

ES4B7-15 Vehicle Propulsion

27/28

Department

School of Engineering

Level

Undergraduate Level 4

Module leader

Jonathan Saul

Credit value

15

Module duration

10 weeks

Assessment

40% coursework, 60% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

ES4B7-15 Vehicle Propulsion

[Module web page](#)

Module aims

At the end of this module students will be able to critically analyse a range of common propulsion technologies such as ICE, electrification and hybrid solutions.

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.

Propulsion choices.

Motivation for using HEVs

Preliminary concepts: Thermodynamic processes

Engine power cycles

Ignition and valve timing

Combustion fundamentals in SI and CI engines
Actual fuel-air cycles: Otto, diesel and two-stroke
Mixture preparation: stoichiometric, rich and lean mixtures
Combustion and exhaust formation
Emission norms, testing and control
Engine force balance and performance characteristics
Engine performance testing and turbocharging
Vehicle transmission
Vehicle power and traction requirements calculation
Engine sizing for HEV application
Hybrid vehicle architecture
Electric Machines: Principles and Modelling
Design of PM synchronous motors
Switched reluctance (stepper) and induction motors
Control of permanent magnet, stepper and induction motors
Energy storage technologies: electrical and mechanical
Battery modelling and characterisation
Battery pack design, management and control systems
Fuel cells

Learning outcomes

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

- Be familiar with the complex design and operating parameters of current engine operating characteristics. (M1, M3, M4, M5)
- Interpret the complex requirements for and operating characteristics of HEV enabling technology and the complexity of technology integration. (M4, M5, M13)
- Critically analyse the diverse justifications for complex vehicle hybridisation and electrification. (M4, M5, M13)

Indicative reading list

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

Subject specific skills

Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality.

Ability to develop economically viable and ethically sound sustainable solutions

Transferable skills

Appreciation of the global dimensions of engineering, commerce and communication

Be professional in their outlook, be capable of team working, be effective communicators, and be able to exercise responsibility and sound management approaches.

Exercise initiative and personal responsibility, including time management, which may be as a

team member or leader.

Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions.

Plan self-learning and improve performance, as the foundation for lifelong learning/CPD

Study

Study time

Type	Required
Seminars	18 sessions of 2 hours (24%)
Other activity	2 hours (1%)
Private study	112 hours (75%)
Total	150 hours

Private study description

Guided Independent Learning 112 hours

Other activity description

Examples class (exam revision)

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 D4

	Weighting	Study time	Eligible for self-certification
Assessment component			
Individual report 8 pages/1600 words	40%		Yes (extension)

Weighting	Study time	Eligible for self-certification
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Reassessment component is the same

Assessment component

Summer exam	60%	No
TYPE TBD		
~Platforms - QMP		

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- Online examination: No Answerbook required
 - Engineering Data Book 8th Edition

Reassessment component is the same

Feedback on assessment

Individual and cohort feedback for all assessments.

[Past exam papers for ES4B7](#)

Availability

Courses

This module is Core for:

- Year 4 of UESA-H336 MEng Automotive Engineering
- UESA-H337 MEng Automotive Engineering with Intercalated Year
 - Year 4 of H337 Automotive Engineering with Intercalated Year
 - Year 5 of H337 Automotive Engineering with Intercalated Year

This module is Optional for:

- Year 4 of UESA-H114 MEng Engineering
- UESA-H115 MEng Engineering with Intercalated Year
 - Year 4 of H115 Engineering with Intercalated Year MEng
 - Year 5 of H115 Engineering with Intercalated Year MEng

This module is Core option list A for:

- Year 4 of UESA-HH76 MEng Manufacturing and Mechanical Engineering
- UESA-HH77 MEng Manufacturing and Mechanical Engineering with Intercalated Year
 - Year 4 of HH77 Manufacturing and Mechanical Engineering MEng with Intercalated Year
 - Year 5 of HH77 Manufacturing and Mechanical Engineering MEng with Intercalated Year