

FIRST SEMESTER 2019 - 2020

(COURSE HANDOUT PART II)

Date: 01/08/2019

In addition to part-I (general handout for all courses in the timetable), this handout provides the specific details regarding the course.

**Course No.**: ME F214 / MF F214

**Course Title**: APPLIED THERMODYNAMICS

**Instructor-in-charge**: SATISH KUMAR DUBEY

**Instructor(s)**: R Naresh , Sama.Sanghamitra, A. Uday Kumar.

**1. Course Description**: Availability and irreversibility, Thermodynamic relations, Compressible flow, Ideal gas and vapour cycles, Combined power generation cycles, gas mixtures, Refrigeration cycles, Psychrometrics and introduction to heat load calculations, Gas turbine cycles, Compressors, Boilers and accessories.

**2. Scope and Objective:** This course is designed to acquaint the students with the thermodynamics of power developing and power absorbing machines. The course discusses about gas and vapour cycles, combined power generation cycles, refrigeration cycles, psychrometry and basic air conditioning concepts, gas turbine cycles. It also focuses on thermodynamic relations, gas mixtures, exergy and gas dynamics fundamentals.

**3. Text Book**:

**P.K. Nag**, “*Engineering Thermodynamics*” – Tata McGraw-Hill Publishing Company Ltd., 4th Ed., 2008.

**Reference Books**:

1. **T. D. Eastop & A. McConkey**, “*Applied Thermodynamics*” – Pearson Education, 5th Ed., 2008.
2. **Rayner J.**, “*Basic Engineering Thermodynamics*” – Pearson Education, 5th Ed., 2008.
3. **Claus Borgnakke & Richard E. Sonntag**, “*Fundamentals of Thermodynamics*”, John Wiley & Sons, 7th Ed., 2009.

**4. Course Plan**:

| **Lecture Nos.** | **Learning Objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| --- | --- | --- | --- |
| 1-4 | Availability & Irreversibility | Maximum work in a reversible process, Dead state, Availability and its balance, Second law efficiency | 8 |
| 5-11 | Vapour Power Cycles | Rankine cycle, Actual vapour cycle and comparison with Carnot cycle, Mean temperature of heat addition, Reheat cycle, Regenerative cycle, Feed water heaters, Exergy analysis, Binary vapour cycles, Process heat and by-product power, Efficiencies in steam power plant | 12 |
| 12-18 | Gas Power Cycles & Propulsion | Stirling, Ericsson, Otto, Diesel, Dual cycle, Comparison, Brayton cycle, Combined cycles and Aircraft propulsion | 13 |
| 19-22 | Gas Compressors | Single-stage and Multi-Stage Compression, Volumetric efficiency. Rotary compressor | 18 |
| 23-28 | Refrigeration Cycles | Reversed Heat Engine Cycle, Vapor Compression Cycle, Absorption Cycle, Heat pump system, Gas cycle refrigeration, Liquefaction of gases | 14 |
| 29-33 | Psychrometrics | Properties of air, Psychrometry chart, Psychrometric processes | 15 |
| 34-38 | Compressible Fluid Flow | Stagnation properties, 1-D steady isentropic flow, Normal shocks, Adiabatic flow with friction, Diabatic flow without friction | 17 |
| 39-40 | Boilers and Accessories | Boiler classification, Functions, Nomenclature, Mountings and accessories, Circulation | Class notes |
| 41-42 | Thermodynamic Relations & Gas mixtures | Maxwell’s equations, Energy equation, Joule-Kelvin effect, Clausius-Clapeyron equation, Dalton’s law of partial pressures | 11.1 – 11.8 & 10.8 |

**5. Evaluation Scheme**:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Evaluation Component | **Duration**  **(minute)** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Tutorial Test# | – | 20 | During Tutorial hours | **OB** |
| Quiz# | - | 10 | During lecture hours | CB |
| Mid Semester Test# | 90 | 25 | 13/12 FN | CB |
| Comprehensive Exam# | 180 | 45 | 5/10, 9.00 -- 10.30 AM | CB |

**NOTE:**

# EDD Notes on Thermodynamics Tables and Psychrometric Chart are allowed to use during the tests. However, they should not be defaced by writing formula, equations, etc.

**6. Chamber Consultation Hour**: To be announced in the class room.

**7. Notices**: All notices concerning this course shall be displayed on the Mechanical Engineering Notice Board. Students are advised also to visit regularly **CMS** (institute’s web based course management system) for updates on the course matters.

**8. Make-up Policy**: Make-up shall be given only to the genuine cases with prior intimation. No make-up will be given for the surprise tests. Surprise tests shall be conducted in either *lecture class* or *tutorial class*.

**9. 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**

**ME F214 / MF F214**