

# WM994-15 Electrical Drivetrains

**24/25**

**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

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## Description

### Introductory description

30 hours over 4 weeks consisting of interactive presentations, question and answer sessions and discussion, online sessions, videos, small group exercises and problem classes.

The module includes a significant practical element (~30%) where students gain hands-on experience of electric machine design, switches characterisation and electric machine modeling and control.

### Module aims

The purpose of the module is for the students to learn about advanced propulsion technologies for hybrid and electric vehicles. In particular, the learning is focused on electric machines, power electronics and control appropriate for hybrid and electric 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.

- Electric machine types and characteristics.

- Design of control for electric machines.
- Use of power electronics in electric machines.
- The future of propulsion technology in the automotive industry.
- Hands-on practical: Electric machine design.
- Hands-on practical: Electric machine modeling and control.
- Hands-on practical: Switches characterisation.

## Learning outcomes

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

- Interpret electric machine technologies, operation and their characteristics [AHEP:4; 7, M2]
- Demonstrate comprehensive understanding of power electronics devices and circuits [AHEP:4; 7, M2, M3]
- Demonstrate comprehensive understanding of control methods for different machine technologies [AHEP:4; 7, M2, M3]
- Interpret practicalities of electrical drivetrains in real-world application to hybrid and electric vehicles [AHEP:4; 7, M2, M3, M6]
- Interpret power electronics or control modelling activities in electric vehicles [AHEP:4; 7, M2]
- Work within a team to resolve problems in the context of electric drivetrains [AHEP:4; 7, M16]

## Indicative reading list

- “Principles of Electric Machines and Power Electronics”, P.C. Sen. New York: John Wiley and Sons, 2013 (3rd Edition). ISBN : 978-1-118-07887-7
  - Mechanical design of electric motors, Wei Tong, 2017
  - "Electric Machinery Fundamentals" Stephen Chapman, 2005
  - “Electric Machinery” - A.E. Fitzgerald, C. Kingsley, S.D. Umans, 2003
  - “Mathematics for engineers” - Anthony Croft, Robert Davison 2015
  - “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamental, Theory and Design”, M Ehsani, Y Gao, S Gay, A Emadi. CRC Press, Sept 2009 (2nd Edition), ISBN 9781420053982
  - “Electric and Hybrid Vehicles Design Fundamentals”, I. Husain. CRC Press, 2011, ISBN 9781439811757
- A variety of up-to-date sources including:
- Latest government / UK Automotive Council roadmaps for automotive technology (<https://www.automotivecouncil.co.uk/technology-group-2/automotive-technology-roadmaps/>)
  - Latest automotive emissions legislation and current academic research in the field of engine and electric machines for hybrid and electric vehicles (references to be provided within the specific lectures and practical sessions)

[View reading list on Talis Aspire](#)

## Subject specific skills

- Electric machine types and characteristics
- Power electronics used in electric motors;
- Control systems for electric machines
- Future propulsion technology in the automotive industry
- Hands-on practical in electric machine design.
- Hands-on practical in electric machine modeling and control
- Hands-on practical in switches characterisation

## 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.

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## Study

### Study time

Type	Required
Lectures	12 sessions of 1 hour (13%)
Seminars	2 sessions of 1 hour (2%)
Tutorials	(0%)
Supervised practical classes	16 sessions of 1 hour (17%)
Online learning (independent)	18 sessions of 1 hour (19%)
Private study	45 hours (48%)
Total	93 hours

### Private study description

Online independent learning includes:

- Completion of prework activities prior the start of the module

Private study learning includes:

- Revision of lectures after delivery
- Completion of homework
- Prior research required to complete the PMA

### Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

### Assessment group A2

	Weighting	Study time	Eligible for self-certification
Evaluation of technology application This part is related to discussing a typical electric machine configuration and their associated control and power electronics system.	50%	30 hours	Yes (extension)
Electric machine performance and simulation - Group work The task consists in evaluating the performance and efficiency of different Electric Motors in the context of Hybrid/Battery Electric Vehicles using related software. Students are assessed by writing a group report based on the undertaken activities. This is a group task where students are divided into groups of 3 to 6 supported by a tutor. Peer review assessment methodology will be implemented in this assessment.	20%	12 hours	Yes (extension)
Evaluation of practical activities - Group work This is a group task and consists in reporting the investigations of one of the practicals undertaken in the module. The group chooses which practical to report. Peer review assessment methodology will be implemented in this assessment.	30%	18 hours	No

### Feedback on assessment

Written report: Scaled ratings for comprehension, effort and presentation, individual written feedback and overall mark. The written feedback will be provided based on WMG feedback template and it will address each of the questions submitted, including feedback comments on presentation, structure and grammar. Approximately 100-250 words will be provided as feedback

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## 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:

- WM983-15 Electrical machine design and manufacturing
- WM982-15 Power electronic converter design and manufacturing

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