Liverpool John Moores University

Title:	ADVANCED AUTOMOTIVE MECHATRONICS
Status:	Definitive
Code:	**6095ENG** (115910)
Version Start Date:	01-08-2016
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	Maritime and Mechanical Engineering

Team	Leader
Christian Matthews	Y

Academic Level:	FHEQ6	**Credit Value:**	10	**Total Delivered Hours:**	49
Total Learning Hours:	100	**Private Study:**	51		

Delivery Options
Course typically offered: Standard Year Long

Component	**Contact Hours**
Lecture	20
Practical	6
Tutorial	20

Grading Basis: 40 %

Assessment Details

Category	**Short Description**	**Description**	**Weighting (%)**	**Exam Duration**
Exam	AS1	Examination	70	3
Report	AS2	Coursework Laboratory Excercise	15	
Report	AS3	Coursework Laboratory Excercise	15	

Aims

This module will build upon the foundations laid in ENRME2220 to deliver an advanced course in Mechatronic Systems analysis and design. Students will learn about, and apply, modern theory in Dynamics and Control and will use model based design (MBD) techniques to develop mechatronic systems with an embedded control *system. Students will gain valuable practical experience in the design and validation of mechatronic systems using industry standard tools.*

Learning Outcomes

After completing the module the student should be able to:

1. Use traditional analytical techniques to derive linear and nonlinear engineering models in the form of differential equations, transfer functions and state-space equations.
2. Apply classical and modern control theory to linear closed loop systems. Discuss and apply time-domain and frequency domain analysis.
3. Apply modern multi-physics modelling tools to simulate automotive engineering systems.
4. Select appropriate electrical and electronic hardware (including sensors and actuators) for automatic electronic control of an automotive system.
5. Use Model Based Design to develop a control system for an automotive system and to determine its performance through simulation.
6. Validate a system design using development hardware and rapid control prototyping (RCP) technology.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

EXAM	1	2	4	5	
Laboratory Excercise	1	2	3	4	5
Laboratory Excercise	3	4	5	6	

Outline Syllabus

System Dynamics & Modeling: Equations of motion, State-Space equations, transfer functions. Modern computing tools for system modeling, MBD (Simulink, Dymola, Modelica) and RCP.
Control Theory: Frequency response representation (Bode, Nyquist), Closed-Loop Stability & Robustness, Modern computer aided control system design methods
Electrical & Electronic Systems: Signal conditioning, motor drives, hardware filtering, electrical characteristics of sensors and actuators, shielding and noise.
Multiplexed Signals: Automotive applications of multiplexed signals using protocols such as CAN. Raise awareness of other Automotive bus systems such as LIN, MOST and FlexRay.
Rapid Development and Prototyping: Using MBD and RCP to simulate a dynamic engineering system, design an appropriate control system, automatically generate target-ready code and validate a design using development hardware.
Case Studies and Industry Applications: Examples of how MBD and RCP are being used to develop Mechatronics systems in the Automotive industry. Common tools and software packages. Relevant industry jobs and roles.

Learning Activities

Lectures, tutorials, case studies, laboratory exercises and practical assignments.

Notes

In this module students will learn about, and apply, modern theory in Dynamics and Control and will use model based design (MBD) techniques to develop mechatronic systems with an embedded control system. Students will gain valuable practical experience in the design and validation of mechatronic systems using industry standard tools.