Advanced Heat and Mass Transfer - Web course

COURSE OUTLINE

Unified point of view to energy and mass transport.

Steady and unsteady mass and heat diffusion in solids and stagnant liquids.

Laminar, forced and natural convection.

Equations of change for non-isothermal systems and multi-component systems.

Analytical and approximate solutions to equations of change with applications to problems in research and design.

Heat and Mass Transport in Turbulent Flows.

Diffusion under various driving forces and with chemical reaction.

Energy and mass transport in boundary layers with relevant analogies.

Simultaneous heat and mass transfer.

Multi-component mass transport for dilute solutions.

COURSE DETAIL

Sl. No.	Topic	No. of lectures
1	**Module 1. THE EQUATION OF "CONTINUITY": 6 lectures (Lectures 1-6)** (i) Overall Mass Balance (ii) Momentum Balance (iii) Energy Balance (iv) Special Mass Balance (v) Equation for the fluxes	6
2	**Module 2. "DIFFUSIVE" HEAT AND MASS TRANSFER: 14 lectures (Lectures 7-20)** (i) Steady and Unsteady/One and Multiple Dimensions (ii) Mass Transfer with Chemical Reaction (iii) Perturbation Techniques (iv) Moving Boundary Problems (v) Simultaneous Heat and Mass Transfer	14
3	**Module 3. "CONVECTIVE" HEAT AND MASS TRANSFER: 12 lectures (Lectures 21-32)** (i) Flow Inside Ducts (ii) Dispersion (iii) Laminar Boundary Layers (iv) Mass Transfer with Chemical Reactions (v) Asymptotic Methods (vi) Simultaneous Momentum, Heat and Mass Transfer (vii) Natural Convection	10

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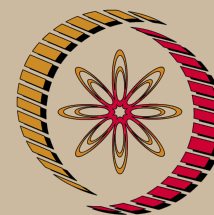
Chemical Engineering

Pre-requisites:

1. Transport Phenomena (UG level).
2. Heat Transfer (UG level).
3. Mass Transfer (UG level).

Additional Reading:

1. Whitaker, S., Fundamental Principles of Heat Transfer, New York, Pergammon, 1997.
2. Cussler, E, L., Diffusion. Mass Transfer in Fluid Systems, Cambridge, 1985.

Coordinators:

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4	**Module 4. MULTICOMPONENT TRANSPORT: 5 Lectures (Lectures 33-37)** (i) Binary Systems (ii) Muti-component Flux Equations (iii) Thermal Diffusion (iv) Dimensional Analysis	5	
5	**Module 5. MASS TRANSFER IN TURBULANT FLOWS: 4 lectures (Lectures 38-41)** (i) Time Averaging and Eddy Viscosity (ii) Universal Velocity (iii) Mass Transfer in Turbulent Pipe Flow	4	
	Total lectures	**41**	

References:

1. Bird, R.B, Stewart, W.E. and Lightfoot, E.N., Transport Phenomena, Wiley, 2001.

2. Slattery, J.C. Advanced Transport Phenomena, Cambridge University Press, 1999.