

Engineering Tripos Part IIB, 4I10: Nuclear Reactor Engineering, 2023-24

Leader

[Dr E Shwageraus](#) [1]

Lecturers

[Mr T Roulstone](#), [Dr E Shwageraus](#) [2]

Timing and Structure

Michaelmas term. 16 lectures, 1 examples class & 5 examples papers; Assessment: 100% exam

Prerequisites

4M16

Aims

The aims of the course are to:

- provide understanding of the principles of reactor systems, their engineering, and related thermo-hydraulics

Objectives

As specific objectives, by the end of the course students should be able to:

- understand the design and safe operation of nuclear reactors
- perform approximate calculations of component & system parameters
- understand how more precise and detailed analyses are performed

Content

The course will cover:

- Overview – compare and contrast the fundamental engineering principles of current types of reactor system: PWR, BWR, HWR, AGR;
- Coolant types, heat transfer regimes, multi-phase flow, burn-out and thermal cycles;
- Core analysis – flow networks, heat & mass transfer calculations, fuel element design, thermal limits – models and codes;
- Whole reactor circuit, steam generator, pressuriser, pumps & whole circuit design and modelling;
- Operating modes: normal, warm-up and cool down, operating envelopes, load following;
- Main fault conditions accident types and limits – design issues and modelling;
- Principles of loss of cooling accident modelling – description of TMI – design aims for avoidance and mitigation – active and passive protection;
- Design optimisation – system architecture, pressure and temperature, vessel design and sizing, effect on equipment cost – small and medium-sized reactors.

LECTURE SYLLABUS

- Introduction to nuclear energy, reactor power cycles (2I)
- Core configurations choices (4I)
- Reactivity control (2I)
- Reactor plant design & modelling (2I).
- Safety & design – classes of accidents – reactivity, LOCA, etc. (4I)
- Reactor control & operations (1I)
- Severe Accidents (1I)

Booklists

Please refer to the Booklist for Part IIB Courses for references to this module, this can be found on the associated Moodle course.

Examination Guidelines

Please refer to [Form & conduct of the examinations](#) [3].

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Links

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[2] <mailto:armr2@cam.ac.uk>, es607@cam.ac.uk

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