



# Birla Institute of Technology & Science, Pilani

## Hyderabad Campus

FIRST/ SECOND SEMESTER 2022-2023

Course Handout Part II

Date: 29-08-2022

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 : M Srinivas, Satish K Dubey, B Sravya, S Prudhvi Raj, R Naresh, Shaik Gouse Ahammad  
Practical Instructors : M Srinivas, B Sravya, Satish K Dubey, Shaik Gouse Ahammad, N Jalaiah, Meduri Sitaram

### 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	Introduction and review 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	Gas power cycles	Basic considerations and assumptions, Otto cycle, Diesel cycle, Stirling and Ericsson cycles, Brayton cycle – simple, with Intercooling, reheating and regeneration	9
9-17	Vapor power cycles	Carnot vapor and Ideal Rankine cycle, Actual vapor cycle, Reheat, Regenerative Rankine cycles, Co-generation, combined gas-vapor power cycles	10
18-22	Refrigeration cycles	Refrigerators and heat pumps, reversed Carnot cycle,	11



Lecture	Learning objective	Topics to be covered	Chapter in the Text Book
		Ideal and actual vapour compression refrigeration cycles, Gas refrigeration cycles, Absorption refrigeration systems	
23-25	Gas mixtures	Gas mixtures: Composition, P-v-T behavior, properties of ideal and real gases	13
26-20	Gas-vapor mixtures and air conditioning principles	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	Gas compressors	Single-stage and Multi-Stage Compression, Volumetric efficiency. Rotary compressor	Class notes & Chapter 18 in RB1
35-39	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	Boilers and accessories	Boiler classification, Functions, Nomenclature, Mountings and accessories, Circulation	Class notes

#### List of Experiments:

- Calibrating the venturi meter and orifice meter
- Estimating the frictional loss in a pipe flow
- Estimating the losses due to various pipe fittings
- Estimating the force exerted when a jet imping a flat and curved plates
- Verification of Bernoulli's theorem
- Study and Performance test on Vapor Compression Refrigeration System.
- Study and Performance test on Ice Plant Test Rig
- Study and Performance test on Vapor Absorption Refrigeration System
- Study and Performance test on Heat Pump Test Rig
- Study and Performance test on Window A/C Test Rig
- Study and Performance test on Steam Power Plant
- Study and Performance test on Reciprocating Compressor Test Rig

#### Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid semester Test	90 Minutes	30	05/11 9.00 - 10.30AM	CB
Surprise 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	30/12 FN	CB

\* Shall be conducted either in Tutorial or lecture classes. Best 5 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**

