Fundamental of Thermodynamics and Heat

BEG 149 ME

YEAR: I **SEMESTER: II**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
3	2/2	1	1.5	40	-	-	10	25	75

Course Objectives: To provide the students with a basic understanding and norms of Thermodynamics and Heat Transfer

Course Content:

1.0 Basic Concepts **(2 Hrs)**

1.1 The nature of Thermodynamics
1.2 Social value of energy
1.3 Application of energy balance approach in engineering
1.4 Work and heat transfer

2. Energy and Energy Transfer **(4 Hrs)**

2.1 The meaning of energy and energy transfer
Thermodynamic systems: boundary of closed, heterogeneous, homogeneous, isolated
2.2 Thermodynamic equilibrium and quasi-static process
2.3 Thermodynamic properties, state and process
2.4 Energy transfer as heat and work

3.0 Properties of Pure Substances (Steam): **(3 Hrs)**

3.1 Pure substances, phase and wet steam (Two phase mixture)
3.2 Thermodynamic properties: Specific Volume, internal energy, enthalpy, entropy and specific heats
3.3 Common process: Throttling, Isothermal and Isobaric
3.4 Common diagram for a pure substance: P-V, P-T, T-S, H-S or mollier
3.5 Steam Tables, Quality or Dryness fraction and measurement of stream quality

4.0 First Law of Thermodynamics and Its Applications: **(8 Hrs)**

4.1 Definitions and law of conservation of energy
4.2 Application of the law to a closed system (Non-flow process)
4.3 Application of the first law of Thermodynamics to some common process:
Constant Volume, Adiabatic, Reversible Polytropic, Constant Pressure, Constant Internal Energy.
4.4 Steady flow process
4.5 Application of the first law to open system (General Energy Equation)
4.6 Energy of an isolated system
4.7 Perpetual Motion Machine of the kind PMM I

5.0 Second Law of Thermodynamics and Entropy: **(4 Hrs)**

5.1 Statements of second law: Clausius, Kelvin-Plank, Principle of degradation of Energy, Principles of increase of entropy
5.2 The principles and properties of Entropy
5.3 Entropy and disorder, Absolute entropy and Entropy balance in open and closed system.
5.4 Reversible and Irreversible processes
5.5 Consequences of the second law and isentropic process
5.6 Carnot cycle and its efficiency

6.0 Thermodynamic Power Cycles, Refrigeration and Air Conditioning **(5 Hrs)**

6.1 Heat engine cycles
6.2 External heat transfer cycles
6.3 Rankine cycles and Modified Rankine cycle
6.4 Air standard cycles: Air standard ottocycle, Diesel cycle and dual cycle
6.5 Refrigeration, air-conditioning and heat pump cycles
6.6 Psychometric chart and process

7.0 Introduction to Engineering Heat Transfer: **(4 Hrs)**

7.1 Basic concepts and modes of heat transfer
7.2 The common laws of heat transfer: Fourier's Law, Newton's law and Stefan – Boltzmann law
7.3 Conduction: Critical insulation thickness of pipes, R values and electric analogies; Overall coefficient

Laboratories:

Six laboratory exercises will be performed in this course. These are:

(i.) Pressure and Temperature measurement
(ii.) Experiment on compression and expansion of gases
(iii.) Heat conduction and convection
(iv.) Operation of refrigeration or heat pump
(v.) Performance of small I-C engine
(vi.) Experiment on Thermal radiation

Tutorials:

a) Three assignments in each before first and second assessments.
b) Quiz before first and second assessments.

Refrences:

- "Fundamental of Engineering Thermodynamics", John R. Howell and Richard O. Buckius, Mc Graw Hill Publishers, 1987
- "Engineering Thermodynamics", Gupta C.P. and Prakash R., Nemchand & Broj, Roorkee 1991
- "Engineering Thermodynamics" Nag P.K., Tata Mc Graw Hill, New Delhi, Second Edition.
- "Engineering Heat Transfer",Gupta C.P. and Prakash R., Nemchand and Broj Roorkee, 1994.
- "Heat Transfer", J.P. Holman, Mc GrawHill, 1981.

- 6. “Heat Transfer – A Basic Approach” M.N. Ozicik Mc Graw Hill, 1985