

SEE3102: POWER PLANT ENGINEERING

Effective Term

Semester A 2024/25

Part I Course Overview

Course Title

Power Plant Engineering

Subject Code

SEE - School of Energy and Environment

Course Number

3102

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

SEE2001 Electromagnetic Principles for Energy Engineers or equivalent; and
SEE2101 Engineering Thermofluids I or equivalent

Precursors

SEE2002 Chemical Sciences for Energy and Environmental Engineers or equivalent

Equivalent Courses

Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

This course introduces the general knowledge and engineering principles of conventional power plants. The course will emphasise on energy resources such as fossil fuels, nuclear and hydroelectric. Electric generators, corresponding devices and technologies for power generation, distribution and transmission will be discussed.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Calculate energy output and study gas emission from various fuel sources	20		x	
2	Describe the principles of heat engines and analyse energy conversion efficiency	30		x	
3	Explain the mechanisms of various power plant systems, and evaluate the power generation level for different applications	10		x	
4	Identify different kinds of power generators, and evaluate the application occasions of different generators	10		x	
5	Analyze power transmission and distribution systems, and describe the basic concepts and principles of modern grid systems	30	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	Lecture	Students will engage in lectures to learn key concepts, including principles of combustions, heat engines, theories and knowledge related to electricity generation and distribution.	1, 2, 3, 4, 5	2.5

2	Tutorial, class demo	Students will engage in lectures to solidify concepts and principles with demonstrations and practice of combustion, heat engines, power generation and distribution.	1, 2, 3, 4, 5	0.5
---	----------------------	---	---------------	-----

Assessment Tasks / Activities (ATs)

ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)	
1	In-class test Students will complete a midterm test to demonstrate their learning ability to understand and apply their knowledge in power combustion and generation problems.	1, 2	20	
2	Assignment Several assignments will be given throughout the semester. Students need to complete the assignments to demonstrate their ability to understand and apply their knowledge in fuel combustion, energy output, heat engines, power generation ways, power generators, power transmission, power distribution, and modern power grids.	1, 2, 3, 4, 5	30	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Final exam will be given to test students' ability to apply their knowledge learned in power generation, transmission and distribution.

Examination duration: 2 hrs

Percentage of continuous assessment, examination, etc.: 50% by continuous assessment; 50% by exam

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. In-class test

Criterion

Ability to analyse and solve problems related to energy supply, power combustion and generation.

Excellent (A+, A, A-)

Excellent analysis and problem solving skills to demonstrate in-depth understanding of energy supply, power combustion and generation

Good (B+, B, B-)

Good analysis and problem solving skills to demonstrate good understanding of energy supply, power combustion and generation

Fair (C+, C, C-)

Acceptable analysis and problem solving skills to demonstrate adequate understanding of energy supply, power combustion and generation

Marginal (D)

Marginally acceptable analysis and problem solving skills to demonstrate some understanding of energy supply, power combustion and generation

Failure (F)

Poor analysis and problem solving skills and is barely able to demonstrate an understanding of energy supply, power combustion and generation

Assessment Task

2. Assignment

Criterion

Ability to evaluate and analyse questions related to fuel combustion, power generation, engines, generators, power transmission and distribution.

Excellent (A+, A, A-)

Excellent analysis and problem solving skills to demonstrate in-depth understanding of fuel combustion, power generation, engines, generators, power transmission and distribution.

Good (B+, B, B-)

Good analysis and problem solving skills to demonstrate good understanding of fuel combustion, power generation, engines, generators, power transmission and distribution.

Fair (C+, C, C-)

Acceptable analysis and problem solving skills to demonstrate adequate understanding of fuel combustion, power generation, engines, generators, power transmission and distribution.

Marginal (D)

Marginally acceptable analysis and problem solving skills to demonstrate some understanding of fuel combustion, power generation, engines, generators, power transmission and distribution.

Failure (F)

Poor analysis and problem solving skills and is barely able to demonstrate an understanding of fuel combustion, power generation, engines, generators, power transmission and distribution.

Assessment Task

3. Final exam

Criterion

Ability to analyse and solve problems related to fuel combustion, power generation, engines, generators, power transmission and distribution.

Excellent (A+, A, A-)

Excellent analysis and problem solving skills to demonstrate in-depth understanding of fuel combustion, power generation, engines, generators, power transmission and distribution

Good (B+, B, B-)

Good analysis and problem solving skills to demonstrate good understanding of fuel combustion, power generation, engines, generators, power transmission and distribution

Fair (C+, C, C-)

Acceptable analysis and problem solving skills to demonstrate adequate understanding of fuel combustion, power generation, engines, generators, power transmission and distribution

Marginal (D)

Marginally acceptable analysis and problem solving skills to demonstrate some understanding of fuel combustion, power generation, engines, generators, power transmission and distribution

Failure (F)

Poor analysis and problem solving skills and is barely able to demonstrate an understanding of fuel combustion, power generation, engines, generators, power transmission and distribution

Part III Other Information

Keyword Syllabus

- Fossil fuel based energy:
 - Coal; Fuel gas; Oil
 - Combustion, air-fuel ratio
 - Heat engine, Steam generators; Steam turbines; Gas turbines, power plant
- Nuclear power:
 - Nuclear reactor; Uranium; Fission; Nuclear waste management
- Hydro-electric power plant
- Power generation and electric generators
- Power transmission and distribution
 - Switches, cables, fuses, transformers, converters
 - three phases, power factor, harmonics
 - High voltage DC
 - Smart grid
 - Power grid

Reading List

Compulsory Readings

Title	
1	Nil

Additional Readings

Title	
1	F.M. Vanek and L.D. Albright, Energy Systems Engineering – Evaluation & Implementation, McGraw-Hill, second edition, 2012.
2	A.W. Culp, Principles of Energy Conversion, McGraw-Hill, 1991.
3	A.K. Raja, A. P. Srivastava, M. Dwivedi, Power Plant Engineering, New Age International (P) Ltd., 2006.
4	P.K. Nag, Power Plant Engineering, McGraw-Hill, 2001.
5	C. King, Thermal Power Plant Cooling Context and Engineering of, ASME, 2014.
6	J.R. Lamarsh and A.J. Baratta, Introduction to Nuclear Engineering, 3rd Ed., Prentice Hall, 2001.
7	D. Buchla, T. Kissell, T. Floyd, Renewable Energy Systems, Pearson, 2015