications.	Lecture
	Thu (9-10)	Energy Storage System- Hybrid Energy Systems.	Lecture

10. Grade Distribution:

Assessment	Grade	Date
- First Exam	20%	Fifth Week
- Second Exam	20%	10 th Week
- Assignments	10%	
- Final Examination	50%	16 th Week

* Make-up exams will be offered for valid reasons. It may be different from regular exams in content and format.