
Module Leader
Dr E Shwageraus

Lecturers
Dr E Shwageraus, Mr A Roulstone

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 - Dr C. Roach CCFE (2l)
Fusion reactions: cross sections and reactivity
Magnetic and inertial approaches to fusion
Equilibrium, transport, instabilities and power balance

Physics & Materials - Dr M. Fleming CCFE (2l)

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

Performance Safety and Design Dr M. Fleming 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

<table>
<thead>
<tr>
<th>Coursework #1</th>
<th>Group project (3-4 students) researching into a particular advanced reactor design.</th>
<th>3 weeks preparation</th>
<th>Due date: 21 February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning objective:</td>
<td>Research in depth one of the advanced reactor systems, Familiarise with a broad range of advanced systems, their strengths and weaknesses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coursework #2</th>
<th>Fast reactor transient analysis using provided computer models.</th>
<th>2 weeks preparation</th>
<th>Due date: 28 February</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning objective:</td>
<td>Understand fundamentals of fast reactors transient behaviour and safety</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Examination Guidelines

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

Last modified: 15/01/2018 00:53

Source URL (modified on 15-01-18): http://teaching.eng.cam.ac.uk/content/engineering-tripos-part-iib-4i11-advanced-fission-and-fusion-system-2017-18

Links

[1] mailto:es607@cam.ac.uk