

MODULE DIRECTORY

LEVEL 6

ACADEMIC DISCIPLINE OF ENGINEERING

WALES INSTITUTE OF SCIENCE & ART

2019-2020

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INTRODUCTION

This Module Directory includes all the modules for Level 6 within the Engineering Portfolio in the academic year 2019-2020.

This directory accompanies the Programme of Study Handbook, which will provide you with details of which modules you will be studying for your programme this year in the 'Programme of Study' section. This directory may include modules that are running on other programmes of study within your School/Faculty. If you require assistance in identifying the modules for your programme of study, please contact the Programme Director (whose name and contact details are provided in the accompanying Programme of Study Handbook), or the relevant Faculty Office.

The University has made every effort to make the information as full and as accurate as possible, but you should note that minor changes in the organisation of modules between the planning stage and the actual teaching are inevitable. We shall try to keep any such changes to a minimum, and you will receive plenty of advance warning in the event of any alteration. We would also be grateful if you would let us know about any changes that you think might be helpful if introduced into future handbooks.

MODULES

MODULE CODE: M6X02206
TITLE: Research Methods & Project
DATED: 28/04/2016

LEVEL: 6
CREDITS: 40

JACS CODE: X220

AIM(S)

- To develop the student's ability to show individual creativity and originality; to apply where appropriate and go beyond where necessary, the knowledge and skills taught throughout the degree programme, to enhance investigative problem-solving and other transferable skills, and to apply all this to a successful project.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to demonstrate the ability to:

1. Prepare and present to specialist and non-specialist audiences an academic seminar paper that reviews critically the current research literature pertinent to an area of motorsport/automotive/motorcycle engineering and proposes a suitable title and objectives for the project.
2. Undertake the project proposed, applying appropriate methodologies for the achievement of the objectives of the study whilst considering the sustainable consequences.

INDICATIVE CONTENT

- Research principles and approaches (e.g. the research process, purpose, sources of data including primary/secondary research, quantitative/qualitative data, objective/hypothesis formation, reliability, validity).
- Research design strategies, (e.g. action research, experiments, surveys, case studies), their advantages and limitations, and their suitability to a variety of research contexts.
- Data collection & sampling methods (e.g. interviews, questionnaires, observation), and their advantages and limitations in a variety of contexts.
- Data analysis techniques.
- Ethical and professional considerations.
- Referencing conventions (e.g. the Harvard system, numeric system).
- Critical, analytical thinking and writing.
- Academic writing convention (e.g. the structure and format of a seminar paper, and a project report).
- Presentation techniques/skills appropriate to a professional engineer.

LEARNING AND TEACHING STRATEGY

The student is initially required to select a topic relevant to motorsport, automotive or motorcycle engineering suitable for the project element of this module. He or she must then prepare and present to an audience of staff and fellow students an academic seminar paper that critically reviews the current research literature pertinent to the topic selected and proposes the project title with a project plan that identifies how the objectives proposed will be achieved. He or she must then undertake the project and produce a project report. This module, therefore, requires that the student demonstrate a high level of self-direction and initiative, and takes responsibility for the direction of his or her own learning. This is reflected in the teaching and learning strategy implemented at the start of the module. Lectures will introduce conceptual, theoretical issues and key ideas and will allow students to engage in discussion on the application of the theoretical concepts to practical situations. However, for the exploration of these topics and their application to practical, pathway-specific situations and case studies, tutorials are the most appropriate strategy. During tutorials, a flexible, student-led approach will be taken; students will discuss and develop their individual project ideas, and will be given the opportunity to consult with topic specialists amongst the teaching team. During academic seminars, student will disseminate to their peers the findings of their research and respond to peer questioning; such activity further enhances their transferable skills of presentation techniques.

The allocation of teaching to deliver the module is:

Activity type	Hours	Percentage
Scheduled learning	96	24%
Independent learning	304	76%
Placement learning	0	0%
TOTAL	400	100%

ASSESSMENT

Assessment Component 1 – 10%

Coursework: The student will be required to prepare a written seminar paper based on secondary research and present the paper to his/her peers (1000-1200 words).

Exemplar

See appendix 2: Research Methods & Project Handbook.

Assessment Component 2 – 60%

Coursework: The student undertakes a project on the subject proposed (6000-8000 words).

Exemplar

See appendix 2: Research Methods & Project Handbook.

Assessment Component 3 – 30%

Practical: student will undertake a viva examination to assess their understanding of their methodologies and overall conclusion whilst demonstrating their overall ownership of the project. (15-20 minutes).

