MNE3128: RADIOLOGICAL ANALYSIS

New Syllabus Proposal

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Radiological Analysis

Subject Code
MNE - Mechanical Engineering
Course Number
3128

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
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to provide students with knowledge of the basic properties of radiation that is relevant to nuclear engineering, the detection methodologies of radiation, the principles of radiation interaction with matter and the human body, as well as the fundamentals of radiation protection and safety of radiation sources. The regulations and standards for tackling radiation will also be introduced.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain the origin, nature, and production of radiation.		x		
2	Describe the operation of various radiation detectors and radiation dosimeters.			x	
3	Analyze the interactions of radiation with matter and the human body.			x	
4	Discuss the principle of radiation protection practices in line with rules and regulations.			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 the fundamentals of the source of radiation, radiation detection, interaction mechanisms of radiation with matter and the human body, and protection rules against radiation.	1, 2, 3, 4	3 hrs/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3	10	
2	Mid-term Examination	2, 3, 4	30	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

3

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

Assignments

Criterion

Describe the operation of various radiation detectors, analyze the interactions of radiation with matter and the human body, and discuss the principle of radiation protection practices in line with rules and regulations.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of the concept

Fair (C+, C, C-)

Student is profiting from the class; understanding the subject; ability to develop solutions to concerning problems

Marginal (D)

Basic familiarity with the subject matter

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correct use knowledge in radiation

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Assessment Task

Mid-term Examination

Criterion

Explain the origin, nature, and production of radiation, and describe the operation of various radiation detectors and radiation dosimeters.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of the concept

Fair (C+, C, C-)

Student is profiting from the class; understanding the subject; ability to develop solutions to concerning problems

Marginal (D)

Basic familiarity with the subject matter

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correct use knowledge in radiation

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Assessment Task

Examination

Criterion

Analyze the interactions of radiation with matter and the human body and discuss the principle of radiation protection practices in line with rules and regulations.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of the concept

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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

- Source of ionizing and non-ionizing radiations; Activity, half-life, exponential attenuation, half-value layer (HVL), inverse square law, tenth-value layer (TVL).
- Interaction of radiation with matter and the human body; energy loss; photoelectric effect, Compton scattering, pair production, biological effects; Time, distance and shielding; shielding properties and design.
- Radiation protection; Effective dose and equivalent dose limits; Exclusion and exemption.
- Radiation monitoring and dose measurement instruments; Ionisation chambers; Scintillation spectrometer; Geiger Muller counter; DAP meter; Semiconductor detector and thermoluminescent dosimeter (TLD); portable survey and contamination radiation monitoring devices; personal radiation monitoring; internal exposure.

Reading List

Compulsory Readings

	Title
1	Bushong, Stewart C. Radiologic science for technologists: physics, biology, and protection. 11th ed. 2016. St. Louis, Elsevier.

Additional Readings

	Title
1	J R Lamarsh and A J Baratta “Introduction to Nuclear Engineering”, Prentice Hall (latest ed.).
2	Martin Alan. An introduction to Radiation Protection, 2019, 7th ed. London: Hodder Arnold.
3	Martin, James E. Physics for Radiation Protection. Third Completely Updated ed. Weinheim, Germany: Wiley-VCH Verlag GmbH & KGaA, 2013. Web.