WM986-15 Energy Storage Systems

26/27

Department
WMG
Level
Taught Postgraduate Level
Module leader
Carlos Pastor Fernandez
Credit value
15
Module duration
4 weeks
Assessment
Multiple
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The transition to sustainable transportation has placed energy storage systems (ESS) at the forefront of innovation in the automotive industry. This module offers a comprehensive exploration of the technologies that power hybrid and electric vehicles (HEVs and EVs), with a particular focus on the design, integration, and performance of advanced battery systems. As global demand for cleaner mobility solutions accelerates, understanding the role of ESS in achieving energy efficiency, reducing emissions, and enhancing vehicle performance is more critical than ever.

For the Full-Time delivery, this module includes 30 hours over 4 weeks consisting of interactive presentations, question and answer sessions and discussion, online sessions, videos, small group exercises and problem classes. When this module is delivered on DA Programmes, it is delivered in a 1-week block with 6 weeks to submit, rather than over a 4 weeks block.

The module includes a significant practical element (~30%) where students gain hands-on experience in battery pack design, battery modeling and characterisation testing.

Module aims

The module provides a comprehensive study of energy storage systems for hybrid and electric vehicle applications in the automotive industry, and the complexities and challenges of introducing high voltage technology to passenger vehicles.

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.

- Energy storage requirements for vehicle applications
- Storage technologies and metrics for comparison
- Modular battery packs and packaging
- Battery modeling and battery charging
- Battery management systems
- Battery diagnostics and end of life
- Hands-on practical: Battery modeling
- Hands-on practical: Battery characterisation and testing
- Problem class: Energy storage design

Learning outcomes

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

- Evaluate the wide variety of energy storage technology for vehicle applications [AHEP:4; 7, M2]
- Independently make a systematic and sound choice of energy storage technologies, architecture and means of conversion for practical real-world vehicle applications [AHEP:4; 7, M2, M6]
- Creatively design the integration of high voltage systems into vehicle platforms, critiquing design trade-offs and autonomously applying a sound knowledge of integration issues, best practice guidelines, safety systems and practical considerations [AHEP:4; 7, M2, M3]
- Interpret battery pack design and battery characterisation or battery modelling activities in electric vehicles [AHEP:4; 7, M2]
- Work within a team to resolve problems in the context of energy storage systems [AHEP:4; 7, M16]

Indicative reading list

Reading lists can be found in Talis

Specific reading list for the module

Subject specific skills

Energy storage requirements for vehicle applications; storage technologies and metrics for comparison; modular battery packs and packaging; battery modeling and battery charging; battery management systems; battery diagnostics and end of life. Hands-on practical: battery modeling; battery characterisation and testing. In-Class problem: energy storage design.

Transferable skills

Critical thinking; Problem solving; Self-awareness; Communication; Teamwork and working effectively with others; Information literacy (research skills); Digital literacy; Sustainability; Professionalism; Organisational awareness.

Study

Study time

Type	Required
Lectures	12 sessions of 1 hour (8%)
Seminars	2 sessions of 1 hour (1%)
Supervised practical classes	16 sessions of 1 hour (11%)
Online learning (independent)	15 sessions of 1 hour (10%)
Private study	45 hours (30%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Online independent learning and private study learning includes:

- Preparation and revision of lectures after delivery
- Completion of activities related to energy storage systems.
- Prior research required to complete the assessment

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A3

	Weighting	Study time	Eligible for self-certification
Evaluation of technology application	60%	36 hours	Yes (extension)

This part is related to discussing a typical energy storage design based on given requirements.

	Weighting	Study time	Eligible for self-certification
Evaluation of practical activities - Group work	40%	24 hours	No

Students are divided into groups of 3 to 6 supported by a tutor. Each group needs to record 2 video presentations based on the practical activities undertaken in the module. Module marker is able to observe the contribution of each student in sufficient detail through the recording to allocate individual marks without the use of peer assessment.

Assessment group R3

	Weighting	Study time	Eligible for self-certification
Evaluation of practical activities - Individual work	40%		No

The student needs to record 2 video presentations based on the practical activities undertaken in the module.

Evaluation of technology application	60%	36 hours	No

Feedback on assessment

Feedback is provided following on from University/Department current policies. The written feedback will be provided based on WMG feedback template and it will address each of the questions submitted.

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - WM985-15 Automotive Hybridisation and Electrification

Post-requisite modules

If you pass this module, you can take:

- WM995-15 Battery Electrochemistry, Design and Manufacturing

There is currently no information about the courses for which this module is core or optional.