Exemplar

See appendix 2: Research Methods & Project Handbook.

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	70%
Practical	30%
TOTAL	100%

Assessment Distribution

Seminar paper - 10%

Oral examination - 30%

Written Report - 60 %

EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

Does the module contribute to ESD?	Yes
This module encourages the students through their own individual aims, research methodologies, technical evaluation and conclusion an insight into the global issues and constraints with regards to a sustainable approach whilst incorporating new technological solutions	

BIBLIOGRAPHY

Essential

Maylor H - *Project Management* 4th Edition, (Prentice Hall, 2010)

Quinn M J - *Ethics for the Information Age: International Edition*, 3rd Edition, (Pearson, 2009)

Background

Seppala N - *Business Ethics and Corporate Social Responsibility*, (Cengage Learning, 2010)

Masterman G – *Sponsorship for a Return on Investment*, (Butterworth Heinemann, 2007)

Cottrell S - *Critical Thinking Skills: Developing Effective Analysis and Argument*, (Palgrave Macmillan, 2005)

Journals

Journal of Automotive Engineering, IMechE, MIRA Papers, SAE Electronic Database

MODULE CODE: M6X02207
TITLE: Race Engineering
DATED: 28/04/2016

LEVEL: 6
CREDITS: 20

JACS CODE: H100

AIM(S)

- To introduce students to the fundamental principles and analysis of race vehicle handling and aerodynamics.
- To provide the student with a grounding in data analysis and simulation techniques.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to demonstrate the ability to:

1. Critically analyse and assess a race vehicle's aerodynamic and handling performance.
2. Plan, conduct and collate data from a vehicle performance test and deploy established analysis techniques to critically evaluate the resulting data.

INDICATIVE CONTENT

- Advanced Data Acquisition
 - Data logger design and specification
 - Sensor design and utilisation
 - System specification and design
 - Advanced math channels
 - Filters
 - Damper analysis
 - Aerodynamic analysis techniques
 - System Design
 - CAN
- Race Vehicle Aerodynamics
 - Fundamental Fluid Dynamics
 - Wing Theory
 - Boundary Layers
 - Separation
 - Common aerodynamic devices on automobiles
 - Introduction to Computational Fluid Dynamics
- Lap Simulation
 - Lap time simulation software
 - Driver in the loop and driver out the loop simulations
- Vehicle setup and optimisation procedures

LEARNING AND TEACHING STRATEGY

Formal lectures will introduce the students to the concepts, principles and practices which will be supported by tutorial periods to allow students to apply the theory through worked examples and laboratory sessions.

The allocation of teaching to deliver the module is:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1 – 50%

Coursework – Written Assignment (3000 Words).

Exemplar: Produce a technical report investigating the effects of different aerodynamic setups on vehicle performance and handling from data collated from a vehicle test.

Assessment Component 2 – 50%

Coursework – Written Assignment (3000 Words).

Exemplar: Produce a technical report detailing race driver development and analysis of driver performance using data produced by a driver in the loop simulator.

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

Does the module contribute to ESD?	Yes
This module teaches students the importance of simulation modelling for the industry, and how this can replace some of the requirement for live testing, which in turn reduces the environmental impact on both a regional and global scale.	

BIBLIOGRAPHY

Essential

Segers J - [Analysis Techniques for Racecar Data Acquisition](#), (SAE, 2008)

McBeath S - *Competition Car Data Logging*, 2nd Edition (Haynes, 2008)

Templeman G - *The Competition Car Data Logging Manual* (Veloce, 2008)

Background

Park J & Mackay S - *Practical Data Acquisition for Instrumentation and Control Systems*, (Newnes, 2003)

Spalding N - *MotoGP Technology*, (Haynes, 2006)

MODULE CODE: M6X02209
TITLE: Alternative Powertrain Technology
DATED: 28/04/2016

LEVEL: 6
CREDITS: 20

JACS CODE: H990

AIM(S)

- To develop the student's ability to critically analyse the control and monitoring systems required for alternative powertrain technologies and to enable the critical evaluation of powertrain system design for alternative storage and propulsion methods including kinetic energy recovery systems.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to demonstrate the ability to:

1. Critically analyse the control and monitoring systems required for electric and hybrid storage and propulsion systems.
2. Critically evaluate alternative powertrain designs and energy recovery systems.

