

UCH603 TRANSPORT PHENOMENA

L	T	P	Cr
3	1	0	3.5

Introduction: Basic concepts of transport phenomena, Newtonian and non-Newtonian fluids; Newton's law of viscosity, Fourier's law of heat conduction and Fick's law of diffusion.

Momentum Transport: Velocity Distribution, Equation of continuity in Cartesian, polar and spherical coordinates, Laminar flow of Newtonian fluid over an inclined plate, through circular tube and through annulus, Bingham flow in a circular tube, Equation of Change: Partial, total and substantial times derivatives, Equation of motion and Navier's-Stokes equation and their applications to solve problems of different geometries.

Flow with More Than One Independent Variable: Unsteady-state Newtonian fluid flow, Stream function, Potential function and two-dimensional viscous flow, Boundary layer theory.

Energy Transport: Temperature Distribution: Heat conduction with an electrical, viscous, chemical and nuclear heat source, Heat conduction in a cooling fin, Equation of Change, Equation of energy in rectangular, spherical and cylindrical geometries, Equations of energy for convection in non-isothermal flow, Forced convection, Free convection.

Mass Transfer: Concentration distribution with shell mass balances, Diffusion through stagnant gas film, Diffusion with moving interface, Diffusion through a non-isothermal spherical film, Gas absorption with chemical reaction in an agitated tank, Diffusion with heterogeneous and homogeneous chemical reaction, Diffusion and chemical reaction inside porous catalyst, Equation of Change, Equation of component continuity for binary and ternary mixtures and various simplifying assumptions.

Text Books:

1. Bird, R. B., Stewart, W. E., and Lightfoot, E. N., Transport Phenomena, Wiley (2002).
2. Geankoplis, C. J., Transport Processes and Unit Operations, Prentice-Hall (1993).

Reference Books:

1. Bennett, C.O., and Myers, J.E., Momentum, Heat, and Mass Transfer, McGraw-Hill (1973).
2. Welty, J. R., Wicks, C. E., and Wilson, R. E., Fundamentals of Momentum, Heat, and Mass Transfer, John Wiley and Sons (1984).
3. William J. T., Introduction to Transport Phenomena, Prentice Hall (1999).