Course Code	Course Name	Credits
MEC602	**Turbo Machinery**	**03**

Objectives

1. To apply principles of thermodynamics and fluid mechanics to turbomachines.
2. To learn the design and significance of various components of the turbomachine.
3. To estimate various parameters related to turbo machines using the governing equations.
4. To evaluate the performance of turbo machines.

Outcomes: Learner will be able to…

1. Define various parameters associated with steam generators and turbo machines.
2. Identify various components and mountings of steam generators with their significance.
3. Identify various turbo machines and explain their significance.
4. Apply principles of thermodynamics and fluid mechanics to estimate various parameters like mass flow rate power, torque, efficiency, temperature, etc.
5. Evaluate performance of SG and Turbo machines and apply various techniques to enhance performance.
6. Evaluate various phenomena related to performance like cavitation, choking, surging.

Module	Details	Hrs
1	**1.1 Steam Generators-** Layout of Thermal Power Plant, Classification of boiler, Difference between Fire tube and Water tube boiler with examples, Low pressure and high pressure boilers, once through boiler, important features of HP boilers, Mountings and accessories, Equivalent evaporation of boilers, Boiler performance, Boiler efficiency. **1.2 Introduction to turbo machines:** 1.2.1 Review of Thermodynamic principles, compressible gas flow relations, estimation of non-dimensional performance parameters for incompressible flow, specific speed. 1.2.2 Basic Euler's theory of turbo machines and it application to pumps, turbines and compressors.	**04** **04**
2	**HydraulicTurbines:** Basic theory, classification of turbines, theory of impulse and reaction turbines, estimation of work done, efficiency, characteristics of turbines, concept of draft tube and its types	**06**
3	**Pumps** **3.1** Classification of pumps, definition of pumping systems and system characteristics. **3.2 Centrifugal pumps:** Construction, estimation of work done, efficiency, characteristics, determination of operating point, cavitation and NPSH, specific speed of pumps **3.3 Positive Displacement pumps-**	**02** **04** **04**

	Types and applications, general feature of reciprocating pumps, definition of head, discharge, work done and efficiency, types of reciprocating pumps, indicator diagram (no numerical on reciprocating pump). Use of air vessel (only application no numerical).	
4	**Air compressor-** Introduction and general classification of reciprocating compressor-positive displacement, Multi Staging of reciprocating compressor (no derivation, numerical on single stage and two stage compressor). Centrifugal compressor, surging and choking of compressor (No numerical on centrifugal compressor).	**04**
5	**Steam Turbine**- Basic of steam turbine, Classification, compounding of turbine, Impulse turbine –velocity diagram, Condition for max efficiency Reaction turbine, Numerical on Simple Impulse turbine (De-Laval turbine) of single stage only. Degree of reaction, Parson's turbine, Condition for maximum efficiency, Numerical on Parson's turbine only.	**06**
6	**6.1 Gas Turbines** Applications of gas turbine, Actual Brayton cycle, open and closed cycle gas turbine, methods to improve efficiency and specific output, open cycle with intercooling, reheat, and regeneration, Effect of operating variable on thermal efficiency and work ratio **6.2 Jet Propulsion Engines** Classification of jet propulsion engines, Thrust, Thrust power, Propulsive efficiency and thermal efficiency.	**05**

Assessment:

Internal Assessment for 20 marks:

Consisting**Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

Text Books:-

1. Thermal Engineering, AjoyKumar,G. N Sah,Narosa Publishing House,New Delhi
2. Fluid Mechanics and Machinery; CSP Ojha, R. Berndtsson, Oxford University.
3. Fluid Mechanics and Fluid Machines by Gautam Biswas, S K Som, Suman Chakraborty - Tata McGraw-Hill Education Pvt. Ltd.
4. Turbines, Compressors and Fans by S.M. Yahya, McGraw-Hill Education Pvt. Ltd.

5. Turbomachinery Design and Theory by Aijaz and Gorla
6. Fluid Mechanics, thermodynamics of turbomachinery- S.L.Dixon,
7. Amsterdam; Boston: Elsevier-Butterworth-Heinemann

Reference Books:-

1. R.K.Rajput; Engineering Fluid Mechanics; S. Chand publications.
2. Dr. Mody& Seth; Hydraulics and Fluid Mechanics; Standard book house
3. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines, Dhanpat Rai publishing company.
4. Strecter, Fluid Mechanics, Tata McGraw Hill.
5. Thermal Engineering, R K. Rajput, Laxmi Publication
6. Fluid Mechanics: Fundamentals and application; Yunus A Cengel and John M CimbalaPublisher: Special India

Links for online NPTEL/SWAYAM courses:

https://nptel.ac.in/courses/112/106/112106303/ - Introduction to Turbomachines, IIT Madras
https://nptel.ac.in/courses/112/106/112106200/ - Fluid Dynamics and Turbomachines, IIT Madras