

**16AE203****FUNDAMENTALS OF I.C. ENGINES**

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	W/RA	SSH/HSH	CS	SA	S	BS

**Course Description and Objectives:**

The course aims at offering the basic knowledge of I.C. Engine working and combustion process in SI and CI engines and to provide knowledge about the fuel system used in I.C engine. This course objective is to provide fundamental aspects of engine thermodynamic cycles, Fuels, Supercharging techniques, Cooling systems and lubrication systems and their functions. It also provides the knowledge on recent technological developments in fuel systems of SI and CI engines.

**Course Outcomes:**

The student will be able to:

- understand the constructional and working principles of SI & CI engine.
- familiarize with modern technology in fuel system of SI & CI engines.
- learn the concept of SI & CI engine combustion in microscopic level
- know the basic design of combustion chambers.
- know the concept and methods of turbo charging in addition to engine
- performance and combustion measurement.

**SKILLS:**

- ü *Identify the effect of fuel on engine performance*
- ü *Engine selection criteria for different applications.*
- ü *Identify different engine constructions*
- ü *Understand fuel supply system*
- ü *Understand construction of IC engine*

**UNIT-1**

**L-10**

**ENGINE CYCLES** :Otto, Diesel and Dual air standard cycles, Comparison, Fuel-air cycle, Actual cycle, Deviation of actual cycle from air standard cycle. Introduction to I. C. Engine: History, Basic engine components and nomenclature, Classification with respect to cycle of operation, Working principle, Fuel used, Cylinder arrangement, Cooling method, Purpose, Valve timing diagram, Port timing diagram, Engine selection criteria for different applications.

**UNIT-2**

**L-9**

**ENGINE CONSTRUCTION** :Cylinder head, Cylinder block, Crank case, Sump, Cooling passages, Cylinder liners, Piston types, Piston rings, Connecting rods, Crank shafts, Valves, Valve seat inserts, Valve actuating mechanisms, Drive mechanisms.

**UNIT-3**

**L-8**

**FUELS** : Availability and properties of fuels, Octane number, Cetane number. Biofuels: Various vegetable oils for engines, Esterification, Performance in engines, Performance and emission characteristics, Bio diesel and its characteristics. (Conventional fuels, properties etc.)

**UNIT-4**

**L-9**

**FUEL SUPPLY SYSTEM IN S.I. ENGINE** :Carburetion, Factors affecting carburetion, Mixture requirements, Principal of carburetion, Simple carburettor, Calculation of air fuel ratio, Limitations of carburettor, Altitude compensation, Gasoline injection- Direct, Port, Manifold injection, Electronic fuel injection system. Fuel Supply System in C. I. Engine :Requirements & types of injection systems, fuel injection pumps, Injectors, governor – mechanical, Pneumatic, Common rail fuel injection, Electronic injection system.

**V-UNIT**

**L-8**

**LUBRICATION SYSTEM** : Mechanical friction, Factors affecting friction, Pumping losses, Blow by losses, Lubrication of engine components, Lubricating systems. Cooling System: Temperature distribution of engine components, Need of cooling system, Air cooling, Liquid cooling, Types, Comparison.

**ACTIVITIES:**

- o *Perform a test on SI and CI engines for valve timing diagram.*
- o *Comparison analysis of different engine cycles*
- o *Differentiate different engine constructions*
- o *Perform measurements on an engine using different fuels*
- o *Distinguish between SI and CI engines.*
- o *Performance test of IC engine*

**LIST OF EXPERIMENTS:**

Total hours: 30

1. Construction details of I.C. engine demonstration
2. Plot valve and port timing diagrams on SI Engines
3. Ignition systems demonstration and study.
4. Fuel feed pumps demonstration
5. Performance Test on 4 -Stroke Diesel Engine
6. Engine friction measurement using Morse test.
7. Heat balance test on a multicylinder engine
8. Air fuel ratio and volumetric efficiency measurement
9. Performance Test on Variable Compression Ratio Engines, economical speed test.
10. Performance Test on Reciprocating Air – Compressor Unit.
11. Study of Boilers.
12. Dis-assembly / Assembly of Engines.

**TEXT BOOKS:**

1. Richard L. Bechfold, "Alternative Fuels Guide Book", 2nd edition., SAE International, 1997.
2. C. Engine Fundamentals, Heywood J.B., 2nd ed., McGraw Hill Book Co., 2002.
3. V. Ganeshan, I.C. Engine, 3<sup>rd</sup> edition, , Tata McGraw Hill.

**REFERENCE BOOKS:**

1. "Automobiles and Pollution" SAE Transaction, 1995.
2. V. L. Maleev, "I. C. Engine", 2nd edition, McGraw Hill Book Co. Ltd.
3. Gill P. W., Smith J. H., Zurich E. J., "Fundamentals of I. C. Engine", 3rd edition, Oxford & IBH Pub. Co., 1999.
4. Mathur & Sharma, "I. C. Engine", Dhanpat Rai & Sons, 2000.