MODULE SPECIFICATION PROFORMA

Module Code:	ENG767

Module Title:	Advanced Automotive Chassis, Engine, Powertrain & Control

Level:	7	**Credit Value:**	20

Cost Centre(s):	GAPC	JACS3 **code**:	H330

School:	Applied Science, Computing & Engineering	**Module Leader:**	O DURIEUX

Scheduled learning and teaching hours	40 hrs
Guided independent study	160 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
MSc Engineering (Automotive)	✓	

Pre-requisites

Office use only
Initial approval: 19/06/2018 Version no:1
With effect from: 01/09/2018
Date and details of revision: Version no:

Module Aims

- To provide students with an in-depth understanding of engine thermodynamic of real engines including knowledge for the optimisation of modern powertrains.
- To provide students with a detailed understanding and knowledge in automotive chassis engineering, the factors that influence stability, comfort and efficiency of vehicles.
- To prepare students to solve practical problems and to carry out research and development in the field.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Develop a full analysis of the real combustion process taking place in ICE. Predict and solve combustion anomalies.	KS1	KS2
		KS3	KS4
		KS6	
2	Demonstrate a comprehensive understanding of fuel cells and alternative energy sources.	KS1	KS2
		KS3	KS4
		KS6	
3	Analyse the operations of vehicle transmission and braking systems from an efficiency point of view.	KS1	KS2
		KS3	KS4
		KS6	
4	Analyse the performances and design an electric/hybrid electric powertrain	KS1	KS2
		KS3	KS4
		KS6	KS7
5	Analyse the suspension dynamics and handling performance of any conventional wheeled vehicle in low and high-speed use.	KS1	KS3
		KS4	KS5
		KS6	KS9

Transferable skills and other attributes

Application of science in technology, design for efficiency, environmental issues awareness, mathematical applications.

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.

Assessment:

Indicative Assessment Tasks:

Assessment One:
Time constrained examination. Analytical and descriptive questions will typically be proposed, the student will not have the choice in the questions to be answered.

Assessment Two:

Report. The student will typically be asked to demonstrate using qualitative and quantitative evidence his understanding in suspension dynamics and handling performance or wheeled vehicle. Formula Student can be the baseline for this assessment, any other available platform may be used for the exercise.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1, 2, 3, 4	Examination	50	2 hrs	
2	5	Report	50	N/A	2000

Learning and Teaching Strategies:

Lectures, tutorials and student-driven investigative work (ie: Assignment) assisted by the use of computer based design and simulation software when available.
Relevant video material and practical demonstrations will be used to strengthen topics from within the module.
Directed learning using library and internet resources facilitated using Moodle.

Syllabus outline:

- Engines Analyse:
Efficiencies of real engines,
Ignition, normal and abnormal combustions in SI and CI engines,
Combustion chamber design,
Emissions and emissions control (HC,Nox and particles), engine management systems.
Fuels and additives,
Dynamic behaviour of valve gear including valve operating systems.

- Alternative Powertrains:
Electric and hybrid electric powertrain: design, performance and efficiency analysis.

Atkinson cycle for hybrid engines,
Battery types,
Fuel Cells: Solid polymer fuel cells (SPFC) Sources of hydrogen for SPFC (Steam reforming, partial oxidation reforming.) and storage.

- Chassis Suspension:
Dynamics of the chassis,
Road interactions.
Vibrational Analysis of quarter and half car model - one and two DOF.

- Handling and Steering:
Low and high speed turning theory,
Effects of tractive forces.
Steering geometry errors.

Indicative Bibliography:

Essential reading

Pulkrabek (2013); Engineering Fundamentals of the Internal Combustion Engine; 2nd Ed, Prentice.

Other indicative reading

Hall Stokes A (1999); Manual Gearbox Design; Butterworth Heinemann.

Makartchouk A (2002); Diesel Engine Engineering: Thermodynamics, Dynamics, Design and Control; Marcel Dekker Ltd.

Adams H. (1992); Chassis Engineering HP1055; HPBooks.

Hammill D. (2006); Suspension and Brakes High-Performance Manual; Veloce

Gillespie T. (1992); Fundamentals of Vehicle Dynamics; SAE International.

Hiereth H. (2007); Charging the Internal Combustion Engine; Springer-Verlag.

Katz J. (2006); Race Car Aerodynamics; Bentley Publishers.

Segers J (2014); Analysis Techniques for Race Car Data Acquisition (2nd edition); SAE International.

Haney P.W. (2003); The Racing and High-Performance Tire: Using the Tires to Tune for Grip and Balance; SAE International.