

WM983-15 Electrical machine design and manufacturing

27/28

Department

WMG

Level

Taught Postgraduate Level

Module leader

Mohammadali Abbasian

Credit value

15

Module duration

4 weeks

Assessment

100% coursework

Study locations

University of Warwick main campus, Coventry Primary

Distance or Online Delivery

Description

Introductory description

This module provides in-depth knowledge of electric machine technologies, design and manufacturing for hybrid and electric vehicles. The modelling and design of electric machines are covered in depth through lectures and activities. Mechanical and thermal design fundamentals are covered. This module also includes aspects of control, novel topologies, noise and vibration of electric machines in the context of electric vehicles, for today and future technologies. When this module is delivered on DA Programmes, it is delivered in a 1-week block with 6 weeks to submit, rather than over 4 weeks.

[Module web page](#)

Module aims

The students will gain a high-standard of technical knowledge about electric machines, allowing them to act as component experts, understand stakeholder/interface requirements and limitations and liaise with researchers to translate state-of-art into business opportunities.

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.

Topologies, operation and characteristics of synchronous permanent-magnet and wound-field machines, switched reluctance machines, synchronous reluctance machines and induction machines.

Mechanical design of electric machines

Materials of electric machines

Thermal modelling and thermal design of electric machines

Electric machine manufacturing

Novel electric machines for electric vehicles

Noise, vibration and Harshness of electric machines

Future technology direction and state-of-art of electric machines research

Learning outcomes

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

- Work in a team to analyse electric machines in electric vehicles, considering their operation and characteristics.[AHEP4;7, M2, M4]
- Analyse the electromagnetic, mechanical, and thermal performance of electric machines by working on a group or individual project [AHEP4;7, M3, M4]
- Interpret the practicality of electric machine designs considering manufacturing processes and cost [AHEP4;7, M5, M7]
- Design electric machines for hybrid/electric vehicles , with considerations of powertrain architecture [AHEP4;7, M1, M2]
- Critique design trade-offs and technological advances of electric machines for electric and hybrid vehicles [AHEP4;7, M4, M7]
- Select and critically evaluate technical literature and other sources of information to solve complex problems [AHEP4;7, M2, M4]

Indicative reading list

[Specific reading list for the module](#)

Subject specific skills

S1: Apply engineering techniques to solve problems in electric machine technologies.

S2: Model and design electric machines and their components.

S3: Evaluate limitations of design methods and select appropriate approaches for electric machine design.

S4: Develop mechanical solutions for components considering NVH (noise, vibration, and

harshness) aspects.

S5: Assess the practicality and manufacturability of electric machine designs.

Transferable skills

Analyse and interpret the behaviour of complex electromechanical systems.

Apply engineering analysis methods to solve complex problems and critically evaluate their limitations.

Investigate, integrate, and adapt new and emerging technologies.

Study

Study time

Type	Required
Lectures	14 sessions of 1 hour (9%)
Seminars	(0%)
Supervised practical classes	16 sessions of 1 hour (11%)
Online learning (independent)	10 sessions of 1 hour (7%)
Private study	50 hours (33%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

Some texts and papers are provided to students for them to read in order to better understand various aspects of electric machines

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A4

	Weighting	Study time	Eligible for self-certification
Assessment component			
Thermal and Mechanical Design of a PMSM	80%	48 hours	Yes (extension)
Individually, students design the thermal and mechanical aspects of a Permanent Magnet Synchronous Machine (PMSM) to meet the specifications for Vehicle 1, applying relevant principles and methodologies in their development. They should use scientific resources to support their design process and consider the manufacturing and cost implications of their design choices. They then submit a report explaining their process and outcomes.			

Reassessment component			
Thermal and Mechanical Design of a PMSM			No
Individually, students design the thermal and mechanical aspects of a Permanent Magnet Synchronous Machine (PMSM) to meet the specifications for Vehicle 2, applying relevant principles and methodologies in their development. They should use scientific resources to support their design process and consider the manufacturing and cost implications of their design choices. They then submit a report explaining their process and outcomes.			

Assessment component			
Electromagnetic design of PMSM	20%	12 hours	Yes (extension)
Within their groups, students complete activities and review resources on the electromagnetic design of PMSM for a specific electric vehicle (Vehicle 1). Each group then writes and submits a report detailing their completed tasks and demonstrating their understanding of the subject matter. Peer adjustment will be used to reflect individual contributions within the group.			

Reassessment component			
Electromagnetic design of PMSM			No
Students individually complete a series of activities and review relevant resources related to the electromagnetic design of a PMSM for a specific electric vehicle (Vehicle 2). They then prepare and submit a report describing the tasks they have carried out and demonstrating their understanding of the key concepts.			

Feedback on assessment

The work reports will be marked based on achievements, with general comments and highlighted issues in their submission. Feedback will be provided using WMG feedback forms.

Availability

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