ES4F5-15 Gas Turbine Equipment

20/21

Department
School of Engineering
Level
Undergraduate Level 4
Module leader
Richard Lillington
Credit value
15
Module duration
30 weeks
Assessment
60% coursework, 40% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES4F5-15 Gas Turbine Equipment

Module web page

Module aims

To provide a rigorous understanding of the design, construction, and use of gas turbine equipment (aka jet engines) and a sound understanding of the requirements of associated ancillary equipment required and how these are met on the wing.
To provide insights into applications of under-pinning Engineering Science learnt throughout their degree in a high-technology, highly-efficient, safety critical application.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The course will include the following:

- Origins – early jet engine concepts, designs, and limitations

o Whittle’s vision / early engines / operation / limitations.
- Engine developments since inception, showing significant advances in technology.
  o Gas turbine specification and selection / operating regimes / differing engine architectures.
- Gas turbine engine function and use
  o Engine overview / PVT diagrams / control / material constraints / environmental considerations.
- Gas turbine technology
  o Compressors / combustion and fuelling / turbines / thrust & power.
- Future trends
  o Current state-of-the-art / future options.

Learning outcomes

By the end of the module, students should be able to:

- 1. Critically evaluate the technical development of gas turbines, from inception to current solutions at the forefront of technology.
- 2. Robustly evaluate the effectiveness of complex (and highly inter-dependent) systems by analysing anatomical feature developments, demonstrating a solid understanding of current engine capabilities, and by hypothesising future engine trends.
- 3. Operational Requirements : Interpret engine operating regimes, determine engine requirements, type and format specifications, and limitations.
- 4. Engine Anatomy : Evaluate key elements and demonstrate a comprehensive understanding of compressor technologies; fuel system and combustion technologies; and turbine technologies.
- 5. Engine Performance : Evaluate and critique complex engine controls, and engine control strategies, and show a comprehensive understanding of thrust and power delivery.
- 6. Associated Systems : Demonstrate an advanced understanding of modern ancillary systems critical for engine function, control, and reliability; and demonstrate conceptual understanding of developing trends in auxiliary means to improve sustainable engine use (such as data-analytics, and on-the-wing data).

Indicative reading list

1. The Jet Engine, 5th Ed. RR / Wiley Publishing, 2015. ISBN: 978-1-119-06599-9.
2. Pegasus, the heart of the Harrier. Andrew Dow. E-book. 2009. 9781783837823 (e-book).
3. Innovation in Aeronautics / edited by Trevor M. Young and Mike Hirst. E-Book. Woodhead Publishing. 2012. ISBN: 978-1-84569-550-7.
4. Jet Propulsion, Cumpsty, A. 3rd Ed. Cambridge Publishing, 2005. ISBN: 1107511224.
5. The Simple Science of Flight, Tennekes, H. The MIT Press, 2009. ISBN : 978-0-262-51313-5

Research element

The main assignment includes an element of research in to gas turbine applications / anatomy / sub-systems.

Subject specific skills

TBC

Transferable skills

TBC

Study

Study time

Type	Required	Optional
Lectures	20 sessions of 1 hour (13%)	
Seminars	4 sessions of 1 hour (3%)	
Tutorials	3 sessions of 1 hour (2%)	
Practical classes	(0%)	1 session of 2 hours
External visits	(0%)	2 sessions of 4 hours
Private study	123 hours (82%)	
Total	150 hours	

Private study description

Guided Independent Learning.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D

	Weighting	Study time
Assignment A 15-page assignment (nominal).	40%	
Engine Development Poster	20%	

	Weighting	Study time
An engine development poster (A2).		
Online Examination QMP ~Platforms - QMP	40%	

- Students may use a calculator
- Engineering Data Book 8th Edition

Feedback on assessment

- Class summary of typical strengths/weaknesses;
- Discussion in seminar sessions;
- Feedback report including detailed annotations on submitted coursework script;
- Nominal mark via Tabula and feedback (or link to feedback on returned script);
- Student support through advertised Advice and Feedback Hours
- Cohort level feedback on examinations.

Past exam papers for ES4F5

Availability

Courses

This module is Core optional for:

- Year 4 of UESA-H311 MEng Mechanical Engineering

This module is Option list A for:

- Year 4 of UESA-H114 MEng Engineering

This module is Option list B for:

- UESA-H311 MEng Mechanical Engineering
  - Year 4 of H311 Mechanical Engineering
  - Year 4 of H30G Mechanical Engineering with Business Management
  - Year 4 of H30H Mechanical Engineering with Sustainability
- Year 4 of UESA-H318 MEng Mechanical Engineering with Exchange Year
- Year 5 of UESA-H317 MEng Mechanical Engineering with Intercalated Year