

Vehicle Powertrain and Dynamics

Module Code:	MAE7030-B
Academic Year:	2018-19
Credit Rating:	20
School:	Department of Mechanical and Energy Systems Engineering
Subject Area:	Mechanical and Automotive Engineering
FHEQ Level:	FHEQ Level 7 (Masters)

Pre-requisites:

Co-requisites:

Contact Hours

Type	Hours
Lectures	36
Laboratory	12
Directed Study	152

Availability Periods

Occurrence	Location/Period
BDA	University of Bradford / Semester 2 (Feb - May)

Module Aims

To systematically apply the principles which underlie the operation of engine and powertrain systems in order to design strategies to optimise performance, emissions and economy.
Provide detailed study of vehicle dynamics using specialist CAE tools to understand the effect of key ride and handling performance parameters on vehicle stability.

Outline Syllabus

Combustion in SI and CI engines.
Factors which govern power, speed, torque and size.
Induction and exhaust processes, principles of valve timing.
The mean-value model for engine design and prediction.
Combustion processes in engines; ignition, flame propagation.

Knock in petrol engines, detection and avoidance. Emissions; legislative requirements, after treatment systems.

Principles of ignition timing; fuel delivery and control of air/ fuel ratio.

Engine management systems.

Effects of engine speed, turbulence and residual gases.

Sources of gaseous emissions and particulates, and their control.

Effects of varying fuel-air mixture.

Engine - driveline - vehicle matching: gear ratios and vehicle performance prediction.

Alternative fuels.

Electric drive vehicles and hybrid systems.

Review of chassis design principles.

Vehicle Ride: kinematic, dynamic of suspension systems; suspension modelling and simulation.

Tyre properties and tyre dynamics modelling and simulation.

Vehicle Handling: Lateral vehicle dynamics, steady state and transient manoeuvres, analytical and numerical models for high speed cornering, steering systems, and steering characteristics.

Module Learning Outcomes

On successful completion of this module, students will be able to...

- 1 Critically review the complex interactions which underlie the performance, emissions and economy of automotive engines to allow critical evaluation of new and developing technologies.
- 2 Apply modelling and simulation methods to both engine and vehicle dynamics systems in the systematic and critical analysis of complex problems.
- 3 Use CAE tools to assess vehicle ride and handling.
- 4 Use scientific methods; Solve problems systematically; Manage, present and interpret data using IT skills. Show improved communication, teamwork, leadership and personal management skills

Learning, Teaching and Assessment Strategy

The basic subject matter is introduced by lectures and computer laboratory sessions, using hardware examples and lectures from practitioners. Topics cover the science, technologies and principles that apply to vehicle ride, handling and propulsion. Directed study takes the form of background reading to deepen the understanding of the material

Technical knowledge is consolidated by project work with the completion of a programme of coursework (Learning outcomes LO1-4). Final assessment is a closed book examination (Learning outcomes LO1, LO2). Supplementary assessment is to repair deficiency in original submission.

Formative assessment is enabled via an online assessment with immediate solutions enabling self-evaluation and identification of areas for support.

Mode of Assessment

Type	Method	Description	Length	Weighting	Final Assess'
Formative	Examination - MCQ	Test the formal knowledge and understanding with immediate solutions for self evaluation		%	No
Summative	Examination - closed book	2 hour closed book examination	2 hours	50%	Yes
Summative	Coursework	Portfolio of coursework on vehicle dynamics and powertrain	-2000 words	50%	No

Legacy Code (if applicable)

Reading List

To view Reading List, please go to [rebus:list](#).