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**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.

1. **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.

1. **Text book**
2. **John Twidell, Anthony D. Weir, "Renewable energy resources", Second Edition, Taylor & Francis, NY, 2006(TB1) John Twidell, Anthony D. Weir, "Renewable energy resources", Second Edition, Taylor & Francis, NY, 2006.  
   (TB2) Aldo V. Da Rosa, "Fundamentals of Renewable Energy Processes", 2nd Edition, Academic Press (an Imprint of Elsevier), MA, USA, 2009.**Yunus A. Cengel, Michael A. Boles, [Mehmet Kanoglu](https://www.amazon.in/s/ref=dp_byline_sr_book_3?ie=UTF8&field-author=Mehmet+Kanoglu&search-alias=stripbooks), Thermodynamics – An Engineering Approach, 9th Edition, McGrawhill India, 2019
3. **2.John.D.HoesReference books**
4. P.K. Nag, “Engineering Thermodynamics” – Tata McGraw-Hill Publishing Company Ltd., 4th Ed., 2008
5. T. D. Eastop & A. McConkey, “Applied Thermodynamics” – Pearson Education, 5th Ed., 2008.
6. Claus Borgnakke & Richard E. Sonntag, “Fundamentals of Thermodynamics”, John Wiley & Sons, 7th Ed., 2009.
7. **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, Ideal and actual vapour compression refrigeration cycles, Gas refrigeration cycles, Absorption refrigeration systems | 11 |
| 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:**

* 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 Ice Plant Test Rig
  8. Study and Performance test on Vapor Absorption Refrigeration System
  9. Study and Performance test on Heat Pump Test Rig
  10. Study and Performance test on Window A/C Test Rig
  11. Study and Performance test on Steam Power Plant
  12. 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 |
| 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 | 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**