Module specification

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Module Code	ENG5A8
Module Title	Automotive Powertrains & Fluids
Level	5
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
BEng Automotive Engineering	Core
MEng Automotive Engineering	Core

Pre-requisites

None

Breakdown of module hours

Learning and teaching hours	30 hrs
Placement tutor support	0 hrs
Supervised learning e.g. practical classes, workshops	6 hrs
Project supervision (level 6 projects and dissertation modules only)	0 hrs
Total active learning and teaching hours	36 hrs
Placement / work based learning	0 hrs
Guided independent study	164 hrs
Module duration (total hours)	200 hrs

For office use only	
Initial approval date	22/08/2022
With effect from date	September 2022
Date and details of revision	
Version number	1

Module aims

To provide the knowledge required for a critical understanding of:

- Work, power and torque in the context of the automotive environment.
- The fluids and thermodynamics principles, operation, emissions control and fundamental design of automotive engines.
- The fundamentals of efficiency (thermodynamic efficiency, brake efficiency, specific fuel efficiency).
- The fundamentals of automotive powertrain including gear and modern boxes.

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

1	Model the thermodynamic principles and operation of internal combustion engines
2	Analyse the properties of inlet and exhaust gas flow and describe emissions control technology
3	Conceptualise and analyse the designs of automotive power plants and develop a view as to emergent technologies

In addition to the module learning outcomes, students will also cover the following accreditation of higher education programme (AHEP) fourth edition learning outcomes: C2.

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.

All learning outcomes are assessed by means of a formal time constrained examination (2hour).

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)
1	1,2.3	Examination	100%

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Learning and Teaching Strategies

The module is taught through a combination of lectures and workshops. An active and inclusive approach is used to engage learners in the topics and will involve

individual, group work and flipped learning experiences aligned to the university's Active Learning Framework (ALF). The approach offers students a flexible and adaptive learning experience that can accommodate a range of options that includes both on campus learning and remote learning where appropriate.
The Moodle VLE and other on-line materials and resources will be available to support learning. ALF offers a balance between the classroom elements and digitally enabled activity incorporating flexible and accessible resources and flexible and accessible feedback to support learning.

Indicative Syllabus Outline

Fundamental laws of fluids and thermodynamics (Bernoulli's principle, Ideal gas law, Boyle's law, Laplace law…)

Characteristics and engine cycles. Engine parameters, air-fuel ratios, torque and power, criteria of performance, efficiency, air-standard cycle, Otto cycle, real air/fuel engine cycles, dual cycle. Indicated pressure, brake mean effective pressure, indicated power, brake power, volumetric efficiency, performance characteristics.

Combustion thermochemistry, hydrocarbon fuels, alternative fuels, intake design and efficiency, supercharging and turbocharging.

Fluid motion within a combustion chamber and combustion. Turbulence, swirl, squish and tumble, combustion chamber design, combustion modelling, combustion and engine design, engine operating characteristics.

Components of air pollution, emission reduction, gas recycling.

Heat transfer in engines, energy distribution, engine temperatures, heat transfer throughout engine, the effect of operating parameters, engine cooling, heat exchangers.

Developments in Engine Technology, alternative automotive power plant technologies, optimising engine performance.

Indicative Bibliography:

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads

A. Bonnick, *Automotive Powertrain Science and Technology*. Taylor & Francis, Routledge, 2020.
W. Pulkrabek, *Engineering Fundamentals of the Internal Combustion Engine*. Prentice-Hall, 2013.

Other indicative reading

J. Hayes, *Electric Powertrain.* Wiley, 2018.
R. Stone, *Introduction to Internal Combustion Engines*. Palgrave Macmillan, 2012.

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
Leadership and Team working
Critical Thinking
Communication