Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST/ ~~SECOND~~ SEMESTER 2023-2024

Course Handout Part II

Date: 11-08-2023

In addition to part I (general handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course no	:	MEF217
Course title	:	APPLIED THERMODYNAMICS
Instructor in charge	:	MORAPAKALA SRINIVAS
Tutorial Instructors	:	R Parameshwaran, Shine jude hamilton , M. Srinivas, Santanu Prasad Datta, Shaik Gouse Ahammad, KRC Murthy
Practical Instructors	:	Joshua Kumar Saladi, K Monika, S S Deshmukh, Meduri Sitaram, Shaik Gouse Ahammad, Satish K Dubey, Shine jude Hamilton, Sibin V Mathew,

1. Course Description

Thermodynamics relations, gas and vapor cycles, combined power generation cycles, gas mixtures, refrigeration cycles, psychometrics and heat load calculations, gas turbine cycles, compressors, boilers, and accessories; Experiments related to applied thermodynamics and fluid mechanics courses.

2. Scope and objective

The course is an extension of the classical thermodynamics learnt earlier and is intended to learn how to apply the thermodynamics principles to several thermal systems mechanical engineers come across. The classical and state-of-the art aspects required to design and analyze different power producing, power absorbing and allied systems would be discussed in the course. The broad topics include gas & vapor power cycles, combined power generation cycles, gas turbine cycles, refrigeration cycles, psychrometry & basic air conditioning concepts, thermodynamic relations, gas mixtures besides other supplementary topics required to understand these. The theory learnt is complimented by experiments related to applied thermodynamics and fluid mechanics. At the end of the course the student would be able to apply the principles learnt to design and analyze different thermal systems using thermodynamics principles.

3. Text book

1. Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu, Thermodynamics – An Engineering Approach, 9th Edition, McGrawhill India, 2019

4. Reference books

1. P.K. Nag, “Engineering Thermodynamics” – Tata McGraw-Hill Publishing Company Ltd., 4th Ed., 2008
2. T. D. Eastop & A. McConkey, “Applied Thermodynamics” – Pearson Education, 5th Ed., 2008.
3. Claus Borgnakke & Richard E. Sonntag, “Fundamentals of Thermodynamics”, John Wiley & Sons, 7th Ed., 2009.

5. Course plan

Lecture	Learning objective	Topics to be covered	Chapter in the Text Book
1	Reviewing of basic concepts	Importance of thermodynamics and its applications, review of first and second law concepts, heat engines and refrigeration systems	Excerpts from 1-8
2-8	Understand and analyse	Basic considerations and assumptions, Otto cycle,	9

	Gas power cycles	Diesel cycle, Stirling and Ericsson cycles, Brayton cycle – simple, with Intercooling, reheating and regeneration	
9-17	Understand and analyse Vapor power cycles	Carnot vapor and Ideal Rankine cycle, Actual vapor cycle, Reheat, Regenerative Rankine cycles, Co-generation, combined gas-vapor power cycles	10

Lecture	Learning objective	Topics to be covered	Chapter in the Text Book
18-22	Understand and analyse Refrigeration cycles	Refrigerators and heat pumps, reversed Carnot cycle, Ideal and actual vapour compression refrigeration cycles, Gas refrigeration cycles, Absorption refrigeration systems	11
23-25	Understand the basic concepts of Gas mixtures	Gas mixtures: Composition, P-v-T behavior, properties of ideal and real gases	13
26-20	Apply Gas-vapor mixtures concepts to air conditioning processes	Dry and atmospheric air, Specific and relative humidity of air, Dew point, adiabatic saturation and wet bulb temperatures, Human comfort and air conditioning, air conditioning processes	14
31-34	Understand the Thermodynamic aspects of Gas compressors	Single-stage and Multi-Stage Compression, Volumetric efficiency. Rotary compressor	Class notes & Chapter 18 in RB1
35-39	Understand and use Thermodynamics property relations	Quick review of partial derivatives, Maxwell relations, the Claypeyron equation, relations for changes in IE, enthalpy, entropy, specific heat relations, Joule-Thomson coefficient, relations for real gases	12
40-42	Understand the thermodynamic aspects behind working of Boilers and accessories	Boiler classification, Functions, Nomenclature, Mountings and accessories, Circulation	Class notes

List of Experiments:

1. Calibrating the venturi meter and orifice meter
2. Estimating the frictional loss in a pipe flow
3. Estimating the losses due to various pipe fittings
4. Estimating the force exerted when a jet imping a flat and curved plates
5. Verification of Bernoulli's theorem
6. Study and Performance test on Vapor Compression Refrigeration System.
7. Study and Performance test on Vapor Absorption Refrigeration System
8. Study and Performance test on Heat Pump Test Rig
9. Study and Performance test on Window A/C Test Rig
10. Study and Performance test on Reciprocating Compressor Test Rig
11. Study experiment on Steam Power Plant
12. Study experiment on Air-pre conditioner to mimic different psychrometric conditions

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid semester Test	90 Minutes	30	13/10 - 2.00 - 3.30PM	CB
Surprize tests/quizzes*	10 Minutes	10	Surprise in nature. See the footnote for details	OB
Lab work@	Take home	20	See the footnote for details	OB
Comprehensive Examination	180 Minutes	40	19/12 FN	CB

* Shall be conducted in Tutorial classes. Best 4 out of 6 will be considered. Other details would be communicated separately.
@ Lab work consists of reports (for every experiment) and viva or quiz (at appropriate intervals), with 10% weightage each. Other

details would be communicated separately.

Chamber Consultation Hour: To be announced in the class.

Notices: All notices concerning this course shall be displayed on the CMS (the Institute's web based course management system). Students are advised to visit regularly CMS for latest updates.

Make-up Policy: Make-up shall be given only to the genuine cases with prior confirmation. Request for the make-up tests, duly signed
by the students, should reach the under signed well before the scheduled test.

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