

Liverpool John Moores University

Title: HYBRID AND ELECTRICAL VEHICLE TECHNOLOGY
Status: Definitive
Code: **5505ICBTAE** (127067)
Version Start Date: 01-08-2021

Owning School/Faculty: Engineering
Teaching School/Faculty: ICBT, Colombo

Team	Leader
Alison Cotgrave	Y

Academic Level: FHEQ5
Credit Value: 15
Total Delivered Hours: 86
Total Learning Hours: 150
Private Study: 64

Delivery Options

Course typically offered: S2 and Non Std S2 (S2 for Jan)

Component	Contact Hours
Lecture	45
Practical	12
Seminar	6
Tutorial	15
Workshop	6

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Practice	AS1	Practical/Workshop	30	
Exam	AS2	Exam	70	2

Aims

This unit addresses the theoretical aspects on the novel concepts in automotive engineering including electric drive systems and hybrid systems. As the main part of the unit, the design aspects, construction and operating principles are included. In addition, the efficiency, environmental concerns and other advantages of electric and

hybrid systems and integrated into the content. Knowledge on different types of hybrid systems such as series, parallel and series-parallel as well as full electric vehicles and plug in hybrid systems are expected to be delivered.

Learning Outcomes

After completing the module the student should be able to:

- 1 Explain the operational deficiencies of traditional IC engines such as fuel efficiency, wastage of energy environmental pollution and describe the need of electric and hybrid drivetrains.
- 2 Appraise the operational principles of hybrid drivetrains and compare with traditional IC engines and electric drivetrains.
- 3 Illustrate the risks and hazards associated with electric and hybrid drivetrains and recommend safety precautions needed in operation and maintenance.
- 4 Define performance characteristics applicable for hybrid and electric drivetrains and carry out vehicle performance tests.

Learning Outcomes of Assessments

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

Practical/Workshop	3	4
Exam	1	2

Outline Syllabus

Introduction

Energy economy of traditional engines, analysis of energy wastage, environmental and other concerns, the need of energy efficient and environmentally friendly vehicles

Introduction to electric systems

Types of electric drive trains, motor specifications, power sources, types of batteries, fuel cells, control and charging systems, efficiency and environmental benefits, torque transmission elements (mechanical transmissions and other components);

Definition of hybrid drives.

Introduction to the concept of energy accumulation and energy recovery, regenerative braking properties, efficiency of electric systems

Electric and hybrid car architectures.

Various Hybrid electric vehicles (HEV) configurations and their operation modes, Electric machine torque transmission to vehicle's tractions wheel, mechanical and electrical differential.

Selection of electric vehicle components parameters.

Power of electric machine, torque, electrochemical battery size, gear ratios selection

and quantify in terms of the criterion of the highest efficiency and lowest weight

Evaluation of electric/hybrid propulsion system in terms of power train architecture. Electric vehicle movement characteristics, cornering movement of electric vehicle, maintenance of HEV and hazards, current international economic and environmental policy on alternative vehicles development and market launch.

Advancements of Energy Efficient Vehicles

Improvements of energy recovery and efficiency, integration with different energy sources; for example, solar energy, recovery of non-mechanical energy for enhanced efficiency

Learning Activities

Students will be supported in their learning, to achieve the above learning outcomes, in the following ways:

Through a series of lectures and tutorials and through participation within laboratory practical sessions for problem solving.

Self-managed investigative study to analyse cases related to design and failure of hybrid and electric drive systems

A recommended resource list - indicating key reading, internet support and physical learning assistance, is provided to help enable students to undertake self-directed study.

Notes

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