BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2PE02: ENGINEERING THERMODYNAMICS AND HEAT TRANSFER
CREDITS - 4 (LTP:3,1,0)

Course Objective:
To understand the basic concepts of engineering thermodynamics, first & second laws of thermodynamics and fundamentals of three modes of heat transfer: conduction, convection and radiation.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Engineering Thermodynamics:** Introduction, Thermodynamic Systems, Macroscopic and Microscopic points of view, Pure substance, Concept of continuum, Thermodynamic Equilibrium, Properties of systems, State, Process, Cycle, Point function, Path function, Temperature, Zeroth law of Thermodynamics, Reversible and Irreversible processes, Energy, work and heat, Quasi static process, Work Transfer-Displacement work, Electrical Work, Shaft work, Paddle wheel work and flow work, Heat transfer-Specific heat and Latent heat.	07
2	**First law of Thermodynamics:** First law of Thermodynamics, Application of First law to a process, Energy- a property of system, Control volume, Enthalpy, Application of First law of thermodynamics to closed system, Steady Flow Energy Equation, Engineering applications of Steady flow energy equation.	07
3	**Second law of Thermodynamics:** Limitations of First law, Introduction to Second law, Energy reservoirs, Heat engines, Heat pump and refrigerator, Kelvin-Plank and Clausius statements of second law, Equivalence of Kelvin-Plank and Clausius statements, Reversibility and Irreversibility, Carnot cycle, Carnot's theorem, Corollary of Carnot theorem, Efficiency of reversible heat engine, Entropy, Third law of thermodynamics.	07
4	**Introduction to Heat Transfer and Heat Conduction:** Modes of heat transfer, General laws of heat transfer, General heat conduction equation in Cartesian and Cylindrical coordinates, Heat conduction through plane and composite wall, Heat conduction through hollow and composite cylinders, Critical thickness of Insulation, Heat transfer from Extended Surfaces (Fins).	08

Unit No.	Topics	Teaching Hours
5	**Heat Convection:** **Forced Convection**: Laminar flow: Laminar flow over a flat plate, Laminar tube flow, Turbulent flow: Turbulent tube flow. **Free Convection**: Characteristic parameters in free convection, Momentum and Energy equation for laminar free convection, heat transfer on a flat plate, Integral equations for momentum and energy on a flat plate.	08
6	**Radiation:** Introduction, Surface emission properties, Absorptivity, Reflectivity and transmissivity, concept of black body, The Stefan Boltzmann law, Kirchoff's law, Planck's law, Wien displacement law.	05
	Total	**42**

List of References:

1. YunusCengel and Boles, *"Thermodynamics: An Engineering Approach*", Eight edition, Mc-Graw Hill education, 2014.
2. Borgnakke and Sonntag, "*Fundamentals of Thermodynamics*", Seventh edition, Wiley India Pvt. Ltd., 2008.
3. P. K. Nag, "*Engineering Thermodynamics*", Fifth edition, Mc-GrawHill education, 2013.
4. Er. R.K Rajput, "*A textbook of Engineering Thermodynamics*", Laxmi Publications.
5. Er. R.K Rajput, "*Heat and Mass Transfer*", S. Chand Publications.
6. Incropera and Dewitt, "*Fundamentals of Heat and Mass Transfer",* Seventh edition, Wiley India edition, 2011.
7. Cengel and Ghajar, "*Heat and Mass Transfer: Fundamental and Applications*", Fourth edition, Mc-Graw Hill education, 2011.
8. J. P. Holman, "*Heat Transfer*", Nineth edition, Mc-Graw Hill education, 2008.
9. S. P.Sukhatme, "*A Text book on Heat Transfer*", Fourth edition, University press, 2005.
10. P. K. Nag, "*Heat and Mass Transfer*", Third edition, Tata Mc-Graw Hill education, 2007.

Course Outcomes:

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

1. Learn basic concepts of engineering thermodynamics & apply laws of thermodynamics to various engineering systems.
2. Compare heat and work, and analyze heat engine, refrigerator and heat pump.
3. Understand various modes of heat transfer and analyze steady state and transient heat conduction in solids.
4. Investigate heat transfer by forced and natural convection.
5. Examine heat transfer by thermal radiation and evaluate combined modes of heat transfer in manufacturing processes.