BMEE324E	Turbomachines	L	T	P	C
		2	0	2	3
Pre-requisite	**BMEE203L , BMEE204L , BMEE204P**	**Syllabus version**			
		1.0			

Course Objectives

1. To familiarize the student with the working of various Turbo machines.
2. To impart the design-oriented knowledge related to various Turbo machines.
3. To develop problem solving abilities in Turbo machines.
4. To develop the skills of experimental design.

Course Outcome

At the end of the course, the student will be able to

1. Apply Euler's equation of energy transfer for turbomachines.
2. Demonstrate the aerofoil and cascade nomenclature.
3. Design the stages of centrifugal compressors and fans.
4. Analyse the stage parameters and performance characteristics of Axial Fans and Axial Compressors.
5. Evaluate the performance parameters of radial and axial turbines.
6. Experimentally determine the performance characteristics of both power absorbing and power generating turbo machines.

Module:1	**Energy Transfer**	**5 hours**

Definition and classification of turbo machines, Specific work - T-s and h-s diagram - Euler's equation of energy transfer - Losses - Various efficiencies - Effect of reheat - Preheat- Incompressible vs compressible turbomachines - review of incompressible turbomachines: Peloton, Francis, Kaplan Turbines and Centrifugal Pump.

Module:2	**Cascading**	**3 hours**

Aerofoil section - Cascading of compressor and Turbine blades - Energy Transfer in terms of lift and drag co-efficient for compressor and turbine blades - variation of lift - Deflection and stagnation pressure loss with incidence.

Module:3	**Centrifugal Compressors**	**4 hours**

Centrifugal Fans, Blowers and Compressors - Construction details – Inducers - Backward and Radial blades – Diffuser - Volute casing stage work - Stage pressure rise - Stage pressure co-efficient - Stage efficiency - Degree of reaction - Various slip factors.

Module:4	**Axial Fans**	**4 hours**

Axial flow Fans with various guide vane mechanisms: Stage with upstream guide vanes - Stage with downstream guide vanes - Stage with both upstream and downstream guide vanes- Stage velocity triangles - Flow coefficient - Stage pressure coefficient - T-S diagram and h-s diagram - Degree of reaction.

Module:5	**Axial Compressors**	**4 hours**

Axial Compressors with guide vane mechanisms - Stage velocity triangles - Flow coefficient- Stage pressure coefficient - Static pressure rise- T-S diagram and h-S diagram - Degree of reaction- work done factors - Stalling and Surging.

Module:6	**Radial Turbines**	**3 hours**

Inward flow radial flow turbine stages - Cantilever IFR turbine and 90 IFR Turbine - Stage velocity triangles - T-S diagram and h-s diagram - Degree of reaction.

Module:7	**Axial turbines**	**5 hours**

Axial turbine stages - Stage velocity triangles - T-s diagram and h-s diagram - work – Single stage Impulse Turbine - Speed ratio maximum utilization factor - Multistage velocity compounded impulse - Multi stage pressure compounded impulse - Reaction stage - Degree of reaction - Fifty percent reaction stages.

Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)	
1.	Yahya S.M, Turbine, Fans and Compressors, 2017, 4th Edition, Tata McGraw-Hill.
2.	Dubey M, Prasad BVSSS, Nema A, Turbomachinery, 2019, 1st Edition, McGraw Hill Education (India).
Reference Books	
1.	Larry Dixon S, Cesare Hall, Fluid Mechanics and Thermodynamics of Turbomachinery, 2013, 7th Edition, Butterworth- Heinemann.
2.	Kadambi, Prasad, Energy conversion Vol.III- Turbomachines, 2011, New Age International.
3.	Korpela, Seppo A, Principles of Turbomachinery, 2019, John Wiley & Sons.
4.	Round, George Frederick, Incompressible Flow Turbomachines: Design, Selection, Applications and Theory, 2004, Elsevier.
Mode of Evaluation: CAT, written assignment, Quiz, FAT.	
Indicative Experiments	
1.	To study the performance of gear pump at different discharge pressures
2.	To study the Performance of Reciprocating Pump at different discharge pressures.
3.	To study the performance characteristics of Variable Speed Centrifugal Pump at different speeds and different discharge pressures.
4.	To study the performance of jet Pump at different discharge pressures.
5.	To study the performance of Submersible Pump at different discharge pressures.
6.	To study the performance of Kaplan turbines at constant speed, constant load and different vane and blade positions
7.	To study the performance of Francis Turbine at constant speed, constant load and different vane positions
8.	To study the impact of jet on vanes.
9.	To study the performance of a radial blower at different discharge pressures
10.	To study the performance of a constant speed Axial Fan
11.	To study the flow characteristics in a Boundary layer
Total Laboratory Hours	**30 hours**
Mode of assessment: Continuous assessment, FAT, Oral Examination.	
Recommended by Board of Studies	09-03-2022
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