BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2ME02: ENGINEERING THERMODYNAMICS
CREDITS - 3 (LTP:3,0,0)

Course Objective:

To apply laws of thermodynamics to thermal engineering problems.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Marks Distribution				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Topics	Teaching Hours
1	**Basic Concepts:** Microscopic & macroscopic point of view, thermodynamic system and control volume, thermodynamic properties, processes and cycles, Thermodynamic equilibrium, Quasi-static process, homogeneous and heterogeneous systems, zeroth law of thermodynamics and different types of thermometers.	04
2	**First Law of Thermodynamics:** First law for a closed system undergoing a cycle and change of state, energy, PMM1, first law of thermodynamics for steady flow process, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger and throttling process, unsteady flow energy equation, filling and emptying process.	04
3	**Second Law of Thermodynamics:** Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, PMM2, refrigerator and heat pump, causes of irreversibility, Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale.	05
4	**Entropy:** Clausius theorem, property of entropy, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy and its applications, entropy change for non-flow and flow processes, third law of thermodynamics.	04
5	**Availability, Irreversibility :** Available and unavailable energy, available energy referred to a cycle, availability in non-flow and steady flow systems, reversibility and Irreversibility.	05
6	**P-v, P-T , T-s and h-s diagrams for a pure substance**	03

Unit No.	Topics	Teaching Hours
7	Maxwell's equations, TDS equations, Difference in heat capacities, ratio of heat capacities, energy equation, Joule-Kelvin effect and Clausius-Clapeyron equation.	04
8	**Liquefaction of Gases:** Liquefaction, Linde Hampson system, Cloude System, Analysis.	03
9	**Properties of Gases and Gas Mixtures:** Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy; enthalpy and specific heat of a gas mixtures.	04
10	**Combustion of Fuels:** Combustion of air, combustion equations, minimum air requirement, excess air and air fuel ratio, wet and dry analysis of products of combustion, conversion of volumetric analysis by mass, Enthalpy of formation, Enthalpy of reaction, First law for reactive systems , Adiabatic flame temperature, Bomb calorimeter and Junker's gas calorimeter.	04
	Total	**42**

List of References:

1. P.K. Nag, "*Engineering Thermodynamics"*, Sixth Edition, McGraw-Hill Education.
2. Van Wylen and Sonntag, "*Fundamentals of Classical Thermodynamics*", Second Edition
3. Yunus Cengel & Boles, "*Thermodynamics – An Engineering Approach"*, Fourth Edition, McGraw-Hill Education ,
4. T D Eastop and A McConkey, "*Applied Thermodynamics*"
5. J P Holman, "*Thermodynamics"*, McGraw-Hill Education.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Apply first law of thermodynamics to thermal and fluid systems.
2. Interpret second law of thermodynamics, entropy, available energy and its applications.
3. Deduce thermodynamic relations.
4. Analyze Liquefaction systems.
5. Determine thermodynamic properties for non-reactive gas mixtures.
6. Analyze combustion process.