

SEE4117: SOLAR ENERGY ENGINEERING

Effective Term

Semester A 2025/26

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
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.	3
			2

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks ("- for nil entry)	Allow Use of GenAI?	
1	Assignments	1, 2, 3	10	-	Yes
2	Laboratory	2	10	-	Yes

3	Mid-term test	1, 2	20	-	No
4	Design project	1, 2, 4	20	-	Yes

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

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)