

1151AU110

ENGINE DESIGN AND DEVELOPMENT

L T P C  
2 2 0 3**1. Preamble**

This course enables the students to appreciate the different requirements, design principles and procedures involved in automotive design. It helps the students to speculate and verify different design possibilities to meet the customer requirements. It develops the ability in understanding the technical requirements and feasibilities while designing and manufacturing automotive components.

**2. Pre-requisite**

1151AU107	I.C Engines
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**3. Links to other Courses**

- Vehicle Design & Data Characteristics

**4. Course Educational Objectives**

Students undergoing this course are expected to

- Analyze and evaluate the different requirements of the crank train components to meet the functional needs.
- Develop the skill of designing different engine components to meet the requirements in the perspective of material, manufacturing technology.
- Apply the different engineering facts, concepts and procedures in accordance with the engine design requirement.

**5. Course Outcomes**

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Describe the various engine performance parameters	K2
CO2	Construct crank train for the given specifications which includes the design of piston, connecting rod, crankshaft and flywheel	K3
CO3	Calculate thermal loads and select a suitable material to design cylinder head and block	K3
CO4	Select and design suitable valve train for the given specifications.	K3
CO5	Describe the design procedure involved in Cooling, Lubrication, Intake, Exhaust and Fuel Injection Systems	K2

**6. Correlation with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	M	L	H							H	H
CO2	H	H	H	M	L	H							M	H
CO3	H	H	H	M	L	H							M	H
CO4	H	H	H	M	L	H							M	H
CO5	H	H	H	M	L	H							M	H

H- Strong; M-Medium; L-Low

## **7. Course content**

### **UNIT – I: PARAMETERS**

**L-6 T-6**

Compression Ratio, Pressure Volume and Pressure Crank Angle Diagram, Frictional Mean Effective Pressure, Engine Capacity, Calculation of Bore And Stroke Length, Velocity and Acceleration, Gas Force, Inertia and Resultant Force at Various Crank Angles – Side Thrust on Cylinder Walls, Optimization Criteria for Improving Thermal, Mechanical and Volumetric Efficiency.

### **UNIT – II: DESIGN OF CRANK TRAIN**

**L-6 T-6**

Design of Piston, Piston Rings, Piston Pin, Design of Connecting Rod; Big End, Small End and Shank. Material and Failures Related to Cylinder, Piston, Connecting Rod, Design of Crankshaft For Light and Heavy Vehicle; Crankshaft, Front End, Rear End, Journals, Crank Pin, Crank Web. Design of Flywheel; Speed Fluctuation and Stress Calculations, Turning Moment Diagram, Design of Hub, Rim and Arms of the Flywheel, Ring Gear Material and Failures Related to Crankshaft and Flywheel.

### **UNIT – III: DESIGN OF CYLINDER HEAD AND BLOCK**

**L-6 T-6**

Functional Requirement, Block Material Like Gray Iron, Aluminum, Compacted Graphite Iron and Magnesium, Cylinder Head Alloys, Design Layout, Basic Block, Bulk Head Design, and Cylinder Liner Design Approach and Thermal Loads. Cylinder Arrangement, Number of Cylinders,

### **UNIT – IV: DESIGN OF VALVE TRAIN**

**L-6 T-6**

Effect of Valve Timing on Engine Performance, Number of Valves, Design of Valves, Valve Seat, Valve Guide and Cotter. Time Selection of Valve, Cam Profile Construction, Design of Valve Spring, Design of Camshaft, Single and Double Overhead Camshaft Design, Design of Valve Gear Train for Variable Valve Timing.

### **UNIT – V: DESIGN OF COOLING, LUBRICATION, INTAKE, EXHAUST AND FUEL INJECTION SYSTEMS**

**L-6 T-6**

Design of Cooling System, Radiator, Water Pump, Thermostat and Fan, Computation Of Air Cooling System Engine Friction and Wear, Selection of Lubricant, Lubricating System, Pump and Filters, Design of Intake and Exhaust System ,Design of Fuel System for CI Engine, Governor Design, Design of Carburetor - Electronic Carburetor, Design ofMPFI, GDI, CRDI System.

**Total: 60 Periods**

## **8. Text Books**

1. Kevin L. Hoag, "Vehicular Engine Design",SAE international, 2005.
2. A.Kolchin and V.Demidov, "Design of Automotive Engines", MIR Publishers, Moscow,1984.
3. R.K. Jain, "Machine Design", Khanna Publishers, New Delhi, 1997.

## **9. Reference Books**

1. "Design Data Book", PSG College of Technology, Coimbatore, 2000.
2. Engine Design – Giles J. G., Liffle Book Ltd.
3. Engine Design – Crouse, Tata McGraw Publication, Delhi