MEPC3004 IC ENGINES AND GAS TURBINES (3-0-0)

Course Objectives

The course aims to:

- Provide fundamental and advanced understanding of spark-ignition (SI) and compression-ignition (CI) engines.
- Develop knowledge of fuel–air cycles, combustion processes, and engine performance characteristics.
- Introduce gas turbine theory, components, cycles, and applications.
- Familiarize students with modern developments like turbo charging, fuel injection systems, and low-emission technologies.
- Equip students for automotive, power plant, and aerospace applications.

MODULE – I: Introduction to IC Engines (10 Hrs)

Classification and applications of IC engines, Four-stroke and two-stroke SI & CI engines, Engine components and their functions, Fuel–air cycles, actual cycles, comparison with air-standard cycles, Valve timing & port timing diagrams, Engine performance parameters: IP, BP, FP, BSFC, indicated efficiency, brake efficiency, mechanical efficiency

MODULE – II: Combustion in IC Engines (10 Hrs)

SI Engines: Combustion stages, Flame speed, Ignition lag, Abnormal combustion: detonation, preignition, Factors affecting detonation and control

CI Engines: Combustion stages, Delay period, Diesel knock—causes and control, Fuel spray formation and atomization, Combustion chambers for SI and CI engines

MODULE – III: Engine Systems & Modern Technologies (10 Hrs)

Carburetion and fuel-injection systems, Electronic fuel injection (EFI), Common-rail direct injection (CRDI), Supercharging & Turbocharging: systems, spark plugs, glow plugs, Governing of IC engines, Emission formation (NOx, CO, HC, PM), Emission control technologies: catalytic converters, EGR, DPF, SCR

MODULE – IV: Introduction to Gas Turbines (08 hrs)

Classification of gas turbines, Open cycle & closed cycle gas turbines, Brayton cycle–ideal & actual, Regeneration, intercooling, reheating, Gas turbine fuels, materials, blade cooling

Performance analysis and efficiency improvements

MODULE – V: Gas Turbine Components & Applications (08 Hrs)

Compressors: axial & centrifugal—principles, characteristics, Combustion chambers: types, design considerations, Turbines: impulse and reaction, Nozzle and diffuser principles, Gas turbine power plants, Applications in power generation, marine systems, and aerospace propulsion

Course Outcomes (COs)

After completing the course, students will be able to:

1. Explain the working principles and classifications of IC engines and gas turbines.
2. Analyze combustion processes, fuel systems, and engine operation parameters.
3. Evaluate performance metrics such as power, efficiency, and fuel consumption.
4. Understand gas turbine cycles and component design principles.
5. Identify emission control strategies and modern technological advancements.
6. Apply thermodynamic and fluid-flow principles to engine and turbine performance.

Text Books

1. V. Ganesan – Internal Combustion Engines
2. Heywood – Internal Combustion Engine Fundamentals
3. Cohen, Rogers &Saravanamuttoo – Gas Turbine Theory
4. Mathur & Sharma – IC Engines
5. H.I.H. Saravanamuttoo – Gas Turbines

Reference Books

1. Ferguson & Kirkpatrick – Internal Combustion Engines
2. Hill & Peterson – Mechanics and Thermodynamics of Propulsion
3. Boyce – Gas Turbine Engineering