INDICATIVE CONTENT

- Internal combustion engine operating conditions
- Vehicle operating conditions
- Energy storage principles, including chemical, electrical and mechanical
- Energy conversion principles
- Electrical Principles
- Electric propulsion systems
- Hybrid systems
- Electrical and electronic hardware calibration and testing
- Instrumentation and control software design and implementation

LEARNING AND TEACHING STRATEGY

The module will be delivered by a combination lectures, tutorials and laboratory sessions.

The allocation of teaching to deliver the module is:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1 – 50%

Coursework: Consisting of a written report (3000 words).

Exemplar

Produce a technical report investigating the effects of converting a petrol ICE recreational off-road buggy into a series hybrid vehicle.

Assessment Component 2 – 50%

Written exam: Exam to assess the students understanding of concepts and techniques (2 hours).

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	100%

EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

Does the module contribute to ESD?	Yes
This module focusses on alternative powertrain and the issues brought about by its implementation, in terms of: • Tail pipe emissions off-setting by using less/ no hydrocarbon based fuels. • Carbon emission reduction throughout manufacture. • Carbon impact in terms of electricity generation. • Ethical impact of resource and raw material management and use.	

BIBLIOGRAPHY

Essential

Yimin Gao et al - *Modern Electric, Hybrid Electric and Fuel Cell Vehicles*, (CRC Press, 2004)

Background

Seth L - *Build your own plug in hybrid vehicle*, (McGraw-Hill, 2009)

Journals

Electric and Hybrid Vehicle Technology International. UKIP Media and Events Ltd.

Racecar Engineering – The Chelsea Magazine Company

Websites

<http://www.greenmotorsport.com/>

<http://www.electricmotorsport.com/>

<http://www.avt.uk.com/>

<http://www.fiaformulae.com/>

<http://www.dft.gov.uk/vca/>

www.tfl.gov.uk/transport-emissions

MODULE CODE: M6X02210
TITLE: CAD & FEA
DATED: 28/04/2016

LEVEL: 6
CREDITS: 20

JACS CODE: H150

AIM(S)

- To develop computer modelling techniques in order to simulate engineering scenarios, to develop advanced skills in 3D solid modelling and CAD drafting and to analyse tolerances in drawings based on functional requirements and manufacturing capabilities.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to demonstrate the ability to:

1. Design and produce a fully dimensioned and toleranced drawing of a 3D part based on analysis of tolerances required to make the part function correctly in its assembly in line with industrial practice
2. Simulate a real world engineering situation, produce results and critically interpret them

INDICATIVE CONTENT

This module will contain some compulsory elements and some which can be chosen by the student based on their interest

- Design requirements analysis
- Tolerancing for function including manufacturing capability and GDT
- Finite Element Analysis with validation techniques
- Motion Simulation
- Parametric modelling of complex assemblies

LEARNING AND TEACHING STRATEGY

Students will model an assembly such as a quarter car wishbone/suspension assembly or motorcycle swingarm/suspension. An FEA analysis of a component within the assembly will be conducted and will then be validated using the real components. Changes/improvements will then be made and new technical drawings created. The allocation of teaching to deliver the module is:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

There are two 50% assignments / coursework

Assessment Component 1 – 50%

Coursework (3000 words).

Exemplar

For this assignment you will need to choose a Wishbone/Swingarm and suspension linkage assembly, which you have access to that you can accurately measure, model and assemble. A motion study of the assembly will need to be completed to show correct movement of the assembly. An FEA analysis will then be completed on your chosen component from the assembly and a validation exercise completed.

You are free to choose the assembly you simulate and the component that you complete the FEA on.

Assessment Component 2 – 50%

Coursework (3000 words).

Exemplar

For this assignment you will be using the previous model from your first assignment. You will need to make improvements or geometry changes to your previous model and complete another FEA of your new model. Once the FEA results are satisfactory you will create a set of drawings to show all the dimensions and tolerances needed to make the components of the. You will also need to show an assembly drawing of how the system fits together, for this you will need to include the bolts etc. You will need to include any notes, thread sizes/pitches, a BOM (Bill of Materials) for the assembly, etc.

In your accompanying report you will need to show how any tolerances were arrived at, what materials are to be used and why. You will need to conduct research on GD&T and report your findings including the standards that you have used.

Assessment Summary

Activity type	Percentage
Written exam	0%
Coursework	100%
Practical	0%
TOTAL	100%

EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

Does the module contribute to ESD?	Yes
This module teaches students the importance of simulation modelling for the CAD industry, and how this can replace some of the requirement for live testing of manufactured parts. This reduces the environmental impact on the amount of raw materials that are wasted and the amount of energy used.	

