

## II YEAR II Semester

ME4T3

IC ENGINES AND GAS TURBINES

Credits: 3

Lecture: 3 periods/week

Internal assessment: 30marks

Tutorial: 1 period/week

Semester end examination: 70 marks

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### Course 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

### Course outcomes:

Upon the completion of course the students will be able to:

1. Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of IC engines along with its working principles.
2. Describe the combustion phenomenon in SI and CI engines.
3. Evaluate the performance of IC engines and the importance of alternate fuels.
4. Classify the essential components of gas turbine along with its performance improving methods.
5. Illustrate the working principle of different types of Jet propulsive engines and Rockets.

### 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 Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles Of CI Engines.

#### 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 – II

**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 – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

**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 – III**

**TESTING AND PERFORMANCE OF IC ENGINES:** Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

#### **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 IV**

#### **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-V**

#### **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 types

### **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