Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Title:	**Internal Combustion Engine Systems**	**Level**:	5	**Credit Value**:	20

Module code:	ENG52M	**Is this a new module?**	Yes	**Code of module being replaced**:	ENG556

Cost Centre:	GAPC	**JACS3 code**:	H311

Trimester(s) in which to be offered:	1+2	**With effect from:**	September 17

School:	Applied Science, Computing and Engineering	**Module Leader:**	O.Durieux

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Automotive Engineering	✓	☐

Pre-requisites
None

Office use only
Initial approval February 17
APSC approval of modification Version 1
Have any derogations received Academic Board approval? Yes ✓ No ☐

Module Aims
To provide the knowledge required for a critical understanding of the thermodynamic principles, operation, emissions control, and fundamental design of automotive engines.

Intended Learning Outcomes			
At the end of this module, students will be able to		Key Skills	
1	Model the thermodynamic principles and operation of internal combustion engines	KS1	KS3
2	Analyse the properties of inlet and exhaust gas flow and describe emissions control technology	KS1	KS3
		KS4	KS6
		KS9	
3	Conceptualise and analyse the designs of automotive power plants and develop a view as to emergent technologies	KS1	KS3
Transferable/key skills and other attributes			
Apply theoretical modelling skills and techniques, be able to critically describe emergent engineering technologies, solve engineering problems.			

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%.

Assessment:

Learning outcome 2 is assessed by means of a case study; for example to test the output of a single cylinder petrol engine and compare it to a theoretical model the air standard of the same engine, to evaluate, correlate and compare the two sets of results and determine the inlet and exhaust gas restrictions.

Learning outcomes 1 and 3 are assessed by means of a formal time constrained examination.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	2	Case Study	50%		2000
2	1,3	Examination	50%	2 hrs	

Learning and Teaching Strategies:
The module will be delivered through lectures, tutorials and student-driven investigative work assisted by programmed access to computer based modelling software.

Syllabus outline:
Engine classification: 2nd Law of thermodynamics, heat engine, compare real and air standard cycles. **Operating characteristics and engine cycles:** Engine parameters, air-fuel ratios, torque and power, criteria of performance, efficiency, air-standard cycle, Otto cycle, real airfuel engine cycles, diesel cycle, dual cycle, two-stroke cycle, exhaust process, indicated pressure, brake mean effective pressure, indicated power, brake power, volumetric efficiency, performance characteristics. **Thermochemistry, fuels, air and fuel Induction:** Combustion thermochemistry, hydrocarbon fuels, diesel fuel, alternative fuels, intake design and efficiency, supercharging and turbocharging, intake design for two-stroke cycle engines. **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. **Exhaust flow, emissions and air pollution:** 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.

Bibliography:
Essential reading
Pulkrabek, W. (2013) Engineering Fundamentals of the Internal Combustion Engine; 2nd ed, Prentice-Hall.
Other indicative reading
Hiereth, H. and Prenninger, P. (2007) Charging the Internal Combustion Engine, SpringerVerlag. Stone, R. (2012) Introduction to Internal Combustion Engines, 4th ed, Palgrave Macmillan.