MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME926 NUCLEAR POWER SYSTEMS

Module Registrar: Dr P Tuohy paul.tuohy@strath.ac.uk	**Taught To (Course): Level 5 Cohorts**	
Other Lecturers Involved: None	**Credit Weighting: 10**	**Semester: 2 (online)**
Compulsory/ optional/ elective class	**Academic Level: 5**	**Suitable for Exchange: Y**

Required prerequisites

Note: It is the responsibility of ALL students to ensure that they satisfy the prerequisite knowledge for this module BEFORE adding as part of curriculum selection. If unsure, please contact the Module Registrar or discuss with your Programme/Year Adviser of Studies.

None.

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
20	10						20	50	100

Educational Aim

This module aims to provide core knowledge of nuclear power plant engineering and to develop a critical awareness of the nuclear basics, reactor basics, reactor operation and design, waste disposal, and key issues relating to health and safety.

Learning Outcomes

On completion of the module the student is expected to be able to:

LO1 Understand atomic physics terminology, nuclear particles, and interaction processes with material.

LO2 Identify and discuss the purpose of key components of nuclear power plant for a variety of different configurations.

LO3 Understand the basic nuclear principles underlying power reactor technology and be able to carry out basic calculations in relation to the design and operation of the plant.

LO4 Have a critical understanding of nuclear plant health, safety, and environmental issues.

Syllabus

The module will teach the following:

Prelude - history of nuclear power and typical power plant configuration.

Part 1 Nuclear fundamentals
(i) Fundamentals of nuclear physics
(ii) Interaction of radiation with matter
(iii) Radiation protection and shielding

Part 2 Nuclear Reactor Engineering
(i) Neutron diffusion and moderation
(ii) Reactor core theory

(iii) Heat generation and core thermal characteristics
(iv) Nuclear reactor designs
(v) Reactor operational characteristics

Part 3 Wider Industry Topics
(i) Radiation and health
(ii) Plant safety and accidents
(iii) Fuel resources and fuel processing
(iv) Waste and storage

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning, these will be formally assessed through two time-constrained online quizzes:

LO1 To understand atomic physics terminology, nuclear particles, and their interaction processes with materials
C1 The ability to describe and explain radioactive decay processes from a nuclear physics perspective.
C2 The ability to explain the consequences of nuclear radiation and its interaction with matter.
C3 The ability to explain the effect on biological tissue of radiation and understand current safety limits
C4 The ability to carry out basic decay rate, half-life, and abundance calculations.

L02 Identify and discuss the purpose of key components of nuclear power plant systems for a variety of different configurations.
C1 The ability to describe the main components of a nuclear reactor power plant and explain their role.
C2 The ability to identify different designs of nuclear power plant including thermal and fast reactors and explain their differences with engineering or nuclear physics reasoning.
C3 The ability to describe plant operating and shut-down conditions for thermal reactors.
C4 The ability to describe and discuss the key issues associated with the nuclear fuel cycle, reprocessing and waste storage.

LO3 To understand the basic nuclear principles underlying power reactor technology and be able to carry out basic calculations in relation to the design and operation of the plant
C1 The ability to understand the mechanisms of neutron diffusion and moderation.
C2 The ability to understand and solve simple problems in homogeneous reactor theory.
C3 The ability to understand and apply simple models for the operation and shut down of reactors.
C4 The ability to understand and calculate the thermal aspects of core heat generation and cooling.

LO4 To have a critical understanding of nuclear plant health, safety, and environmental issues
C1 The ability to describe the general impact of radiation on health, the background environmental radiation levels, health effects of radiation exposure and the relationship between reactor fission products and potential health impacts.
C2 The ability to identify the failure modes associated with historical nuclear accidents, the health and environmental impacts of those accidents, and lessons learned for application in future.
C3 The ability to describe the nuclear waste disposal process and current issues.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)

The class has been implemented as a distance learning module. The students are enrolled to a class blog which allows questions to be asked, facilitates peer discussions, and provides a vehicle for tutor feedback. The class content includes a number of video lectures that end with a tutorial question. The students are asked to attempt the question before looking at the video tutorial answers. If the students have questions, they are encouraged to use the blog. The tutorials in this format are intended to provide the main formative feedback mechanism.

Within the first 3 weeks of the course the students are required to upload summary notes constructed during viewing / review of initial course materials, these are used to assess whether students are engaged sufficiently.

A multiple-choice assignment is provided to give a formative feedback opportunity; this is made available in week 2 for submission in week 4, with answers made available week 4. Students review their answers against solutions and use the blog or contact the tutor to raise issues and receive further individual or group feedback.

A set of questions is provided in week 4 to facilitate and direct learning, it covers: (i) nuclear principles and calculations, (ii) reactor designs and materials, (iii) health effects and accidents, (iv) wastes and disposal. A time constrained quiz in week 7 is used to assess learning and understanding of topics (i) and (ii), a second time constrained quiz in week 11 is used to assess learning and understanding of topics (iii) and (iv). The combined quiz results provide the overall mark for the module.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				**Coursework**		**Online Quiz**		**Project**	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
						2	100%		
*				*		*All		*	

L/Os: *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/project/practical as required.*

Coursework / Submissions deadlines (*academic weeks*):

Students are required to submit their initial course notes in week 2. A guide to aid study for the assessment quizzes is provided in week 4. The first time-constrained assessment quiz is available for a 3-day period in week 7. The second time-constrained assessment quiz is available for a 3-day period in week 11.

Resit Assessment Procedures:
Time-constrained quiz available for a 3-day period prior to commencement of the July/August exam diet. The time constrained quiz will provide the mark for the resit attempt (marks gained / marks available).

^^Students must contact the module Registrar for details as soon as results confirm that a resit is required.

PLEASE NOTE:
Students must gain a summative mark of 50% to pass the module. Students who fail the module at the first attempt will be reassessed prior to the July/August exam diet. This reassessment will consist of an online quiz. No marks from any previous attempts will be transferred.

Recommended Reading

***For reference**

**J.R. Lamarsh, A.J.Baratta, Introduction to Nuclear Engineering, 3rd Edition Prentice Hall, 2001*
**D.J. Bennet, J.R. Thompson, Elements of Nuclear Power, 3rd edition, 1989*

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
By email arrangement		

Session: 2024/25

Approved:

Programme Lead/Director Signature: Dr A McLaren

Date of Last Modifications: 19/08/2024

(MAE template updated July 2024)

MODULE TIMETABLE

Module Code:	**ME926**	**Module Title:**	**Nuclear Power Plant Systems**

Brief Description of Assessment:

Two time-constrained online quizzes available within 3-day periods will be run, one in week 7 and one in week 11, the combined quiz mark (total marks scored / total marks available) will be the overall mark for the module.

Assessment Timing

Indicated on the table below are the start/submission dates for each assignment/project and the timing of each exam/assessment.

Please note: Timings could change during unforeseen periods of disruption; this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Time constrained online quiz 1	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Time constrained online quiz 2	Choose an item.