

PME41103 INTERNAL COMBUSTION ENGINES AND GAS TURBINES

MODULE - I (11 HOURS)

Introduction :

Classification, Engine nomenclature, engine operating and performance parameters, Valve timing diagram of SI & CI Engines, Comparison of SI and CI engine.

Thermodynamic Analysis of cycles :

Significance of Fuel-Air & Actual cycles of I.C. engines. Comparison with Air Standard Cycles. Analysis of Fuel-Air & Actual cycles (Effect of chemical equilibrium and variable specific heats. Effect of air fuel ratio and exhaust gas dilution. Time Loss Factor, Heat Loss Factor, Exhaust Blow down, Loss Due to Gas Exchange Processes, Volumetric Efficiency, Loss due to Rubbing Friction)

Fuels : Fuels of SI and CI engine, Fuel additives, Properties, potential and advantages of alternative liquid and gaseous fuels for SI and CI engines (biofuels, LPG and CNG)

Fuel Induction Techniques in IC engines :

Fuel induction techniques in SI and CI engines, Mixture Requirements at Different Loads and Speeds.

Carburetion: Factors Affecting Carburetion, Principle of Carburetion, Simple Carburetor and its drawbacks, Calculation of the Air-Fuel Ratio, Modern Carburetors.

MODULE II (12 HOURS)

Fuel Injection: Functional Requirements of an Injection System, Classification of Injection Systems, Fuel Feed Pump, Injection Pump, Injection Pump Governor, Mechanical Governor, Pneumatic Governor, Fuel Injector, Nozzle, Injection in SI Engine, Electronic Injection Systems, Multi-Point Fuel Injection (MPFI) System, Functional Divisions of MPFI System, Injection Timing, Group Gasoline Injection System, Electronic Diesel Injection System.

Ignition : Energy requirement for ignition, requirements of an ignition system, conventional ignition systems, modern ignition systems (TCI and CDI), firing order, Ignition timing, Spark advance mechanism,

Combustion : Stages of combustion in SI and CI engines, effects of engine variables on flame propagation and ignition delay, Abnormal combustion, Preignition & Detonation, Theory of Detonation. Effect of engine variables on Detonation, control of Detonation. Diesel Knock & methods to control diesel knock, Requirements of combustion chambers. Features of different types of combustion chambers system for S.I. engine. (I-head, F-head combustion chambers), C.I. engine combustion chambers -Open and divided type, Air swirl turbulence-M. type combustion chamber. Comparison of various types of combustion chambers.

Super Charging & Scavenging : Thermodynamics Cycles of supercharging. Effect of supercharging, Efficiency of supercharged engines. Methods of super charging, supercharging and scavenging of 2-stroke engines.

Module-III (8 hours)

Testing and Performances : Power, fuel & air measurement methods, Performance characteristic curves of SI & CI engines, variables affecting performance and methods to improve engine performance.

Cooling & Lubricating Systems, Engine Emission & Controls : Air cooling & water cooling systems, Effect of cooling on power output & efficiency, Properties of lubricants and different types of lubricating system.

Modern developments in IC Engines, EGR, MPFI, CRDI, GDI, HCCI, dual fuel engine, Lean burn engine, Stratified engine (basic principles).

Engine Emission and control :

Mechanism of pollutant formation and its harmful effects. Methods of measuring pollutants and control of engine emission.

Module-IV (9 hours)

Gas Turbines : Introduction, Open and closed cycle gas turbines, Analysis of practical gas turbine

cycle.

Air Craft Propulsion :Analysis of Turbo Jet, Turbo Prop, Turbo fan & Ram jet engines.

Axial Flow & Centrifugal Compressor :Basic construction of centrifugal and axial flow compressor, Velocity diagram, performance characteristics of centrifugal and axial flow compressor, effects of slip, surging and stalling on compressor.

Text Books:

1. IC Engines, Mathur & Sharma
2. Internal Combustion Engines, V. Ganesan, TMH, 3rd edition
3. Gas Turbines, V.Ganesan, TMH, 3rd edition

Reference books:

1. Fundamentals IC Engines, J.B.Heywood, McGraw Hill
2. A course in IC Engines, V.M.Domkundwar, Dhanpat rai and sons
3. Gas Turbines, Cohen and Roser
4. An Introduction to Energy Conversion, Vol.III, V.Kadambi and Manohar Prasad, New Age International
5. Fundamentals of Internal Combustion Engines, H.N.Gupta, PHI
6. Internal Combustion Engines, K.K.Ramalngam, Scitech Publications