Solar Energy

Academic Year: (2021 / 2022) **Review date: 27-01-2022**

Department assigned to the subject: Thermal and Fluids Engineering Department

Coordinating teacher: MARUGAN CRUZ, CAROLINA

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Thermal Engineering
Heat Power Plants

OBJECTIVES

By the end of the present course the students will be able to have:
1. - A systematic understanding of the key aspects and concepts of both, solar resource and solar energy systems.
2. -A coherent knowledge of working principles of the systems capable of transforming solar energy into heat or electricity and learning of the newer storage systems and hybridization methods of solar energy with other renewable energy sources.
3.- The ability to apply their knowledge and understanding to identify, formulate and solve thermal engineering problems using established methods in thermodynamics and power systems.
4.- The ability to apply their knowledge and understanding to develop and realise designs of solar facilities, with/without storage, to produce heat or electricity and to meet specified requirements.
5.- The ability to conduct searches of literature, and to use weather data bases and other sources of information.
6.- The ability to combine theory and practice to solve energy efficiency problems in solar facilities.
7.- Function effectively as an individual and as a member of a team.
8.- Recognise the need for, and have the ability to engage in independent, life-long learning.

DESCRIPTION OF CONTENTS: PROGRAMME

SOLAR RADIATION: Solar angles. Solar radiation. Solar resource.
SOLAR ENERGY COLLECTORS. Flat plate collector. Thermal analysis. Evacuated tube collector.
LOW TEMPERATURE SOLAR ENERGY FACILITIES. Components and f-chart method
THERMOSOLAR POWER. Concentrating collectors for heat production at HIGH temperature
PHOTOVOLTAIC ENERGY. Photovoltaic effect. Seminconductors. Solar cells. Types of PV. i-v curve.
PV APPLICATIONS:PV panels Related equipment: power trackers, inverters, batteries. Efficiency. Stand-alone/Direct-coupled/Grid connected system.

LEARNING ACTIVITIES AND METHODOLOGY

Lectures, in which the main theory of the course is presented. To facilitate the learning of the theory, a set of class presentations and notes will be delivered to the students together with a reference list of basic text books.

- Practical seminars in class and computer room. These practical sessions will also serve to solve the main practical questions raised by the students about the main processes related to solar energy.

- Visit to a solar power plant. Invited talk of an expert in pv/csp

- All students will solve problems and/or work on projects intended to improve their knowledge and check their learning progression.

- In addition to the questions and problems solved in class, there will be tutorial sessions scheduled at the teacher's office.

ASSESSMENT SYSTEM

Two mid-term exams (partial examination): 40% of the final mark

Practical laboratory work: 20% of the final mark

Final exam at the end of the semester: 40% of the final mark. Minimum mark: 4/10

Voluntary exercises can add up to +1 point in the final exam

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- F.P. INCROPERA & DE WITT FUNDAMENTALS OF HEAT TRANSFER, Willey.
- John A. Duffie, William A. Beckman Solar Engineering of Thermal Processes, Wiley, 2013
- S.A. Kalogirou Solar Energy Engineering: processes and systems, Elsevier.
- Y.A. ÇENGEL & A.J. Ghajar HEAT and MASS TRANSFER: Fundamentals and Applications, McGraw-Hill.

ADDITIONAL BIBLIOGRAPHY

- James L. Threlkeld Thermal Environmental Engineering, Pretince-Hall, 1970

BASIC ELECTRONIC RESOURCES

- Christiana Honsberg and Stuart Bowden . Photovoltaic Education Network: http://www.pveducation.org/
- William B. Stine and Michael Geyer . Power from the sun: //www.powerfromthesun.net/book.html