2/4 B.Tech. FOURTH SEMESTER

ME4T3 IC ENGINES AND GAS TURBINES Credits: 4

Lecture:- 4 periods/week **Internal assessment: 30marks**
Tutorial: - 1 periods/week **Semester end examination: 70 marks**

Objectives:

1. Acquire knowledge about the IC engine cycles, classification and working principles
2. Describe the testing and performance parameters along with heat balance sheet
3. Explain different alternate fuels, gas turbines and about jet propulsion

Learning outcomes:

At the end of course the students will have:

1. Define basic concepts of actual cycles and its analysis.
2. Describe the fundamental concepts of IC engine and its working principles.
3. Reproduce the combustion phenomenon in SI and CI engines.
4. Assess and evaluate performance of IC engines
5. Discuss the importance of alternate fuels
6. Memorize the fundamental concepts of gas turbines and jet propulsions

Pre-Requisite

Basic Thermodynamics

UNIT – I
ACTUAL CYCLES AND THEIR ANALYSIS:
Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles Of CI Engines.

UNIT-II
I.C. ENGINES:
Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine.

UNIT – III

COMBUSTION IN S.I. ENGINES:

Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

UNIT IV

COMBUSTION IN C.I. ENGINES:

Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – V

TESTING AND PERFORMANCE:

Parameters of performance - measurement of cylinder pressure, fuelconsumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT – VI

ALTERNATIVE FUELS:

Liquid fuels – Alcohols - Methanol, Ethanol, Alcohols for SI and CI engines, Gaseous fuels – Hydrogen, Natural gas, CNG and LPG, other possible fuels.

UNIT VII

GAS TURBINES:

Simple gas turbine plant – ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –closed and semi-closed cycles – merits and demerits, types of combustion chambers.

UNIT-VIII

JET PROPULSION :

Principle of operation –classification of jet propulsive engines – working principles with schematic diagrams and representation on t-s diagram - thrust, thrust power and propulsive efficiency – turbo jet engines – needs and demands met by turbo jet – schematic diagram, thermodynamic cycle, performance evaluation, thrust augmentation – methods.

ROCKETS : Application – working principle – classification – propellant type – thrust, propulsive efficiency – specific impulse – solid and liquid propellant rocket engines.

Learning resources

Text books:

1. I.C. Engines, by V. Ganesan, TMH publications - 2008
2. Gas Turbines, by V.Ganesan, TMH publications - 2010
3. Heat engines, by Vasandan & Kumar - - Metropolitan Book Co Pvt Ltd - 2000

References books:

1. IC Engines, by Mathur & Sharma, Dhanpath Rai & Sons - 2005
2. Thermal Engineering, by Rudramoorthy, TMH publications - 2003
3. I.C. Engines, by Heywood - - McGrawHIll publications- 1998