BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI- HYDERABAD CAMPUS
INSTRUCTION DIVISION, FIRST SEMESTER 2016-2017
<u>(COURSE HANDOUT PART II)</u>

Date: 02/08/2016

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

Course No.: **BITS F111**

Course Title: **THERMODYNAMICS**

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

Instructors: Kharthik Chetan, KRC Murthy, Ramsankar V, Supradeepan K**,** S Aparna

1. **Course Description**: Concepts and laws of thermodynamics, macroscopic thermodynamic properties, application to closed and open systems, microscopic approach to entropy, equations of state, thermodynamics of non reacting mixtures.

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**:

   • Claus Borgnakke,&Richard E. Sonntag, "Fundamentals of Thermodynamics", John Wiley& Sons, 2009, 7[th]Edition.

   • Mathur T.N.S., "Entropy & 2nd Law of Thermodynamics", Notes-EDD, 2006.

   • Adopted from book by Van Wylen& others "Thermodynamics Tables, Figures and Charts", Notes-EDD, 2007.

4. **Course Plan**:

Lecture Nos.	Learning Objectives	Topics to be covered	Chapter/ Section
1-3	To familiarize some concepts & definitions	Introduction, thermodynamic systems, properties & state, process & cycle, force, energy, pressure, specific volume, zeroth law.	1,2
4-5	To understand the properties of pure substances	Phase equilibrium, independent properties, equations of state, compressibility factor.	3.1 – 3.3, 3.6, 3.7
6-7	To understand the use of Thermodynamic Tables to get the properties of pure substances	Tables of thermodynamic properties & their use.	3.4
8-10	To understand the concepts behind thermodynamic work	Definition of work and its identification, work done at the moving boundary.	4.1 – 4.5
11-13	To understand the difference between the thermodynamic work and heat	Concept of heat, comparison of heat and work.	4.6 – 4.8
14-16	To understand the concepts behind the First law applied to control mass and formulation of equation of first law for control mass	First law for a cycle as well as for a change of state; internal energy & enthalpy; specific heats, internal energy, enthalpy & specific heat of ideal gases.	5.1 – 5.3, 5.5 – 5.7
17-18	To understand the process of application of first law equation to engineering problems	First law as a rate equation; problem analysis & solution technique, examples.	5.4 & 5.8
19-21	To understand the concepts behind the first law applied to control volume and formulation of equation of first law for control volume	Conservation of mass in control volume; first law for control volume; S.S. process; examples of S.S. processes, transient processes.	6.1 – 6.5
22	To understand the process of application of first law equation for control volume to engineering problems	Problem analysis & solution technique; examples.	6.1 – 6.5
23-26	To understand the need for Second Law of	Limitations of first law & need for the second law;	7.1 – 7.5,

Lecture Nos.	Learning Objectives	Topics to be covered	Chapter/ Section
	Thermodynamics and its basic concepts	reversible process; heat engine, heat pump, refrigerator; Carnot cycle; energy-conversion efficiency and COP, Kelvin-Planck &Clausius statements, The ideal gas Carnot cycle, the thermodynamic temperature scale.	7.7 – 7.9
27-30	To understand the physical principles behind entropy and formulation of second law for control mass	Concept of entropy; the need and 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 technique.	8.1 – 8.12
31-34	To understand the formulation of second law for control volume	Second law for control volume; S.S. &transient processes; reversible S.S.S.F. process; principle of increase of entropy	9.1 – 9.4
35-36	To understand the process of application of second law for control volume to engineering problems	Understanding efficiency and related problems; problem analysis & solution technique.	9.5
37-49	To understand the physical principles behind Irreversibility and availability	Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency.	10.1 – 10.4
40	To understand the thermodynamic considerations of non-reacting mixtures	General considerations and mixtures of ideal gases	13.1
41-42	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

5.   **Evaluation Scheme**:

Evaluation Component	Duration	Weightage (%)	Date &Time	Nature of Component
Test-1	60 min	20%	9/9: 2.30-3.30 Pm	CB
Test-2	60 min	20%	24/10: 2.30-3.30 Pm	OB
Tutorial Test	20	20%	Distributed and Surprise During Tutorial Hours	CB
Comprehensive Exam	3 hours	40%	5/12 FN	CB

NOTE: EDD Notes on "Thermodynamics Tables, Figures and Charts" will be allowed in the closed book tests also. However, it should not be defaced by writing formula, equations, etc.

6.   **Chamber Consultation Hour**: To be announced by the respective instructors.

7.   **Notices**: All notices concerning this course will be displayed only on the **LTC notice board**.

Besides this, students are advised to visit regularly**CMS** (institute's web based course management system) for latest updates and notices

8.   **Make-up Policy**:Make-up for the tests shall be granted only for genuine cases. Requests for the make-up tests, duly forwarded by the respective tutorial section instructors, should reach the IC well before the tests. For cases related to illness, proper documentary evidence is essential. No make-up will be given to Assignments.

Instructors
BITS F111