AUTOMOBILE ENGINES

ENAM 302

Lecture : 3 **Year : III**
Tutorial : 0 **Part : I**
Practical : 3/2

Course Objectives:
The objective of this course is to enable students to understand the construction and operation of IC engines, fuels, and combustion of fuels in SI and CI engines, to perform test procedures and study the formation of exhaust emissions and their controlling measures, and to evaluate engine performance through various testing procedures.

1 Introduction (2 hours)

1.1 History of automobile development
1.2 Classification of motor vehicles
1.3 Components of automobiles and their function
1.4 Introduction to automobile engine

2 Thermodynamics of Fuel Air Cycles and Real Cycles (5 hours)

2.1 Otto cycle, diesel cycle, Atkinson cycle and Stirling cycle
2.2 Comparison of ideal and real cycles
2.3 Composition of cylinder gases
2.4 Related numerical problems on fuel air cycle

3 Engine Construction and Operation (6 hours)

3.1 Classification of automotive engine based on fuels and strokes
3.2 Construction of SI and CI engines
3.3 Major engine components and their function: Cylinder head, cylinder block, crankcase, cylinder, piston, connecting rod, crankshaft, flywheel
3.4 Working principle of four stroke and two stroke cycle petrol engines
3.5 Working principle of four stroke cycle diesel engine
3.6 Valve mechanism, valve timing adjustment mechanism or variable valve timing mechanism and valve timing diagram

4 Engine Fuels (4 hours)

4.1 Basic requirements of engine fuel
4.2 Chemical structure of petroleum
4.3 Heat value of fuel
4.4 Combustion equation for hydrocarbon fuels
4.5 Properties and ratings of petrol and diesel fuels

4.6 Alternative fuels: Introduction and advantages

5 Fuel System in SI Engines (6 hours)

5.1 Components of carbureted fuel system and their functions
5.2 Construction and working principle of basic carburetor
5.3 Electrical fuel pump and its operation
5.4 Petrol injection system
  5.4.1 Types of petrol (Fuel) injection system
  5.4.2 Single point fuel injection system (EFI) or throttle body injection system
  5.4.3 Multi point or port fuel injection system
  5.4.4 Direct fuel injection system (Gasoline direct fuel injection system)
5.5 Fuel injection system
  5.5.1 Continuous fuel injection system
  5.5.2 Intermittent fuel injection system
  5.5.3 Sequential fuel injection system
  5.5.4 Grouped fuel injection system

6 Fuel System in Compression Ignition Engine (5 hours)

6.1 Function of diesel fuel system
6.2 Components of diesel fuel system and their function
6.3 Construction and operation of fuel feed pump
6.4 Types of fuel injection pump and working of inline fuel injection pump
6.5 Function of fuel injector
  6.5.1 Types of fuel injector
  6.5.2 Construction of mechanical and electrical fuel injector
6.6 Electronic diesel control (EDC) system
6.7 Common rail direct injection (CRDI) system
6.8 Combustion chamber of diesel engines
6.9 Turbocharging and super charging: Construction and working principle

7 Ignition System (5 hours)

7.1 Function of ignition system
7.2 Types of ignition system
7.3 Battery coil ignition system: Components and their function and working principle
7.4 Distributor and ignition timing
7.5 Function of ignition advance mechanism
7.6 Types of advance mechanism
7.7 Magneto ignition system: Function of components and working principle
7.8 Electronic ignition system and their types and working
7.9 Capacitive discharge ignition system: Working principle
7.10 Distributor less ignition system

7.11 Direct ignition system or independent ignition system or coil-on-plug ignition system

8 Engine Lubrication system (3 hours)

8.1 Function of engine lubrication system
8.2 Engine lubrication system: Main components and their function
8.3 Types of engine lubrication system and their working principle
8.4 Hydrodynamic theory of lubrication
8.5 Properties of engine lubricant
8.6 Types of engine lubricant
8.7 Function of additives in engine lubricating oil
8.8 Grading of engine lubricant

9 Engine Cooling System (3 hours)

9.1 Purposes of engine cooling system
9.2 Types of engine cooling system
9.3 Components of air and pump circulation water cooling system and their functions
9.4 Working principle of air and pump circulation water cooling system

10 Engine Performance and Testing of Engine (6 hours)

10.1 Engine performance parameters
10.2 Engine power, BHP, fuel consumption, air consumption,
10.3 Engine heat balance sheet
10.4 Engine efficiencies
10.5 Mechanical efficiency
10.6 Engine emissions and emission standards (Nepal, India and European)
10.7 Engine emission control systems

Practical (22.5 hours)

1. Engine dismantling and engine assembly: SI and CI engines
2. Identification of engine components and checking them for defects
3. Carburetor and fuel pump dismantling and assembling, identification of components and checking them for defect
4. Fuel injection pump dismantling and assembling, identification of components and calibration
5. Injector dismantling and assembling, identification of components and testing
6. Lubrication system component identification and testing
7. Cooling system component identification and testing
8. Ignition system component identification and testing
9. EFI components identification and testing
10. CRDI components identification and testing

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1 and 2	7	8
3 and 4	10	10
5	6	8
6	5	8
7	5	8
8 and 9	6	10
10	6	8
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Crouse, W. H., Anglin, D. L. (1983). Automotive automatic transmissions (Latest Edition). United Kingdom: Gregg Division, McGraw-Hill.
2. Gill, P. S. (2010). Automobile engineering–I. India: S. K. Kataria & Sons.
3. Kirkpatrick, A. (2020). Internal combustion engines: Applied thermosciences. Wiley.
4. Rajput, R. K. (2008). A text book of automobile engineering. Laxmi Publications.
5. Sharma, S. P., Mohan, C. (1984). Fuels and combustion. Tata McGraw-Hill.
6. Stotsky, A. A. (2009). Automotive engines: Control, estimation, statistical detection. Springer.
7. Taylor, C. F. (1985). Internal combustion engine in theory and practice (Vol. 2): Combustion, fuels, materials, design (Latest Edition). MIT Press.