INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

TURBO MACHINERY								
VI Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AAED32	**Elective**	3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Fluid Dynamics								

I. COURSE OVERVIEW:

Turbo machinery describes machines that transfer energy between a rotor and a fluid like centrifugal pumps, including both turbines and compressors usually work with a gas. Indulgent in application of aerospace jet engines, turbines and Centrifugal Compressors and Radial flow turbines relationships like Newton's second law of motion and Euler's pump and turbine equation for compressible fluids are also turbo machines.

II. COURSES OBJECTIVES:

The students will try to learn

I. The basic concepts of turbo machinery, hydraulic pumps and effects of flow parameters on the performance of the machine.
II. The geometrical conditions and description of the main components in Centrifugal pumps, Pelton, Francis, Kaplan and gas-turbines.
III. The energy transfer and losses in centrifugal compressors, axial fans and steam turbines.
IV. The Basic design of Wind turbines, Reversible Pump turbines, multi-phase pumps and wet gas compressors.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO 1 Develop a deep understanding of the fundamental principles governing the operation of turbomachinery
CO 2 Classify different types of turbomachinery, including turbines, compressors, and pumps.
CO 3 Analyze the performance characteristics of turbomachinery, including efficiency, work output and power consumption.
CO 4 Study the aerodynamics and thermodynamics of fluid flow through turbomachinery.
CO 5 Analyze the operational considerations and challenges associated with turbomachinery including stall, surge, and cavitation.
CO 6 Discuss the environmental impact of turbomachinery, including considerations related to energy efficiency and emissions.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO TURBOMACHINERY (10)

Classification of turbo machines, second law of thermodynamics applied to turbine and compressors work, nozzle, diffuser work, fluid equation, continuity, Euler's, Bernoulli's, equation and its applications, expansion and compression process, reheat factor, preheat factor.

MODULE-II: FUNDAMENTAL CONCEPTS OF AXIAL AND RADIAL MACHINES (10)

Euler's equation of energy transfer, vane congruent flow, influence of relative circulation, thickness of vanes, number of vanes on velocity triangles, slip factor, Stodola, Stanitz and Balje's slip factor, suction pressure and net positive suction head, phenomena of cavitation in pumps, concept of specific speed, shape number, axial, radial and mixed flow machines, similarity laws.

MODULE-III: AXIAL COMPRESSOR AND FANS (11)

Flow through axial flow fans, principle of axial fan and propeller, application of fan for circulation and ventilation, stage pressure rise and work done.

Slip stream and blade element theory for propellers, performance and characteristics of axial fans, effects of cascading, degree of reaction, blade loading coefficient and blade loss.

MODULE-IV: CENTRIFUGAL COMPRESSORS (09)

Flow through centrifugal compressors, stage velocity triangles, specific work, forward, radial and backward swept vanes, enthalpy entropy diagrams, degree of reaction, slip factor, efficiency, vaneless and vane diffuser system, volute as spiral casing, surge and stall in compressors.

MODULE-V: AXIAL TURBINES (8)

Stage velocity triangles, work, efficiency, blade loading, flow coefficient, single stage impulse and reaction turbines, degree of reaction, 50% reaction turbine stage, radial equilibrium and actuator disc approach for design of turbine blades, partial admission problems in turbines, losses in turbo machines

V. TEXT BOOKS:

1. Yahya S.M, "Turbines, Compressor and Fans", TMH, 4th Edition, 2010.
2. Shepherd D.G, "Principles of Turbo machinery", Collier Macmillan, 2nd Edition, 1961.
3. Venkanna B.K, "Fundamentals of Turbo machinery", PHI, 3rd Edition, 2009.

VI. REFERENCE BOOKS:

1. Peng W.W, "Fundamentals of Turbo machinery", Wiley, 2nd Edition, 2007.
2. Korpela S.A, "Principles of Turbo machinery", Wiley, 2nd Edition, 2011.
3. Turton R.K, "Principles of Turbo machinery", Springer, 3rd Edition, 1994.

VII. WEB REFERENCES:

1. https://www.cfd-online.com/Wiki/Turbomachinery
2. https://www.leka.lt/sites/default/files/dokumentai/key-concepts-in-turbo-machinery_1.pdf
3. https://www.sciencedirect.com/science/book/9781856177931

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II
9. Lecture notes

10. E-learning readiness videos (ELRV)
11. Power point presentation