SEE3102: POWER PLANT ENGINEERING

Effective Term
Semester A 2022/23

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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain key concepts, including principles of heat engines, theories related to electricity generation and distribution	1, 2, 3, 4, 5	2.5
2	Tutorial, class demo	Solidify students' concepts and principles with practice	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 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 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 coursework, examination, etc.: 50% by coursework; 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 coursework (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

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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

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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