ES3B5-15 Engines and Heat Pumps

23/24

Department
School of Engineering
Level
Undergraduate Level 3
Module leader
Stan Shire
Credit value
15
Module duration
10 weeks
Assessment
30% coursework, 70% 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

Recommended Textbooks:

- G.F.C. Rogers and Y.R. Mayhew, Thermodynamic and transport properties of fluids, 5th ed., Oxford Blackwell, 1995.
- Y.A. Çengel & M.A. Boles, Thermodynamics: an engineering approach, 7th ed., McGraw Hill, 2011.
- G.F.C.Rogers & Y.R.Mayhew, Engineering Thermodynamics: Work and Heat Transfer, 4th ed., Wiley, 1992.
- K. Sherwin, Introduction to thermodynamics, Chapman & Hall, 1993.
- R.T. Balmer, Modern engineering thermodynamics, Academic, 2011
- Kenneth A. Kroos & Merle C. Potter, Thermodynamics for Engineers, SI Edition, Cengage Learning, 2015
- Jonh R.Reisel, Principles of Engineering Thermodynamics, SI Edition, Cengage Learning, 2016

View reading list on Talis Aspire

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	20 sessions of 1 hour (13%)
Supervised practical classes	1 session of 3 hours (2%)
Online learning (independent)	10 sessions of 30 minutes (3%)
Private study	122 hours (81%)
Total	150 hours

Private study description

Guided independent learning 122h

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 D5

	Weighting	Study time
Laboratory QMP Laboratory QMP 1 hour	30%	
Online Examination QMP January	70%	

	Weighting	Study time
~Platforms - AEP,QMP		

- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper
- Thermodynamics tables

Feedback on assessment

- Coursework (online laboratory QMP) marks will be returned with cohort level feedback.
- Cohort level feedback on examinations

Past exam papers for ES3B5

Availability

Courses

This module is Core for:

- Year 3 of UESA-H310 BEng Mechanical Engineering
- Year 3 of UESA-H315 BEng Mechanical Engineering
- Year 4 of UESA-H314 BEng Mechanical Engineering with Intercalated Year
- Year 3 of UESA-H311 MEng Mechanical Engineering
- Year 3 of UESA-H316 MEng Mechanical Engineering
- Year 4 of UESA-H317 MEng Mechanical Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H317 MEng Mechanical Engineering with Intercalated Year
    - Year 3 of H317 Mechanical Engineering with Intercalated Year
    - Year 4 of H317 Mechanical Engineering with Intercalated Year
- Year 3 of UESA-H11L Undergradaute Engineering (with Intercalated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergradaute Engineering (with Intercalated Year)
    - Year 3 of H11L Engineering (with Intercalated Year)

    - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
    - Year 3 of H112 Engineering
    - Year 3 of H112 Engineering