Engineering Tripos Part IIB, 4I10: Nuclear Reactor Engineering, 2018-19

Leader

Dr E Shwageraus [1]

Lecturers

Dr E Shwageraus

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 (2l)
- Core configurations choices (4l)
- Reactivity control (2l)
- Reactor plant design & modelling (2l).
- Safety & design – classes of accidents – reactivity, LOCA, etc(4l)
- Reactor control & operations (1l)
- Severe Accidents (1l)

Booklists

Please see the Booklist for Group I Courses [2] for references for this module.

Examination Guidelines

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

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Links
[1] mailto:es607@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56171
[3] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations