BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2ME10: HEAT TRANSFER
CREDITS - 4 (LTP:3,0,1)

Course Objective:

To analyze heat transfer phenomena using fundamental laws of heat transfer.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Fundamentals:** General laws of heat transfer, modes of heat transfer, effect of temperature on thermal conductivity of different solids, liquids and gases,	03
2	**Conduction:** Fourier law, derivation of generalized heat conduction equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases, heat conduction through plane, cylinder, spheres, and composite walls, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient. Transient heat conduction: Lumped heat capacity analysis, time constant, types of fin, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin, Biot number, Estimation of error in temperature measurement in a thermometer well	11
3	**Convection:** Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, momentum and energy equations on flat plate for free convection and also its integral form of equations, thermal and hydrodynamic boundary layer, Blasius solution for laminar boundary layer, General solution of Von-Karman integral momentum equation, empirical correlations for free and forced convection	09
4	**Radiation:** Absorptivity, Reflectivity and Transmissivity, black, white and grey bodies, emissive power and emissivity, laws of radiation – Planck, Stefan-Boltzmann, Wein's displacement law, Kirchhoff's law, intensity of radiation and solid angle, Lambert's cosine law Radiation heat exchange between black bodies, shape factor, heat exchange between non-black bodies- infinite	08

Unit No.	Topics	Teaching Hours
	parallel planes and infinite long concentric cylinders, radiation shield, heat exchange between two gray surfaces, electrical analogy	
5	**Heat Exchangers:** Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, introduction of heat pipe and compact heat exchanger, TEMA standards.	07
6	**Boiling and condensation:** Introduction, general aspects of boiling heat transfer, pool boiling and its regimes, factors affecting nucleate boiling, boiling correlations, flow patterns in flow boiling. General aspects of condensations, film wise and drop wise condensations, Nusselt analysis.	04
	Total	**42**

List of References:

1. R K Rajput, "*Heat and Mass Transfer*", Revised Edition 3rd, S.Chand Publication, 2011.
2 Yunus Cengel, "*Heat and Mass Transfer: Fundamentals and Application*", 5th Edition, McGraw Hill, 2014.
3. P.K. Nag, "*Heat & Mass Transfer*", Revised Edition 3rd, McGraw Hill, 2011.
4. A. F. Mills and V.Ganesan, "*Heat Transfer*", 2nd Edition, Pearson Education, 2009.
5. J P Holman, "*Heat Transfer*", 10th Edition, McGraw Hill, 2009.
6. Dutta, Binay K, "*Heat Transfer: Principles and Applications*", 14th Edition, PHI Publication, 2015.
7. Incropera and Dewitt, "*Fundamental of Heat and Mass Transfer*", 6th Edition, Wiley Publication, 2011.

Course Outcomes (COs):

At the end of semester students will able to…

1. Outline basics of heat transfer.
2. Apply laws of conduction to heat transfer problems.
3. Apply laws of convection to heat transfer problems.
4. Use radiation laws to solve heat transfer problems.
5. Analyze heat exchanger.
6. Explain boiling and condensation.