King Fahd University of Petroleum & Minerals
MECHANICAL ENGINEERING DEPARTMENT
ME 423: Energy Conversion

Catalogue Description: (3-0-3)
Energy sources and their classification. Conventional energy conservation: Power plant and vapor cycles. Renewable energy: Solar energy with emphasis on solar cells, and wind energy, OTEC systems, geothermal energy. Nuclear fission and types of fission reactors.

Status in Curriculum (Required or Elective): Elective

Prerequisites: Thermodynamics II (ME 204), and Heat Transfer (ME 315).

Co-requisites: None

Prerequisites by Topics:
- Thermodynamics of Cycles (ME 204)
- Conservation of energy and thermal energy generation analysis (ME 204, ME 315)

Textbook: El-Wakil,**Power Plant Technology**, McGraw-Hill, 1984.

References:

1. W. Culp, **Principles of Energy Conversion**, McGraw-Hill Company, 1991.
2. H. Sorensen, **Energy Conversion Systems**, John Wiley & Sons, 1983.

Coordinator:Dr. Meamer El Nakla, AssociateProfessor of Mechanical Engineering

Goals:(general objectives)
1. Introduce the concepts and applications of conventional and non-conventional methods of energy conversion, focusing on nuclear energy and the use of Solar cells and wind for localized power production.
2. Discuss the design methodology of various other alternate energy sources.

Course Outline (Lecture Topics):
1. Energy sources, classification and utilization (3 luctures).
2. Growth and prediction (2 lecture).
3. Review of Thermodynamics: 1st and second laws of thermodynamics, efficiency, etc. (5 lectures).
4. Conventional energy (power plant): steam and gas turbine cycles, combined cycles, components, etc. (5 lectures).
5. Fuel and Combustion: types of fuel, chemical reactions, calculations of HHV and LHV, excess air, etc. (6 lectures)
6. Nuclear energy (fission): Nuclear reactors, nuclear technology, reaction, radiation, etc. (9 lectures)
7. Geothermal energy: Locations, technology and types of cycles (3 lectures).
8. Ocean energy and wind energy: Locations, technology and types of cycles (3 lectures).
9. Solar energy (photovoltaics): Types, technology, calculations of current and voltage, solar intensity, project cost and economic aspects (6 lectures).
10. Chemical energy (fuel cells): Introduction to hydrogen cell, applications (3 lectures).

Design Activities/Projects:

The aim of the project is to increase the student ability to solve real world problems that are related to sustainability of energy.

Computer Usage:
Students are encouraged use computers for the project.

Laboratory: None

Assessment Tools:

i- Mid-term Examination
ii- Homework Assignments
iii- Class Test
iv- Project
v- Final Exam

Course Learning Outcomes:

I- Students shall demonstrate a basic understanding of different energy systems.
II- Students shall use thermodynamic principles for evaluating alternative energy processes and systems.
III- Appreciate role of combustion kinetics, heat and mass transfer on practical thermochemical energy system design
IV- Be able to assess the positive and negative features of nuclear technology in comparison with alternative energy systems.
V- Demonstrate ability to perform both design and evaluation of energy conversion system.
VI- Develop the critical thinking skills need to argue for or against particular energy solutions.

Course Learning Outcomes mapped to Student Outcomes:

Student Outcomes	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
Course-to-Student outcome mapping	II, V		II, IV, V	III, VI	I, II, V		V, VI	VI			V
Emphasis*	**M**		**M**	S	**M**		S	M			L

* **L**:: Little/None **M**: Moderate **S**: Strong

Status of Continuous Improvement review of this Course:

Date reviewed: ----------
Prepared by: Dr. Meamer El Nakla

Reviewed by:
Date prepared: March 5, 2015……