
Module Leader
Dr G Parks [1]

Lecturers
Dr N Read [2]

Timing and Structure
Lent term. 16 lectures, 4 examples papers, 2 examples classes in support of coursework. Assessment: 100% coursework

Prerequisites
4M16

Aims
The aims of the course are to:

- provide an understanding of advanced systems, why they are being pursued, what are their advantages and their difficulties in becoming commercially viable designs.

Content
Further aims:

- What are the factors that are driving the development of advanced systems?
- Overview of fast reactor development & Gen IV reactor systems, including accelerator driven sub-critical reactors;
- Introduce the principles of fusion energy physics and the current status of research;
- Explain how the principles of fusion energy are to be applied for the design of future fusion energy systems;
- Re-cycle fuel studies, including reprocessing and re-fabrication;
- Status, issues and what would be needed to bring advanced reactor systems to a commercial standard with safety and economics as good as current Generation III+ designs

Fission Systems

- Design objectives, drivers & alternatives (2l)
- Advanced Thermal systems – example high temperature gas reactor(2l)
- Fast Spectrum Reactor systems – including external Dr A Judd(4l)
- Transmutation and Advanced Fuel cycles (2l)

Fusion Systems

Introduction & Physics of fusion systems - CCFE (2l)
• Fusion reactions: cross sections and reactivity
• Magnetic and inertial approaches to fusion
• Equilibrium, transport, instabilities and power balance

Physics & Materials - CCFE (2l)

• Heating systems and current drive
• Layout of a fusion power plant
• Fusion reactor components and materials requirements

Performance Safety and Design CCFE (2l)

• Safety of a fusion
• Radiological hazards and waste products
• Fusion in the market and timescale to fusion
• Designing a fusion power plant

Examples papers

- Thermal reactor systems (High Temperature Gas-cooled Reactors)
- Fast Reactors
- Fusion: plasma physics and reactor engineering

Coursework

Coursework #1

Group project (3-4 students) researching into a particular advanced reactor design.

This part will be assessed by a group presentation to the rest of the class.

The presentations will be scheduled at a convenient time outside the normal lectures schedule.

Learning objective:

• Research in depth one of the advanced reactor systems
• Familiarise with a broad range of advanced systems, their strengths and weaknesses

Coursework #2

Fast reactor transient analysis using provided computer models.

This part of coursework will be preceded by an examples class, where these models will be introduced and demonstrated.

Learning objective:

• Understand fundamentals of fast reactors transient behaviour and safety

Coursework #3
Problem set on advanced fission reactors, plasma physics and fusion technology.

Learning objective:

- Understand fundamentals of fusion power systems physics and engineering

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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Source URL (modified on 01-09-20): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4i11-advanced-fission-and-fusion-system-2020-21

Links

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