SEE4117: SOLAR ENERGY ENGINEERING

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Solar Energy Engineering

Subject Code
SEE - School of Energy and Environment
Course Number
4117

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
SEE2101 Engineering Thermofluids I or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract
This course covers a wide range of solar energy related topics needed to solve technological and engineering problems in the field for the present applications and future development. The topics include solar radiation, solar energy

availability, sun-earth geometric relationship, solar thermal energy conversion, solar cooling, photovoltaics, daylighting, solar photochemistry, solar tracking, life cycle economic and environmental assessment.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	determine the terrestrial solar radiation and insolation	10	x		
2	describe different types of solar energy conversion technologies and evaluate the energy conversion efficiency	60	x	x	
3	describe different solar photochemical reactors	10	x	x	
4	design solar energy systems	10			x
5	evaluate economic and environmental performance of solar applications	10		x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will learn the properties of solar radiation and engineering systems for its conversion into useful form of energy.	1, 2, 3, 4, 5	3
2	Laboratory	Students are encouraged to engage with teammates in group experiment. Students will gain hands-on experience in solar energy conversion under varying irradiation.	2	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3	10	
2	Laboratory	2	10	

3	Mid-term test	1, 2	20	
4	Design project	1, 2, 4	20	

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Additional Information for ATs

Examination duration: 2 hrs
Percentage of continuous assessment, examination, etc.: 60% by continuous assessment; 40% by examination

To pass a course, a student must do ALL of the following:
1) obtain at least 30% of the total marks allocated towards continuous assessment (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);
2) obtain at least 30% of the total marks allocated towards final examination (if applicable); and
3) meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task

1. Assignments

Criterion

Ability to analyse and solve problems related to solar energy engineering

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal level

Assessment Task

2. Laboratory

Criterion

Ability to analyse solar energy technologies

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
3. Mid-term test

Criterion
Ability to analyse and solve problems related to solar energy engineering

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Assessment Task
4. Design project

Criterion
Ability to solve solar energy problems using critical and creative thinking

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)

Not even reaching marginal level

Assessment Task
5. Examination

Criterion
Ability to analyse and solve problems related to solar energy engineering

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal level

Part III Other Information

Keyword Syllabus

Radiation:
Radiative properties; Emissivity, Absorptivity, Reflectivity, Transmissivity; Radiative heat transfer
Sun-earth geometric relationship:
Terrestrial solar radiation; Solar time; Solar angles
Solar concentrators:
Trough; Tower; Dish; Fresnel lens
Solar Thermal:
Flat plate collectors; Evacuated tube solar collectors; Solar Cooling
Photovoltaics:
Schottky barrier and diode; p-n junction; Multijunction cells; Perovskite solar cells
Photochemical reactions:
Solar photocatalysis; Photolysis
Environment and Economics:
Environmental impacts; Life-cycle cost

Reading List

Compulsory Readings

	Title
1	Solar Energy Engineering, Soteris A. Kalogirou, 2nd Edition, Academic Press (2013)

Additional Readings

	Title
1	Solar Engineering of Thermal Processes, John A. Duffie and William A. Beckman, 4th Edition, Wiley (2013)
2	Handbook of Photovoltaic Science and Engineering, 2nd Edition, Antonio Luque (Editor), Steven Hegedus (Co-Editor), Wiley (2010)
3	Physics of Solar Energy, C. Julian Chen, John Wiley & Sons (2011)
4	Principles of Solar Engineering, 2nd Edition, D. Yogi Goswami, Frank Kreith, Jan F. Kreider, Taylor & Francis (2000)