WM986-15 Energy Storage Systems

23/24

Department
WMG
Level
Taught Postgraduate Level
Module leader
Carlos Pastor Fernandez
Credit value
15
Module duration
1 week
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

30 hours over 1 week consisting of interactive presentations, question and answer sessions and discussion, videos, small group exercises and problem classes.

The module includes a significant practical element (~30%) where students gain hands-on experience of battery and fuel-cell testing in WMG's Vehicle Energy Facility and classroom-based design representative of real-world vehicle applications.

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. Students will gain hands-on experience of battery and fuel-cell testing, including under the widely varying conditions of real-world applications.

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
- Fuel cells theory and applications
- Modular battery packs, packaging, thermal control and legislative implications
- High voltage distribution, safety systems and battery charging
- Hands-on practical: Fuel-Cell characterisation and modeling
- Hands-on practical: Battery characterisation and testing
- Hands-on practical: Fuel-Cell and Battery interaction
- Problem class: Battery pack design
- Battery management systems
- Battery life cycle

Learning outcomes

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

- Evaluate the wide variety of energy storage technology for vehicle applications
- Independently make a systematic and sound choice of energy storage technologies, architecture and means of conversion for practical real-world vehicle applications
- Independently design the electrical configuration of a traction energy storage pack, interpreting thermal management, energy management, safety and environmental considerations
- 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, legislation and practical considerations.
- Systematically compare energy storage designs of electric vehicles
- Interpret battery characterisation or battery modeling activities in electric vehicles

Subject specific skills

Energy storage requirements for vehicle applications; Storage technologies and metrics for comparison; Fuel cells and applications; Modular battery packs, packaging, thermal control and legislative implications; High voltage distribution, safety systems and battery charging; Battery management systems. Hands-on practical: Fuel-Cell characterisation and modeling, Battery characterisation and testing and Fuel-Cell and Battery interaction. 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	8 sessions of 1 hour 30 minutes (8%)
Seminars	1 session of 8 hours (5%)
Supervised practical classes	2 sessions of 4 hours (5%)
Online learning (independent)	15 sessions of 1 hour (10%)
Other activity	2 hours (1%)
Private study	45 hours (30%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Private study and independent learning include:

- Preparation of lectures before delivery and revision after delivery
- Prior research before starting the PMA

Other activity description

Introduction to the PMA and to the practicals

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time
Evaluation of technology application	60%	37 hours

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

Energy Storage Design Class	10%	6 hours

Energy Storage Design Class consists to design three alternative energy storage solutions for a real-world automotive application, based on each of three different technologies: electrochemical, electrostatic and mechanical flywheel. The student should also make a final recommendation to

	Weighting	Study time

the customer.

This is a group task where students are divided into groups of 4 or 5 supported by a group leader. The assessment is conducted via a presentation of each group. Each group receives a mark. This mark is the same for each of the students that form a group.

Evaluation of practical activities	30%	17 hours

his is a group task and consists in reporting the investigations of one of the practicals undertaken in the module. All the members of the group receive the same mark.

Feedback on assessment

Scaled ratings for Comprehension, Effort and Presentation, individual written feedback and overall mark following on from WMG feedback sheet templates.

Availability

Pre-requisites

To take this module, you must have passed:

- All of
  - WM985-15 Automotive Hybridisation and Electrification

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