

Liverpool John Moores University

Title: INTERNAL COMBUSTION ENGINES
Status: Definitive
Code: **4501ICBTAE** (127035)
Version Start Date: 01-08-2021

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

Team	Leader
Alison Cotgrave	Y

Academic Level: FHEQ4
Credit Value: 15
Total Delivered Hours: 74
Total Learning Hours: 150
Private Study: 76

Delivery Options

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

Component	Contact Hours
Lecture	45
Practical	12
Tutorial	15

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Practice	AS1	Practice/Workshop 1500 words	30	
Exam	AS2	Exam	70	2

Aims

This unit recalls the thermodynamic laws related to the operation of an engine and it will provide learners an introduction of internal combustion engines, its functionality, different types of engine configurations and the features of engines. The unit will also provide hands on skills of engines through a series of workshop exercises. The unit introduces the concepts of engine power, torque, efficiency and the unit aims to provide knowledge on enhancing engine performance and efficiency through

technical advancements such as intercoolers, turbo chargers etc. In addition, the unit integrates the other systems such as exhaust systems, cooling systems, fuel control systems and lubrication

Learning Outcomes

After completing the module the student should be able to:

- 1 Explain the functionality of different types of internal combustion engines, their performance and design features and compare the performance.
- 2 Demonstrate the operation of an engine indicating the use of each component and illustrate the importance of these components for the overall engine design.
- 3 Evaluate the need of systems like cooling system, lubrication system, fuel system and electrical spark generation and explain their operation.
- 4 Carryout workshop activities such as basic assembly of engines, replacement of parts and performance testing and evaluation.

Learning Outcomes of Assessments

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

Practice	2	4
Exam	1	3

Outline Syllabus

Recall of laws of thermodynamics and mechanics heat transfer in relation to internal combustion (IC) engines

Different types of reciprocating internal combustion engines (inline, V, radial etc), typical design features, components and performance characteristics.

Design features and characteristics of internal systems of power and motion transmission (use of crank, cam, wheels, belts, connecting rods etc.)

Power cycles of internal combustion engines using ideal gas cycles, air cycles, and fuel-air cycles, power and thermal efficiency of IC engines.

Firing process of an engine and power boosting through turbo charging, intercooling etc.

Thermal loading of engine components and design of cooling systems.

Mechanisms of combustion in SI-engines and CI-engines and fuel quality requirements of SI- and CI-engines.

Exhaust systems, emissions and explain the mechanisms of emission formation and emission control with standards.

Crank mechanism and inertia forces and moments in single- and multi-cylinder engines, balancing of inertia forces, use of flywheels etc.

Dynamic forces in the crank mechanism and compute the angular speed variation of the crank shaft.

Engine friction, wear and lubrication

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 on engine fundamentals and through participation within laboratory practical sessions for problem solving.

In-class participation and case studies are key features of this module.

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

.