

THERMAL ENGINEERING - II

Course Code: 13ME1121

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Pre requisites: Thermodynamics

Course Educational Objectives:

The student is

- ❖ Exposed to the principles and working of various components associated with thermal power plants
- ❖ Exposed to the working and applications of gas turbines
- ❖ Introduced to jet propulsion engines
- ❖ Introduced to principle of rocket engine and its application

Course Outcomes:

The student will

- ❖ Gain knowledge about the various components of thermal power plants and their functions
- ❖ Understand the working and applications of gas turbines
- ❖ Know the various types of jet propulsion engines and evaluate their performance
- ❖ Learn the working principle and application of rocket engines

UNIT-I

(14 Lectures)

Basic steam power cycles – Rankine cycle – Modified Rankine cycle-Regeneration and Reheating.

Boilers: Classification, Working Principle of L.P and H.P Boilers, boiler mountings and accessories-working principles, performance, equivalent evaporation, efficiency and heat balance, boiler draught – classification – height of the chimney for a given draught, discharge, condition for maximum discharge and efficiency of the chimney – artificial draught – induced and forced.

UNIT-II**(10 Lectures)****STEAM NOZZLE:**

Introduction- steam flow through nozzle-nozzle efficiency - supersaturated flow or metastable expansion of steam in nozzle-general relationship between area, velocity and pressure in nozzle flow.

Steam Turbine: Introduction-Classification – impulse turbine: mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency.

UNIT-III**(12 Lectures)****IMPULSE TURBINE:**

Methods to reduce rotor speed-velocity compounding, pressure compounding and velocity & pressure compounding, velocity and pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine, condition for maximum efficiency.

Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction – velocity diagram – Parson's reaction turbine – condition for maximum efficiency – calculation of blade height.

UNIT-IV**(09 Lectures)****STEAM CONDENSERS:**

Introduction-organs of a steam condensing plant – classification – sources of air in condensers-air leakage and its effects - types vacuum efficiency – condenser efficiency – determination of mass of cooling water- air pumps-cooling towers-simple problems.

UNIT-V**(15 Lectures)****GAS TURBINES:**

Simple gas turbine plant layout, classification of gas turbines- open cycle gas turbine – intercooling, reheating and regeneration - effect of variables, closed and semi closed cycles – efficiency, pressure ratio, merits and demerits of open and closed cycles.

JET PROPULSION:

Introduction- the ramjet engine -the pulse jet engine - the turboprop engine-the turbojet engine –thrust & thrust equation - specific thrust of the turbojet engine – efficiencies- performance evaluation- thrust augmentation – methods

Rocket Propulsion: Introduction –classification–principle of rocket propulsion- propeller type – solid propellant rocket engines-propellant and their characteristics.

TEXT BOOKS:

1. R.K. Rajput, “*Thermal Engineering*”, Lakshmi Publications, 2005.
2. V. Ganesan, “*Gas Turbines*”, TMH Publications, , 3rd Edition, 2010.

REFERENCES:

1. D.S. Kumar, “*Thermal Science and Engineering*”, S.K. Kataria and Sons, 4th Edition, 2010.
2. Mathur, M.L., Mehta, F.S., “*Thermal Engineering*”, Jain Brothers, 2012.

