MNE3111: INTRODUCTION TO NUCLEAR POWER PLANT

Effective Term
Semester B 2023/24

Part I Course Overview

Course Title
Introduction to Nuclear Power Plant

Subject Code
MNE - Mechanical Engineering
Course Number
3111

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

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

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
MBE2003/MNE2003 Mechanics or
MBE2036/BME2036/MNE2036 Engineering Computing or
MBE2109/BME2109/MNE2109 Engineering Mechanics

Precursors
Nil

Equivalent Courses
MBE3111 Introduction to Nuclear Power Plant

Exclusive Courses
Nil

Additional Information

#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

This course aims to give an overview of the major subsystems of nuclear power plants which uses mainly light water reactor technology. It also introduces passive heat removal system used in Generation III reactor and the Gen-IV nuclear systems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basics of light water reactor designs.		x	x	
2	Describe the major systems of nuclear power plants.		x	x	
3	Explain the interconnection and importance of the major subsystems.			x	x
4	Demonstrate reflective practice in an engineering context.			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	Take place in classroom setting which consists of lectures on different topics related to system design and operations of the nuclear power plants, and related basic theories and engineering practices.	1, 2, 3	3 hrs/week

2	Laboratory Work	Using the state-of-the-art nuclear reactor simulator at CityU, the lab topics are carefully designed to allow students to practice the knowledge learned in the class on the nuclear power plant design and operation.	1, 2, 3, 4	3 hrs/week for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/ Mid-term Test	1, 2, 3, 4	15	
2	Mini-project	1, 2, 3, 4	10	Mini-project: Typical practical problem(s) related to the major systems of nuclear power plants will be given to students to solve. The students are expected to work in teams to tackle the given problems. This learning activity will be mainly student-led but with some structural guidance from the teacher. At the end of the learning activity, a presentation session will be organised for all the students to present their solutions for the given problem.
3	Laboratory Report	1, 2, 3, 4	15	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Quizzes/ Mid-term Test

Criterion

Ability to describe the major subsystem and components of the light water reactors and other advanced reactor designs, and the basic theories of the reactor design and operation.

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
2. Mini-project

Criterion
Ability to apply the learned theories to conduct the research for a nuclear power plant related 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
3. Laboratory Report

Criterion
Ability to use a nuclear reactor simulator to analyse assigned topics on nuclear power plant design and operations.

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
4. Examination

Criterion
Ability to describe the design and operation of the light water reactor based nuclear power plant system and other advanced reactor designs, and the functions of the major components. Ability to understand the basic theories and engineering practices for the design and operation of the lighter water reactors and other advanced reactor designs.

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

Additional Information for AR
Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

- Introduction to light water reactors (LWRs) now used commercially
- Brief introduction on other renewable energy sources such as wind, solar, hydropower, fuel cell etc.
- Fuel design and fuel cycle
- Control system
- Cooling system
- Safety system
- Waste disposal and management system
- Materials and structural design
- Passive heat removal system

Reading List

Compulsory Readings

	Title
1	Lamarsh, J. R. and Baratta, A. J., “Introduction to Nuclear Engineering”, 4th Edition, Pearson, 2017.

Additional Readings

	Title
1	Murray, R. L., “Nuclear Energy”, 6th Edition, Butterworth-Heinemann, 2009.
2	Todreas, N. and Kazimi, M., “Nuclear Systems I: Thermal Hydraulic Fundamentals”, CRC Press, Taylor & Francis Group, Boca Raton, U.S.A., 2012, ISBN: 978-1-4398-0887-0.
3	Knief, R. A., “Nuclear Engineering: Theory and Technology of Commercial Nuclear Power”, 2nd Edition, American Nuclear Society, c2008.
4	Kok, Kenneth D., “Nuclear Engineering Handbook”, CRC Press, ISBN: 978-1-4200-5390-6.