THERMAL TURBO MACHINES

Course Code: 15ME2311

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Course Outcomes: At the end of the course, the student will be able to

CO1: Apply thermodynamic principles to nozzles, diffusers and methods to estimate the stage work and efficiency of radial turbines.

CO2: Apply the methods to estimate the stage work and efficiency of axial turbines.

CO3: Apply the methods to estimate the stage work and efficiency of axial compressors.

CO4: Apply the methods to estimate the stage work and efficiency of centrifugal compressors.

CO5: Explain the parameters required for the design of fans.

UNIT-I (10-Lectures)

Turbo machines, thermodynamics -basic definitions and laws, energy equation, adiabatic flow through nozzles, adiabatic flow through diffusers, work and efficiencies in turbine stages, work and efficiencies in compressor stages.

Radial turbine stages **-e**lements of a radial turbine stage, stage velocity triangles, enthalpy-entropy diagram, stage losses, performance characteristics, outward flow radial stages

UNIT-II (10-Lectures)

Axial turbine stages -stage velocity triangle, single impulse stage, multi stage velocity and pressure compounded impulses, reaction stages, blade-to-gas speed ratio, losses and efficiencies, performance charts, low hub-trip ratio stages.

UNIT-III (10-Lectures)

Axial compressor stages -stage velocity triangles, enthalpy-entropy diagram, flow through blade rows, stage losses and efficiency, work

done factor, low hub-tip ratio stages, supersonic and transonic stages, performance characteristics, stalling.

UNIT-IV (10-Lectures)

Centrifugal compressor stages -elements of centrifugal compressor stage, stage velocity triangle, enthalpy-entropy diagram, nature of impeller flow, slip factor, diffuser, performance characteristics.

UNIT-V (10-Lectures)

Axial fans and centrifugal fans -fan applications, axial fans, fan stage parameters, types of axial fan stages, types of centrifugal fans, centrifugal fan stage parameters, design parameters.

TEXT BOOKS:

S.M. Yahya, "*Turbines, Pumps, Compressors"*, 4th Edition, Tata McGraw Hill, 2010.

REFERENCES:

1. Charles A, Earsons, "*The steam turbine"*, Cambridge University Press, 2012.
2. Norman Davey, "*Gas Turbines – Theory and practice"*, 3rd Edition, Merchant Books, 2006.
3. S.M. Yahya, "*Fundamentals of Compressible flow with aircraft and rocket propulsion"*, New Age International, 2010.
4. Cophen, Roger and Sarvanamiuttu, "*Gas Turbines"*, 6th Edition, Pearson, 2008.
5. Seppo A. Korpela, "*Principles of turbomachinery"*, John Wiley & Sons, 2011.