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**FIRST SEMESTER 2022-2023**

# *Course Handout Part II*

**Date: 01/09/2022**

In addition to Part-I (a general handout for all the courses appended in the time table) this portion gives further specific details regarding the course.

*Course No.* : ME G514

## Course Title : TURBOMACHINERY

## Instructor-in-Charge : JEEVAN JAIDI

## Lab Instructors : Jeevan Jaidi, N. Jalaiah, G Prashanth Kumar Reddy

1. **Course Description:**

Introduction, thermodynamics, gas turbine plants, steam turbine plants, fluid dynamics, dimensional analysis and performance parameters, flow through cascades, axial turbine stages, high temperature turbine stages, axial compressor stages, centrifugal compressor stages, radial turbine stages, axial fans and propellers, centrifugal fans and blowers, and wind turbines.

1. **Scope and Objective:**

The broad objective of this course is to introduce and familiarize students with various elements of turbomachinery. The course mainly aims at giving analytical treatment to various turbomachines (pumps, compressors, fans, blowers and turbines), which will help to understand practical situations at the design stage as well as during their operations.

1. **Text Book (TB):**
2. TB1: B. K. Venkanna, *Fundamentals of Turbomachinery*, PHI Learning Pvt Ltd. 2012.
3. **Reference Book (RB):**
4. RB1: B. U. Pai, *Turbomachines*, Wiley India Pvt. Ltd., 1st edition, 2013.
5. RB2: S. L. Dixon, and C. A. Hall, *Fluid Mechanics and Thermodynamics of Turbomachinery*, Elsevier, 6th edition, 2010.
6. RB3: Rama S.R. Gorla, Aijaz A. Khan, *Turbomachinery: Design and Theory*, CRC Press, 2003.
7. RB4: Budugur Lakshminarayana, *Fluid Dynamics and Heat Transfer of Turbomachinery*, John Wiley & Sons, 1995.
8. **Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| *Lecture No.* | *Learning*  *objectives* | *Topics*  *to be covered* | *Chapter/*  *Section* |
| 1-7 | Introduction to principles of thermodynamics and fluid mechanics, types of turbomachines, gas turbine plants and steam turbine plants | Introduction, comparison between PDM and TM, types of TM, basic laws and equations, dimensional analysis, model parameters and their significance, unit quantities | TB: Ch. 1 |
| 8-12 | Energy transfer in turbomachines | Euler equation, components of energy transfer, degree of reaction, utilization factor, velocity triangles, analysis of turbomachines | TB: Ch. 2 |
| 13-20 | Operation principle and key parameters of centrifugal compressors and pumps | Working principle, main parts, work done and pressure rise, influence of key parameters and surging, work done analysis | TB: Ch. 4 |
| 21-25 | Operation principle and key parameters of axial flow compressors | Principle of operation T-E diagram, influence of key parameters, combined velocity analysis, work done analysis | TB: Ch.5 |
| 26-32 | Operation principle and key parameters of steam and gas turbines | Principle of operation, method of compounding velocity triangle analysis, multi-stage analysis | TB: Ch. 6 |
| 33-38 | Operation principle and key parameters of hydraulic turbines | Classification, main components, unit quantities, velocity triangles, work done and efficiencies, draft tube, comparison of hydraulic turbines | TB: Ch. 7 |
| 39-40 | Operation principle and key parameters of wind turbines | Principle of operation, classification blade design, siting constraints, maintenance issues | Class notes |

1. **Evaluation Scheme:**

|  |  |  |  |
| --- | --- | --- | --- |
| *Component* | *Weightage (%)* | *Duration (min.)* | *Date & Time* |
| Midsem | 20 | 90 | Closed book;  05/11 1.30 - 3.00PM |
| Lab Experiments (#12) with Reports and Vivas (#2) | 25 (= 15+10) | – | Open book:  Evenly spaced throughout the semester |
| Project Seminars (Mid- and End-sem) | 15 | – | Open book:  Evenly spaced throughout the semester |
| Comprehensive Examination | 40 | 180 | Closed book:  30/12 AN |

1. **List of Experiments:**

|  |  |  |
| --- | --- | --- |
| *Sr. No.* | *Name of Experiment* | *Laboratory* |
| 1. | Performance Study of Centrifugal Pump in Series and Parallel Arrangements | Hydraulic Machines |
| 2. | Performance Study of  Submersible Pump Test Rig | Hydraulic Machines |
| 3. | Centrifugal Blower with Constant and Variable Speeds (Radial Curved Blades) | Hydraulic Machines |
| 4. | Centrifugal Blower with Variable Speed (Forward and Backward Curved Blades) | Hydraulic Machines |
| 5. | Centrifugal Blower with Constant Speed (Forward and Backward Curved Blades) | Hydraulic Machines |
| 6. | Performance Study of Axial Fan | Hydraulic Machines |
| 7. | Performance Study of Francis Turbine | IC Engines |
| 8. | Performance Study of Kaplan Turbine | IC Engines |
| 9. | Performance Study of Pelton Wheel | IC Engines |
| 10. | Steam Power Plant Test Rig; (a) Boiler Efficiency (b) Plant Efficiency (c) Heat Balance Sheet | IC Engines |
| 11. |
| 12. |

1. **Chamber Consultation Hour:**

To be announced in the class.

1. **Notices:**

All notices concerning this course will be displayed in *CMS (institute’s web-based Course Management System)*. Students are advised to visit *CMS* regularly for all notices and updates.

1. **Make-up Policy:**

Make-up request for tests shall be granted only for the *genuine* case with sufficient evidence. Request letter duly signed by the student must reach the undersigned at least one day before the scheduled test.

1. **Academic Integrity Policy:**

It is expected that in compliance with institute rules and regulations, academic integrity should be adhered to in all the evaluation components. No type of academic dishonesty is acceptable and malpractice in any form will have serious implications.

**INSTRUCTOR-IN-CHARGE (ME G514)**