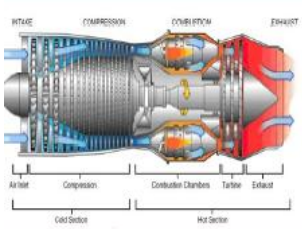

16ME304 THERMAL TURBO MACHINERY

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	-	12	24	0	6	4	2

Course Description and Objective:

This course offers fundamental concepts and application of thermodynamic laws for compressors, turbines and jet propulsion devices. The objective of this course is to impart basic knowledge on work producing and consuming devices, performance parameters and methods to improve their efficiencies.

Course Outcomes:

The student will be able to:

- evaluate various performance characteristics of single and multi-stage reciprocating compressors.
- determine power required to drive centrifugal and axial flow compressors for a given application.
- draw velocity triangles to extract efficiencies of steam turbines
- identify the methods to improve thermal efficiency of gas turbines
- understand the working principles of various jet and rocket propulsion systems.

SKILLS:

- ✓ *Draw velocity diagrams for various turbomachinery.*
- ✓ *Derive basic equations used for turbomachines.*
- ✓ *Evaluate degree of reaction for an axial flow compressor.*
- ✓ *Analyze the performance of gas turbines and jet propulsion engines.*
- ✓ *Differentiate jet and rocket propulsion engines.*

UNIT - 1 **L-9; T-3**

RECIPROCATING COMPRESSORS: Classification and working principle; work of compression with and without clearance. Volumetric efficiency; Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – working of multistage air compressor.

UNIT - 2 **L-9; T-3**

CENTRIFUGAL COMPRESSORS: Principle of operation – velocity and pressure variation. Energy transfer impeller blade shape-losses; slip factor; power input factor; pressure coefficient velocity diagrams; power.
AXIAL FLOW COMPRESSORS: Mechanical details and principle of operation –velocity triangles and energy transfer per stage degree of reaction; work done factor - isentropic efficiency. Polytropic efficiency.

UNIT - 3 **L-9; T-3**

STEAM TURBINES:
IMPULSE TURBINE: Classification; Mechanical details of Impulse turbine; Velocity diagram -effect of friction - power developed; axial thrust; blade or diagram efficiency - condition for maximum efficiency; De-Laval Turbine - its features.Methods to reduce rotor speed - Velocity compounding and pressure compounding; Velocity and Pressure variation along the flow; combined velocity and pressure compounding of impulse turbine.
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.

UNIT - 4 **L-9; T-3**

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.

UNIT - 5 **L-9; T-3**

JET PROUPULSION: Classification of jet propulsive engines - Working Principles with schematic diagrams and representation on T.S. diagram. Thrust; Thrust Power and Propulsion Efficiency of Turbo jet engines-Thermodynamic Cycle; Performance Evaluation; Thrust Augmentation Methods.
ROCKET PROPULSION: Application - Working Principle - Classification - Propellant Type - Thrust; Propulsive Efficiency - Specific Impulse - Solid and Liquid propellant Rocket Engines.

TEXT BOOKS :

1. R.K. Rajput, "Thermal Engineering", 9th edition, Laxmi Publications, New Delhi, 2015.
2. V.Ganesan, "Gas Turbines", 3rd edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCE BOOKS :

1. Sarkar B. K, " Thermal Engineering", 1st edition, Tata McGraw Hill, 2005.
2. P K Nag, "Power Plant Engineering", 3rd edition,Tata McGraw Hill, 2008.
3. Ballaney, P.L., "Thermal Engineering", 23rd edition, Khanna Publishers, 2007.

ACTIVITIES:

- *Determine the performance parameters of compressors*
- *Design prototype steam turbine used in power plants.*
- *Fabrication of cut section models of gas turbine parts.*
- *Fabricate a prototype model of jet and rocket propulsion system.*
- *Visit to a nearby thermal power plant.*