

ES3B5-15 Engines and Heat Pumps

26/27

Department

School of Engineering

Level

Undergraduate Level 3

Module leader

Steven Metcalf

Credit value

15

Module duration

10 weeks

Assessment

100% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES3B5-15 Engines and Heat Pumps

[Module web page](#)

Module aims

Mechanical Engineers are expected to have a working knowledge of the thermodynamic basis of a number of types of engine and refrigerators / heat pumps, together with the principles (such as the Second Law) that constrain their performance.

This module addresses those requirements.

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.

1. Second Law of Thermodynamics
2. Properties of working fluids
3. Air Conditioning, Refrigeration and Heat Pump cycles

4. Otto cycle engines (spark ignition internal combustion engines)
5. Diesel cycle engines
6. Brayton cycle engines (Gas Turbines)
7. Rankine cycle engines (Steam Turbines)
8. Fuels and combustion

Learning outcomes

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

- Apply the Second Law of Thermodynamics to complex processes occurring in internal combustion engines.
- Carry out complex thermodynamic analyses of various engine cycles and calculations relating to the combustion of fuels.
- Discriminate between different types of engine cycle and their applications.
- Perform complex thermodynamic analyses of refrigeration and heat pump cycles.
- Demonstrate practical skills in a professional and scientific manner.
- Apply numerical and mathematical skills to the solution of mechanical and related engineering problems and communicate solutions

Indicative reading list

[Reading lists can be found in Talis](#)

[Specific reading list for the module](#)

Subject specific skills

Discriminate between different types of engine cycle and their applications. Apply the Second Law of Thermodynamics to complex processes occurring in internal combustion engines. Carry out complex thermodynamic analyses of various engine cycles and calculations relating to the combustion of fuels. Perform complex thermodynamic analyses of refrigeration and heat pump cycles.

Transferable skills

Numeracy: apply mathematical and computational methods to communicate parameters and solutions. Apply problem-solving skills, information retrieval, and the effective use of general IT facilities. Demonstrate practical skills in a professional and scientific manner. Communicate (written and oral) and work with others. Plan self-learning and improve performance, as the foundation for lifelong learning/CPD. Exercise initiative and personal responsibility, including time management. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Supervised practical classes	1 session of 3 hours (2%)
Private study	117 hours (78%)
Total	150 hours

Private study description

Guided independent learning 117h

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

Assessment group B1

Assessment component	Weighting	Study time	Eligible for self-certification
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Assessment component

Centrally-timetabled examination (On-campus)	100%		No
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Summer written exam (closed book). The Engineering Data Book and Thermodynamic and Transport Properties of Fluids tables will be provided in the exam.

- Students may use a calculator
- Thermodynamic and Transport Properties of Fluids (ES4D90)
- Answerbook Gold (24 page)
- Engineering Data Book 8th Edition

Weighting

Study time

**Eligible for self-
certification**

Reassessment component is the same

Feedback on assessment

- Cohort level feedback on examinations.
- Model solutions to example papers.
- Support through advice and feedback hours.

[Past exam papers for ES3B5](#)

Availability

Courses

This module is Core optional for:

- Year 4 of UESA-H314 BEng Mechanical Engineering with Intercalated Year

This module is Optional for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year