SECOND SEMESTER 2015 – 2016

Course Handout part II

Date: 13/01/2016

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:	**M. S. SONI**
Lab Instructors:	Kapil Dev, Nikhil Gakkhar, Rajesh Kumar, Sanjeev Jhakhar

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: M.S. Soni; Prime Movers and Fluid machines; EDD notes.

TB2: S. S. Deshmukh & M. S. Soni; Laboratory manual for prime movers and fluid machines; EDD notes.

Reference Books:

RB1: Jagdish lal; Hydraulic Machines; Metropolitan Book Company Private limited, New Delhi; 1975; 6th Edition.

RB2: Kadambi V & Manohar Prasad; An Introduction to Energy Conversion Volume III; New Age International (P) limited; 1977.

RB3: Agarwall S K; Fluid Mechanics and Machinery; Tata McGrawhill publishing company limited, New Delhi; 1997.

3. Course plan:

Lect Nos.	Learning Objectives	Topics to be covered	Reference
1-3	Introduction to the course, To review the basic concepts of fluid mechanics and machinery. To understand the classification of hydraulic turbines; principles of analysis.	Introduction, Elements of a Hydroelectric Power Plant, Classification of Turbines, Head and Efficiencies of a Turbine, Energy Conversion, Fundamental Equation of Hydraulic Machines	Chapter 2 TB1 Section 2.1 to 2.6
4 -7	To understand the analytical principles of various hydraulic turbines.	Pelton Turbine, Francis Turbine, Axial Flow Turbines, Kaplan Turbine, Governing of Water Turbines, Characteristics of Turbines, Selection of Turbines	Chapter 2 TB1 Section 2.7 to 2.13
8- 10	To understand the classification of pumps, working principles of various pumps, Analysis of reciprocating pumps.	Introduction; reciprocating pumps, Classification, Slip, Velocity and Acceleration of Water in Suction and Delivery Pipes, Indicator Diagram, Effect of Acceleration Head, Effect of Pipe Friction, Limitation on Maximum Speed of Reciprocating Pump, Air Vessels, Effect of Air Vessel, Work Saved with Air Vessel	Chapter 3 TB1 Section 3.1 and 3.2
11- 12	To understand the analytical principles of centrifugal pumps	Classification, Fundamental Equation, Curvature of Blades, Variation in Speed and Diameter of a Centrifugal Pump, Characteristics of a Centrifugal Pump	Chapter 3 TB1 Section 3.3
13	To understand classification; working & analytical principles of various compressors.	Introduction; classification; reciprocating compressors; Multi stage compression with inter cooling	Chapter 4 of TB1; Section 4.1 to 4.3
14-15	To understand the analytical principles of centrifugal compressors	Velocity Triangles , Slip , Influence of Impeller Blade Shape, Stagnation Values in Centrifugal Compressor, Pressure Coefficient, Rothalpy, Surging and Stalling, Centrifugal Compressor Characteristics,	Chapter 4 of TB1; Section 4.4
16-17	To understand the analytical principles of Axial flow compressors and various other compressors	Cascade Flow and Nomenclature, Velocity Triangles, Work Done and Degree of Reaction, Effect of Axial velocity on Work, Degree of Reaction, Small Stage or Polytropic Efficiency, Stage Loading	Chapter 4 of TB1; Section 4.5 to 4.6

Lect Nos.	Learning Objectives	Topics to be covered	Reference
		Coefficient , Surging, Stalling and Rotating Stall, Axial Compressor Characteristics	
18	To understand thermodynamic and analytical principles behind the flow of fluids through nozzles and blade passages.	Introduction, Flow of Steam Through Nozzles , Critical Pressure Ratio And Maximum Discharge , Expansion of Steam Considering Friction (Nozzle Efficiency), Supersaturated or Meta Stable Flow of Steam in Nozzle;	Chapter 5 of TB1; Section 5.1 to 5.5
19-21	To understand the classification of steam turbines and basic principles of analysis.	Introduction, Classification of Steam Turbines, Impulse Turbine, Reaction Turbine (Impulse Reaction Turbine), Stage Efficiency, Turbine Efficiency and Reheat Factor, Losses in Steam Turbines:, Governing of Steam Turbines	Chapter 7 of TB1; Section 7.1 to 7.7
22-25	To understand classification; working & analytical principles of gas turbines.	Introduction, Elementary Design of a turbine, Off Design Parameters, Three Dimensional Flows, Gas Turbine Blading; numerical problems.	Chapter 6 of TB1; Section 6.1 to 6.5
26	To understand Dimensional analysis as applied to fluid machines.	Dimensional Analysis, Dimensionless Numbers, Similarity, Unit Quantities, Specific Quantities, Dimensional Analysis for Rotating Systems, Model Testing of Turbines and Pumps	Chapter 1 of TB1 Section 1.1 to 1.9

Numerical problems on the above topics will be discussed in tutorial class.

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	Remarks
Mid Sem	90 min	30%	16/3 9:00 - 10:30 AM	OB
Tutorial Tests	50 min.	5%	Tut hour	Surprise in nature. Closed Book*
Lab Compre	2 hrs	10%	Announced later	CB
Lab Reports		10%		
Lab Group Discussion/Viva		10%		
Compre	3 hours	35%	7/5 FN	CB

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

7. Notices: All the notices related to this course will be put up in Mechanical Engineering Department notice board only.

8. Make up Policy: Make up will be given to only to genuine cases. The request application should reach the Instructor – in – charge before commencement of scheduled test.

9. Laboratory Experiments: Following is the final list of experiments.

Cycle 1:

1. Performance test on Petrol Engine.
2. Valve Timing Diagrams.
3. Performance test on VCR Engine.
4. Characteristics of Centrifugal Pump.
5. Performance test on Air Compressor.
6. Verification of Fan Laws.

Cycle 2:

1. Characteristics of Pelton Turbine.
2. Characteristics of Francis Turbine.
3. Characteristics of Kaplan Turbine.
4. Coordinating Fuel Research Engine.
5. Study of Steam Boilers and Steam Turbines.
6. Performance test on Petrol Engine with eddy current dynamometer.

Instructor – in Charge
ME F341