Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION

Module Title:	Automotive Dynamics and Powertrain Analysis	**Level**:	6	**Credit Value**:	20

Module code:	ENG692	**Is this a new module?**	Yes	**Code of module being replaced**:	ENG631

Cost Centre:	GAPC	**JACS3 code**:	H331

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

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

Scheduled learning and teaching hours	48 hrs
Guided independent study	152 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 develop a detailed understanding of suspension and steering performance To further develop engine theory and to apply it to internal combustion engine design

Intended Learning Outcomes			
At the end of this module, students will be able to		Key Skills	
1	Assess the dynamic performance and apply optimisation for a given vehicle suspension design	KS1	KS2
		KS3	KS4
		KS6	
2	Assess the dynamic performance and apply optimisation for a given vehicle steering design	KS1	KS2
		KS3	KS4
		KS6	
3	Predict the implications of engine speeds on the internal mechanical components and thermo-fluid behaviour of engines	KS1	KS2
		KS3	KS4
		KS6	
Transferable/key skills and other attributes			
Mathematical applications, internal combustion engine design, technical-feasibility and sustainability assessments, team communication.			

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 outcomes 1 and 2 will be assessed by means of separated case studies/ investigations.

Learning outcome 1 can be covered in assigning the learning in the design of a suspension system, this would allow them to assess the dynamic requirements of a suspension system, design it and apply some optimisation techniques in order to meet the requirements.

Learning outcome 2 may be covered using similar approach (analysis, design and optimisation) for a steering system for any vehicle at hand at the moment of the assignment in order to meet the objectives of the assessment.

Learning outcome 3 will be assessed by mean of an individual oral presentation (15 minutes) where the learner is (as an example) explaining in details the rationale, the advantages and drawback of an ICE internal mechanical components in terms of design, materials and manufacturing process in order to demonstrate his/her understanding within the field.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1	Coursework	30%		2000
2	2	Coursework	40%		2000
3	3	Oral presentation	30%	15 mins	

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:

Suspension and steering Design:
Suspension geometry, suspension linkages, steering considerations and design, suspension compliance conflict/steering fight in braking.

Suspension / chassis interactions:
Force transfer within the suspension elements.

Tire Dynamic:
ISO designation, structure, grip and rolling resistance relation, cornering stiffness and response.

Dynamic performance (forward vehicle dynamics):
Weight distribution, dynamics key indicators (steer gradients, yaw rate gain…), steady state turning effects, roll centres.

Petrol engine:
Engine performance characteristics, performance indices; idealised thermodynamic cycles and the limits to ideal behaviour; thermo-fluid implications of maximising efficiency output.

Engine design: Mechanical design of two and four stroke automotive engines. Valve train design, engine configuration and balancing.

Bibliography:

Essential reading

Jazar, R.N. (2013) Vehicle Dynamics: Theory and Application; Springer-Verlag

Pulkrabek, W. (2013) Engineering Fundamentals of the Internal Combustion Engine; 2nd ed, Prentice-Hall.

Other indicative reading

Heywood, J.B. (1988) Internal Combustion Fundamentals, McGraw-Hill.

Hiereth, H. and Prenninger, P. (2007) Charging the Internal Combustion Engine, SpringerVerlag.

Stone, R. (2012) Introduction to Internal Combustion Engines, 4th ed, Palgrave Macmillan.