SEE8112: ENERGY EFFICIENCY AND CONSERVATION TECHNOLOGIES

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Energy Efficiency and Conservation Technologies

Subject Code
SEE - School of Energy and Environment
Course Number
8112

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SEE6102 Energy Efficiency and Conservation Technologies

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to teach students the physics and engineering knowledge on energy usage and energy efficiency, especially for building and transportation systems. Operating principles of power transmission and distribution, motors, heating, ventilation and air-conditioning (HVAC), lighting, humidity control, transportation etc. will be taught in class. Advanced energy efficient systems and technologies will be described. Methods to reduce energy consumption will be introduced.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Solve problems on power transmission, lighting, heat transfer and humidity control	30	x	x	x
2	Analyze energy use in building systems	40		x	x
3	Analyze energy use in transportation systems	10		x	
4	Explore and evaluate advanced and innovative energy-efficient systems and technologies	20	x	x	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	To explain key concepts and theories related to energy usage and conservation technologies including thermodynamics, heat transfer, psychrometrics, motors, etc.	1, 2, 3, 4	2 hrs/wk
2	In-class demonstrations	To demonstrate systems such as air-conditioner, dehumidifier, lighting etc. to show the students how the principles are applied in real life and to solidify students' concepts with practice	1, 2, 3, 4	0.5 hr/wk
3	Tutorials	To teach students how to formulate questions and solve problems about energy usage and efficiency	1, 2, 3, 4	0.5 hr/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignment Homework with both technical and open-ended problems will be given regularly to help the students consolidate the concepts learned in class and also to explore how the principles are applied in our daily life	1, 2, 3, 4	30	-	Yes
2	In-class test/quiz Problems are given to students to solve to demonstrate their understanding of the concepts	1, 2, 4	25	-	No
3	Class project A hands-on project on energy usage where the students will be asked to design based on the concepts learned in class to demonstrate their understanding	1, 2	15	-	Yes

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task

Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and solve practical problems related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B, B-) Able to use the correct concepts for problem solving, but have errors in calculation

Fair
(C+, C, C-) Can apply some of the concepts correctly to partially solve the problems

Marginal
(D) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
In-class test/quiz (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and solve questions related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B, B-) Able to use the correct concepts for problem solving, but have errors in calculation

Fair
(C+, C, C-) Can apply some of the concepts correctly to partially solve the problems

Marginal
(D) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
Class project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to formulate, implement and analyze hands-on experiments to demonstrate energy use

Excellent
(A+, A, A-) Good design of experiments with careful implementation and analyses to demonstrate energy use

Good
(B+, B, B-) Some parts of the experiments require more careful planning and implementation

Fair

(C+, C, C-) Incomplete experimental plans and data analysis

Marginal
(D) Some attempts to carry out some tests, with errors in data analysis

Failure
(F) Minimal attempt to design and implement project

Assessment Task
Final exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and solve practical problems related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B, B-) Able to use the correct concepts for problem solving, but have errors in calculation

Fair
(C+, C, C-) Can apply some of the concepts correctly to partially solve the problems

Marginal
(D) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and solve practical problems related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B) Able to use the correct concepts for problem solving, but have errors in calculation

Marginal
(B-, C+, C) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
In-class test/quiz (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and solve questions related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B) Able to use the correct concepts for problem solving, but have errors in calculation

Marginal
(B-, C+, C) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
Class project (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to formulate, implement and analyze hands-on experiments to demonstrate energy use

Excellent
(A+, A, A-) Good design of experiments with careful implementation and analyses to demonstrate energy use

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(B+, B) Some parts of the experiments require more careful planning and implementation

Marginal
(B-, C+, C) Some attempts to carry out some tests, with errors in data analysis

Failure
(F) Minimal attempt to design and implement project

Assessment Task
Final exam (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and solve practical problems related to energy usage and conservation technologies

Excellent
(A+, A, A-) Able to solve problems without any errors

Good
(B+, B) Able to use the correct concepts for problem solving, but have errors in calculation

Marginal
(B-, C+, C) Can determine the relevant equations and show some attempt to solve a problem in the correct direction

Failure
(F) Not able to use the correct concept to solve a problem

Assessment Task
Case study and oral presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to identify and analyse a problem in an energy system or a process, and propose possible solutions

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
In-class exercises (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to apply concepts and theories to sustainable design of processes in practice

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and calculate practical problems in sustainable processes

Excellent
(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Reading exercises (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to evaluate and make sensible comments on reading materials related to the ‘Case study’ topic.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Quizzes (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and calculate practical problems in energy, environment and sustainability-related issues.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Final examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Ability to analyse and calculate practical problems in energy, environment and sustainability-related issues.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Case study and oral presentation (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to identify and analyse a problem in an energy system or a process, and propose possible solutions

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Assessment Task
In-class exercises (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to apply concepts and theories to sustainable design of processes in practice

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Assessment Task
Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and calculate practical problems in sustainable processes

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Assessment Task
Reading exercises (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to evaluate and make sensible comments on reading materials related to the ‘Case study’ topic.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Assessment Task
Quizzes (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and calculate practical problems in energy, environment and sustainability-related issues.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Assessment Task
Final examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and calculate practical problems in energy, environment and sustainability-related issues.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Low

Part III Other Information

Keyword Syllabus
-Introduction to efficiency
-Power transmission distribution and quality
-Heating and air-conditioning
-Heat transfer and heat exchange, waste heat recovery
-Humidity and ventilation systems
-Lighting equipments; electronic ballasts
-Electrical appliances; motors
-Energy use in transportation systems

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	ASHRAE, ASHRAE Handbooks, US:Atlanta. (latest revision)
2	Mitchell, J.W., Braun, J.E., Principles of Heating, Ventilation, and Air Conditioning in Buildings, Wileys & Sons, 2013.
3	Pita, E.G., Refrigeration Principles and Systems, Business News Publishing Company, 1991.
4	Szokolay, S.V., Introduction to Architectural Science: the Basis of Sustainable Design, Routledge, 2014.
5	Hundy, G.F., Trott, A.R., Welch, T.C. Refrigeration and Air-conditioning, 4th edition, Elsevier, 2008.
6	#engel, Y.A., Turner, R.H., Cimbala J. M., Fundamentals of Thermal-Fluid Sciences, Third edition, McGraw Hill, 2008.
7	Thumann, A., Mehta, D. P., Handbook of Energy Engineering, 7th edition, CRC Press, 2013.
8	CIBSE (Chartered Institution of Building Services Engineers). CIBSE guides. (latest revision).
9	EMSD. Code of Practice for Energy Efficiency of Air Conditioning Installations. (latest revision)
10	EMSD. Code of Practice for Energy Efficiency of Electrical Installations. (latest revision)
11	EMSD. Code of Practice for Energy Efficiency of Escalator Installations. (latest revision)
12	EMSD. Code of Practice for Energy Efficiency of Lighting Installations. (latest revision)
13	EMSD. Hong Kong Energy End-use Data (latest version)
14	EMSD. Performance-based Building Energy Code. (latest revision)
15	EMSD. Voluntary Energy Efficiency Labelling Scheme (EELS) (latest revision)
16	1. Hong Kong Government Architecture Services Department website: http://www.archsd.gov.hk/ 2. Hong Kong Government Electrical & Mechanical Services Department website: http://www.emsd.gov.hk/ 3. Sustainable Development Unit website: http://www.susdev.gov.hk/html/en/index.htm Energy Design Information website: http://www.energydesignresources.com