SECOND SEMESTER 2015-16

Course Handout (Part – II)

Date: 06/01/2016

In addition to Part I (General handout for all course appended to timetable), this portion gives further specific details regarding the course.

Course No.	:	BITS F111
Course Title	:	Thermodynamics
Instructor-in-Charge	:	**Sachin U Belgamwar**
Team of Instructors	:	Bharti Khungar, Bibhas Ranjan Sarkar, Indresh Kumar, Jitendra S Rathore, Kapil Dev, Madhukar Mishra, MS Soni, Murali Palla, Navin Singh , Nikhil Gakkhar, Nilesh Purohit , Priya C Sande, Rajesh Kumar, RamKinkar Roy, Ravi Inder Singh, Sanjiv Jakhar, Sharad Srivastava, Shyam Sundar Yadav, Srinivas Appari, Utkarsh Maheshwari

1. Course Description

Concepts and laws of thermodynamics; thermodynamic properties; applications to closed and open systems; entropy and entropy generation; availability.

2. Scope and Objective

Thermodynamics deals with energy, matter, and the laws governing their interactions. It is essential to learn its usefulness in the design of processes, devices, and systems involving effective utilization of energy and matter. The course emphasizes on the fundamentals and concepts of the laws of thermodynamics as applied to control mass and control volume systems. Irreversibility and availability are powerful tools in the design of thermodynamic systems.

3. Text book (TB):

Sonntag R.E. and Borgnakke C., "Fundamentals of Thermodynamics", John Wiley & Sons, 2009, 7th ed.

Booklet on Thermodynamic Tables, Figures & Charts Notes EDD - 2007

4. Reference books (RB):

Çengel Y.A. and Boles M.A., "Thermodynamics: an engineering approach", Tata Mcgraw-Hill, 2010, 6th ed.

5. Course Plan

Lecture No.	Learning Objectives	Topics to be covered	Text book Chap/Sec #
1-2	Some concepts & definitions	Introduction, thermodynamic systems, properties & state, process & cycle, force, energy, pressure, specific volume, zeroth law.	2

3-4	Properties of pure substances	Phase equilibrium, independent properties, and equations of state, compressibility factor.	3.1-3.3,3.6, 3.7
5-6	Properties of pure substances	Tables of thermodynamic properties & their use. Thermodynamic surfaces	3.4, 3.5
7	Work and heat	Definition of work and its identification, work done at the moving boundary	4.1, 4.2, 4.3,4.5
8	Work and heat	Concept of heat, comparison of heat and work, Engineering Applications	4.6, 4.8, 4.9
9-10	First law for control mass	First law for a cycle as well as for a change of state; internal energy & enthalpy	5.1-5.5
11-12	First law for control mass	Specific heats; internal energy, enthalpy & specific heat of ideal gases; first law as a rate equation; problem analysis & solution technique, Engineering Applications	5.6-5.8, 5.10
13-15	First law for control volume	Conservation of mass in control volume; first law for control volume; SS process; examples of SS processes	6.1-6.4
16	First law for control volume	Transient processes; examples, Engineering Applications	6.4- 6.6
17-21	Second Law of Thermodynamics	Limitations of first law & need for the second law; Reversible process; heat engine, heat pump, refrigerator; Carnot cycle; Two prepositions regarding efficiency of Carnot cycle; energy-conversion efficiency and COP, Kelvin-Planck & Clausius statements, Thermodynamic temperature scale, The ideal gas Carnot Cycle, Engineering Applications	7.1 – 7.10
22-28	Entropy	The inequality of Clausius, Concept of entropy; the Need of entropy definition of entropy; entropy of a pure substance; entropy change of a reversible & irreversible processes; principle of increase of entropy, thermodynamic property relation; problem analysis & solution techniques etc.	8.1-8.13
29-30	Second law for control volume	Second law for control volume; SS & Transient processes; SSSF process; principle of increase of entropy	9.1-9.4
31-32	Second law for control volume	Understanding efficiency and related problems; problem analysis & solution technique, Engineering Applications	9.5
33-37	Irreversibility and availability	Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency, Exergy balance equation, Engg Applications	10.1 – 10.4
38	Thermodynamic relations	Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, generalized chart for enthalpy and entropy change, developing tables of property from experimental data	14.1 – 14.5, 14.7-14.9

Evaluation Scheme

Evaluation Component	Duration	Marks	Date and Time	Nature of Component
Mid Sem	90 min	90	15/3 11:00 - 12:30 PM	OB
Tutorials		60	Surprise in nature	
Quiz (online)		30	Announced	
Comprehensive Examination	180 min	120	5/5 AN	CB

Note: Booklet on "Thermodynamic Tables, Figures & Charts", as prescribed, will be allowed in the closed book tests also. However, **it should not be defaced by writing any formula, equations, etc.**

Chamber consultation hours: To be announced by the respective instructors.

Notices: All notices concerning the course will be displayed on the **FD-II notice board only**.

Make-up: No make-up will be given for tutorial tests and quiz; Make-up request for the midsem is to be forwarded through the respective tutorial section instructor only.

Dr. Sachin U Belgamwar
Instructor–in-Charge
BITS F111