Mechanical Engineering Dept. Department

Syllabus
ME 439: Solar Energy Conversion (3-0-3)

Course Catalog Description:

Thermal aspects of solar energy conversion. Solar radiation measurement and prediction. Selected topics in heat transfer. Flat plate and focusing collector analysis. Solar energy storage. Solar systems including hot water, space heating and cooling, distillation and thermal power conversion.

Course Pre-requisites:

- ME 315: Heat Transfer

Course Objectives:

1. This course is designed to give seniors in Mechanical Engineering an ability to estimate solar radiation and to integrate it into the overall design and thermal analysis of solar collectors and solar-based thermal systems.

Course Learning Outcomes:

CLO1. Demonstrate a basic understanding of solar radiation and its measurements.

CLO2. Demonstrate the calculation of needed information from the available solar radiation data.

CLO3. Demonstrate ability to use the interaction of radiation and opaque and transparent materials to perform the analysis of the performance of different types of solar collectors.

CLO4. Demonstrate ability to develop mathematical models for collectors and storage units.

CLO5. Demonstrate ability to formulate collector circuits with controls and heat exchangers.

CLO6. Demonstrate ability to use solar energy to meet various energy needs particularly to buildings for heating, hot water, and cooling and for desalination.

CLO7. Demonstrate ability to give a professional and well-organized presentation of their design and analysis through the use of written and oral reports.

Learning Resources:

- Solar Engineering of Thermal Processes, J.A. Duffie and W.A. Beckman, Wiley & Sons Inc., New York, 4th edition, 2013.
- Principles of Solar Engineering, D .Y. Goswami, F. Kreith and J.F. Kreider, 2nd Edition,Taylor & Francis, Philadelphia, 2000. Solar Energy Engineering: processes and systems, Kalogirou, Soteris, 2nd Edition, Academic Press, 2014.

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Special/IBL Assignments/Project	14	10.0%
Final Exam	16	35.0%
Midterm Exam	8	25.0%
Quizzes	Varies	20.0%
Homework	Varies	10.0%

Lecture Weekly Schedule:

Week#	Topics
1	Solar radiation characteristics
2	Solar radiation characteristics (Continue)
3	Measurement of solar radiation
4	Estimation of solar radiation
5	Selected topics in heat transfer
6	Radiation characteristics of opaque materials
7	Radiation transmission through glazing
8	Design and analysis of flat-plate solar collectors
9	Design and analysis of flat-plate solar collectors (Continue)
10	Design and analysis of flat-plate solar collectors (Continue)
	Design and analysis of concentrating collectors
11	Design and analysis of concentrating collectors (Continue)
	Energy storage in solar process systems
12	Energy storage in solar process systems (Continue)
	System thermal calculations
13	Solar heating - active and passive systems
	Solar space heating and cooling
14	Solar space heating and cooling (Continue)
	Solar distillation and thermal power conversion
15	Tests