

Module specification

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Module Code	ENG784
Module Title	Modern & Innovative Powertrains
Level	7
Credit value	20
Faculty	FAST
HECoS Code	100201
Cost Code	GAME

Programmes in which module to be offered

Programme title	Is the module core or option for this programme
MSc Engineering (Automotive) MSc Engineering (Automotive) with Advanced Practice MEng Automotive Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	25 hrs
Placement tutor support	0 hrs
Supervised learning e.g., practical classes, workshops	5 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	30 hrs
Placement / work-based learning	0 hrs
Guided independent study	170 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22 nd Aug 2022
With effect from date	Sept 2022
Date and details of revision	
Version number	1

Module aims

The module aims at providing students with an in-depth understanding of automotive powertrain technology including thermodynamic of real engines, technology of electric motors and optimisation of modern powertrains. The module also aims to equip the student with the capability to master complex specialised skills in automotive powertrain with an overarching background of consumption, transformation efficiency and emissions reduction. This aims to challenge the student to develop critical evaluation and selection skills of technology through self-created methodologies, synthesising ideas, and information to generate efficient powertrain solutions.

Module Learning Outcomes - at the end of this module, students will be able to:

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: **M1, M2 & M7**

1	Develop a full analysis of the combustion process taking place in ICE. Predict and solve combustion anomalies.
2	Demonstrate a comprehensive evaluation of fuel cells and alternative energy sources and storage.
3	Analyse the performances and the operations of full electric and electric/hybrid powertrains including braking systems from an efficiency point of view.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment One: A time constrained examination covering all learning outcomes. Analytical and descriptive problem-based questions proposed, the student will not have the choice in the questions to be answered to fully assess the whole learning outcomes. Assessment one is a written examination (3 hrs.) and represents 100% of the overall module mark.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1-3	Examination	100%

Derogations

Credits shall be awarded by an assessment board for those Level 7 modules in which an overall mark of at least 50% has been achieved with a minimum mark of 40% in each assessment element.

Learning and Teaching Strategies

A series of workshop style lectures with student-led seminars and small group activities. Directed learning using library and internet resources will be facilitated using Moodle and MS Teams. This module will also follow the ALF (Active Learning Framework) guidelines, which will include alternative methods of assessment and a blended approach to delivery, with some theory and software sessions being delivered online (depending on requirements and student experience).

Indicative Syllabus Outline

Energy transformation and storage

- Fossil
 - Combustion process and efficiency
 - Normal and abnormal CI/SI cycle thermodynamic analysis
 - Emission and control
 - Additives and synthetic fuels
- Hydrogen
 - Hydrogen storage
 - Fuel cells
- Electric drive characteristics and efficiency
 - Motors
 - Controllers
- Batteries technology
 - Secondary batteries & supercapacitors modelling and efficiency
- Gears (design and efficiency)
- Hybrid powertrain design and analysis

Indicative Bibliography:

Essential Reads

M. G. Ehsani, et al., *Modern Electric, Hybrid Electric and Fuel Cell Vehicles*. 3rd edn. CRC Press, 2018.

Other indicative reading

I. Hussain, *Electric and Hybrid Vehicles: Design Fundamentals*. 3rd edn. CRC Press, 2021.

C. R. Ferguson and A. T. Kirkpatrick, *Internal Combustion Engines: Applied Thermosciences*. 4th ed. Wiley-Blackwell, 2020.

Plus, various others to be signposted on Moodle.

Employability skills – the Glyndŵr Graduate

Each module and programme is designed to cover core Glyndŵr Graduate Attributes with the aim that each Graduate will leave Glyndŵr having achieved key employability skills as part of their study. The following attributes will be covered within this module either through the content or as part of the assessment. The programme is designed to cover all attributes and each module may cover different areas.

Core Attributes

Engaged
Enterprising
Creative
Ethical

Key Attitudes

Commitment
Curiosity
Resilience
Confidence
Adaptability

Practical Skillsets

Digital Fluency
Organisation
Critical Thinking
Communication