BIBLIOGRAPHY

Bramble K - *Geometric Boundaries: The Engineers Edge*, (McGraw-Hill, 2007)
ISO Standards: ISO 128-1:2003

As appropriate case studies.

MODULE CODE: M6X02212
TITLE: Sustainability through Technology
DATED: 28/04/2016

LEVEL: 6
CREDITS: 20

JACS CODE: H990

AIM(S)

- To examine the environmental issues raised by the automotive and motorsport industry.
- To investigate the technical and legislative response available to the governing bodies, teams and manufacturers.

LEARNING OUTCOMES

Upon the successful completion of this module, the student should be able to demonstrate the ability to:

1. Critically evaluate the impact of current and possible future legislation and public opinion on the operation of motorsport events.
2. Critically analyse the operation and effectiveness of alternative fuels, electric and hybrid propulsion and energy recovery systems to reduce the environmental impact.

INDICATIVE CONTENT

- Political and legislative pressures on the industry including Euro emissions legislations and the European drive cycle.
- Emissions legislation within motorsport.
- Fuels for IC engines – bio ethanol, bio butanol bio diesel, lpg, hydrogen.
- Comparison of engine performance improvement methods for conventional and alternative fuels, including feasibility and chemical breakdown.
- Hybrid powertrains.
- Emissions legislation for road and competition.
- CO2 emission levels.
- Carbon off setting and mechanisms.
- Exhaust after treatment.
- Electric propulsion systems.
- Noise pollution.
- Recycling
- LCA

LEARNING AND TEACHING STRATEGY

This lecture takes place within a classroom environment, the lecturer introducing the module topics through a range of media, and then engaging the student in class debate, exercises, and discussion. This combined with private study should culminate in the student being able to draw a range of conclusions through critique of the all the facts in preparation for assessment through either examination of coursework.

The allocation of teaching to deliver the module is:

Activity type	Hours	Percentage
Scheduled learning	48	24%
Independent learning	152	76%
Placement learning	0	0%
TOTAL	200	100%

ASSESSMENT

Assessment Component 1 – 50%

Coursework The student will be required to prepare a report on research on a topic selected by the module tutor (3,000 words).

Exemplar

Perform an analysis on the employment of hybrid and/or electric propulsion vehicles within your chosen discipline (Motorsport/Automotive/Motorcycle).

Critically analyse the immediate and long term implications of the implementation of a large scale change to using these technologies within the industry, commenting on the likelihood of the use of such vehicles for either:

- a. professional and clubman level motorsport or
- b. urban and rural communities for automotive or
- c. road or track motorcycle applications.

Take care to reference and adequately support any conclusions you make with regard to these issues.

Other points you should be mindful to consider are:

- Genuine CO2 benefits,
- Ethics,
- Practicalities of using such technologies,
- Cost (manufacturing, maintenance, everyday practicalities).

Assessment Component 2 – 50%

Written exam: The student will sit an unseen written examination (2 hours).

Assessment Summary

Activity type	Percentage
Written exam	50%
Coursework	50%
Practical	0%
TOTAL	100%

EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)

Does the module contribute to ESD?	Yes
If yes please provide brief details (no more than 100 words): This module covers a range of contemporary issues affecting the automotive and motorsport industries and encourages students to be mindful of the impact different aspects of technology from the industry have on the environment.	

BIBLIOGRAPHY

Essential

James D et al - *Automotive Fuel and Emissions Control Systems*, (Prentice Hall, 2008)

Fuhs A - [*Hybrid Vehicles*](#), (CRC Press, 2008)

Singal S P - [*Noise Pollution and Control*](#), (Narosa Publishing House, 2001)

Westbrook M - [*The Electric Car: Development and Future of Battery, Hybrid and Fuel-cell Cars*](#), (IEE, Power & Energy, 2001)

Background

[Heck R M et al](#) - *Catalytic Air Pollution Control: Commercial Technology*, (Wiley, 2009)

[Gordon D](#) & [Sperling D](#) - *Two Billion Cars: Driving Toward Sustainability* (Oxford University Press, 2009)

Website

<http://www.eemsonline.co.uk/>

Website for Energy Efficient Motorsport

<http://www.evuk.co.uk/>

Website for Electric Vehicles UK

<http://www.the-mia.com/>

Website for the Motorsport Industry Association

Journals

Race Car Engineering, Race Tech Magazine, Race Engine Technology, Autosport Magazine