BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI – HYDERABAD CAMPUS
SECOND SEMESTER 2023 – 2024

Course Handout Part II

Date: 09/01/2024

In addition to part – I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course no:	**ME F341**
Course Title:	**PRIME MOVERS AND FLUID MACHINES**
***Instructor – in – charge*:**	**Sandip Deshmukh**
Tutorial Instructors:	Sandip Deshmukh, N Jalaiah, Supradeepan K, Santanu Prasad Datta
Lab Instructors:	Sandip Deshmukh, Supradeepan K, G Prashanth Kumar Reddy, Dole Mahesh, Kolanu Sai Sandeep, Lingampally Swetha, Meduri Sitaram, Sibin V Mathew

1. Scope and Objective of the Course:

The Course is intended to familiarize the students with theoretical analysis of energy and momentum transfer between the fluid and rotor. The working principles, design considerations, performance and application aspects of turbo machines will be dealt with. Classification, descriptive details and performance of rotary machines and reciprocating machines will be discussed.

2. Text books:

TB1: Venkanna B. K., Fundamentals of Turbomachinery, 6th Print (2009), PHI, New Delhi.
TB2: Jagdish lal; Hydraulic Machines; Metropolitan Book Company Private limited, New Delhi; 1975; 6th Edition.

Reference Books:

RB1: Kadambi V and Manohar Prasad An Introduction to Energy Conversion NAIL, Vol III ,2nd Ed, 2011
RB2: Agarwall S K; Fluid Mechanics and Machinery; Tata McGrawhill publishing company limited, New Delhi; 1997.

3. Course plan (Lecture):

Lecture Nos.	Learning Objectives	Topics to be covered	Reference Chapter in TB/RB
1	To review the basic concepts of fluid mechanics and machinery.	Fluid Mechanics principles; components of turbo machines; classification; Energy exchange in turbo machines	TB1: Ch 2; RB1: Ch 1
2-3	To understand Dimensional analysis as applied to fluid machines.	Methods of dimensional analysis; Buckingham Theorem; Dimension less numbers; Principles of similarity; model testing of pumps and turbines.	TB1: Ch 1
4-5	To understand the classification of hydraulic turbines; principles of analysis.	Introduction; Elements of hydroelectric power plant; classification of turbines; Fundamental equation of hydraulic machines; Head and efficiency of turbines.	TB2: Ch 4; RB1: Ch 6
6-8	To understand the analytical principles of various hydraulic turbines.	Impulse turbines; reaction turbines; Application of aerofoil theory; Governing of turbines; Characteristics of turbines; Selection of turbines.	TB1: Ch 7
9-10	To understand the classification of pumps, and their working principles. Analysis of reciprocating pumps.	Introduction; reciprocating pumps	TB2: Ch 11; RB2: Ch 14
11-12	To understand the analytical principles of centrifugal pumps	Centrifugal pumps; classification; basic equations of analysis; Curvature of blades; velocity triangles; problems on the above topics.	TB1: Ch 4; RB1: Ch 7
13-15	To understand thermodynamic and analytical principles behind the flow of fluids through nozzles and blade passages.	Introduction; Critical pressure ratio & maximum discharge; effect of nozzle efficiency; meta stable flow of steam in nozzles; effect of super saturation;	3 of TB2; 3 of RB2; class notes

Lecture Nos.	Learning Objectives	Topics to be covered	Reference Chapter in TB/RB
		numerical problems	
16-18	To understand the classification of steam turbines and basic principles of analysis.	Introduction; Compounding of steam turbines; velocity diagrams of moving blades.	TB1: Ch 6
19-21	To understand the analysis of various steam turbines.	Impulse turbines; reaction turbines; degree of reaction; stage efficiency; turbine efficiency & reheat factor; losses in steam turbines; governing	TB1: Ch 3; RB1: Ch 3
22-24	To understand classification; working & analytical principles of gas turbines.	Introduction; elementary design of turbines; gas turbine blading; numerical problems.	TB1: Ch 6; RB1: Ch 4
25-26	To understand classification; working & analytical principles of various compressors.	Introduction; classification; reciprocating compressors; Multi stage compression with inter cooling	TB1: Ch 5; RB2: Ch 15
27-28	To understand the analytical principles of centrifugal compressors and various other compressors	Centrifugal compressors; slip in centrifugal compressors; stagnation values in centrifugal compressors; axial flow compressors; cascade flow; velocity triangles; work done and degree of reaction.	TB1: Ch 5; RB1: Ch 5

Course plan (Tutorial)

Tutorial Number	Topic to be Covered
1	Dimensional analysis
2	Hydraulic Turbines – Impulse
3	Hydraulic Turbines – Reaction
4	Reciprocating Pump
5	Centrifugal Pump
6	Steam Nozzle
7	Steam Turbines – Impulse
8	Steam Turbines – Reaction
9	Gas Turbine
10	Reciprocating Compressor
11	Centrifugal Compressor

4. Reading assignments:

Time to time reading assignments will be given to the students. These reading assignments are part of the course and questions may appear in tests/examinations in these portions also.

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of the Component
Mid-Sem Test	90 min	25% (50 Marks)	16/03 - 4.00 - 5.30PM	Closed Book
***Tutorial Tests**	15 min	15% (30 Marks)	Continuous	Open Book
Lab Reports & Quiz	-	15% (20+10 Marks)	Continuous	Open Book
Lab Compre	-	5% (10 Marks)	Last Week of the Sem	Open Book
Compre	3 hours	40% (80 Marks)	20/05 AN	Closed Book

* Shall be conducted in Tutorial classes. Every tutorial class will be followed by a test and all tutorial tests are evaluative. **Best 9 out of 11 tests would be considered**.

6. Chamber Consultation hours: To be announced in the class.

7. Notices: All the notices related to this course will be put up in the Google Classroom.

8. Make up Policy: Make-up will be granted only to genuine cases with prior permission from the IC. For cases related to illness, proper documentary evidence is essential.

9. Laboratory Experiments: The experiments include performance tests on various IC engines, different work producing/work consuming fluid machinery besides some study experiments. Complete modalities of operation of the laboratory such as the exact titles of experiments, reports submission and evaluation methodology etc. shall be announced at the beginning of laboratory session.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor – in Charge
ME F341