

Heat and Mass Transfer - Video course

Module No	Content	No. of Hours
1	INTRODUCTION – Typical heat transfer situations,	1 hour
2	Modes of heat transfer	1 hour
3	Introduction to laws, some heat transfer parameters	1 hour
4	CONDUCTION – Fourier’s law and thermal conductivity	1 hour
5	Differential equation of heat conduction, boundary conditions and initial conditions	1 hour
6	Simple one dimensional steady state situations – plane wall, cylinder, sphere (simple and complex situations), concept of thermal resistance, concept of U, critical radius. variable thermal conductivity (exercise)	3 hours
7	Special one dimensional steady state situations – heat generation, pin fins Other fin configurations (exercise)	2 hours
8	Two dimensional steady state situations	1 hour
9	Transient conduction Lumped capacitance model One dimensional transient problems – analytical solutions One dimensional Heisler charts Product solutions	2 hours
10	Numerical methods in conduction Steady state one dimensional and two dimensional problems One dimensional transient problems – Explicit and implicit	2 hours
11	RADIATION Basic ideas, spectrum, basic definitions	1 hour
12	Laws of radiation, black body radiation, Planck’s law, Stefan Boltzman law, Wien’s Displacement law, Lambert cosine law	1 hour
13	Radiation exchange between black surfaces, shape factor	3 hours
14	Radiation exchange between gray surfaces – Radiosity-Irradiation method Parallel plates	2 hours
15	Enclosures (non-participating gas)	1 hour
16	Gas radiation	1 hour



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Mechanical Engineering

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17	FORCED CONVECTION Concepts of fluid mechanics	1 hour
18	Differential equation of heat convection	1 hour
19	Laminar flow heat transfer in circular pipe – constant heat flux and constant wall temperature, thermal entrance region, Turbulent flow heat transfer in circular pipe, pipes of other cross sections	2 hours
20	Heat transfer in laminar flow and turbulent flow over a flat plate, Reynolds analogy	1 hour
21	Flow across a cylinder and sphere, flow across banks of tubes, impinging jets	1 hour
22	NATURAL CONVECTION Introduction, governing equations, Vertical plate – Pohlhausen solution, horizontal cylinder, horizontal plate, enclosed spaces	3 hours
23	HEAT EXCHANGERS Types of heat exchangers, LMTD approach – parallel, counter-flow, multi-pass and cross flow heat exchanger, NTU approach – parallel, counterflow, shell and tube, cross flow heat exchanger	4 hours
24	Condensation and Boiling Dimensionless parameters, boiling modes, correlations, Forced convection boiling, laminar film condensation on a vertical plate, turbulent film condensation	2 hours
25	Mass Transfer Analogy between heat and mass transfer, mass diffusion, Fick's law of diffusion, boundary conditions, steady mass diffusion through a wall, transient mass diffusion, mass convection, limitations of heat and mass transfer analogy.	3 hours
	Total number of hours	42

Requirement of RA support: **One full time RA preferably with a sound background in heat transfer**