UCH603 TRANSPORT PHENOMENA

L	T	P	Cr
3	1	0	3.5

Course Objectives:
To impart knowledge about individual and simultaneous momentum, heat and mass transfer, model development along with appropriate boundary conditions.

Introduction: Viscosity and generalization of Newton's law of viscosity,Thermal conductivity and mechanism of energy transport, Diffusivity and mechanism of mass transport, Basic concept and review of classical momentum, heat and mass transfer problems.

Momentum Transport: Shell momentum balance, velocity distribution in laminar incompressible flow, The equations of change for isothermal flow: Equations of continuity, motion, conservation of mechanical energy in fluids, Application of Navier-Stokes equation, , Stream function, Potential flow, Boundary layer theory, Velocity and pressure distributions with more than one independent variables, Unsteady flow.

Turbulent flow: Velocity distribution in turbulent flow,fluctuations and time smoothened equations for velocity, Time smoothed of equation of change for incompressible fluids, Reynolds stress, Empirical relations.

Energy Transport: Shell energy balance, temperature distribution in solids and laminar flow, Equations of change for non-isothermal flow - Equations of energy, Energy equation in curvilinear coordinates, set-up of steady state heat transfer problems, Temperature distributions with more than one independent variables, Unsteady heat transfer.

Mass Transfer: Shell mass balance and concentration distribution in solids and laminar flow, Equations of change for multi-component systems: Equations of continuity for a binary mixture, Equation of continuity in curvilinear coordinates, Multi-component equations of change in terms of the flows, Multi component fluxes in terms of the transport properties, Use of equations of change to setup diffusion problems, Unsteady mass transfer.

Simulations momentum, heat and mass transfer: Simultaneous momentum, heat and mass transfer in laminar and turbulent flow regimes, Temperature and concentration distribution in turbulent flow, time smoothed equations of change for incompressible non-isothermal flow, Concentration fluctuation and time smoothed concentration, time smoothed equation of continuity.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. analyze heat, mass, and momentum transport in a process.
2. formulate problems along with appropriate boundary conditions.
3. develop steady and transient solution for problems involving heat, mass, and momentum transport.

Text Book:

1. *Bird, R. B., Stewart, W. E., Lightfoot, E. N., Transport Phenomena, Wiley (2002).*

Reference Books:

1. *Geankoplis, C. J., Transport Processes and Unit Operations, Prentice-Hall (1993).*
2. *Deen, W. D., Analysis of Transport Phenomena, Oxford University Press (1998).*
3. *Griskey, R. G., Transport Phenomena and Unit Operations: A Combined Approach, Jon Wiley (2002).*
4. *Batchelor, G. K., An Introduction to Fluid Dynamics, Cambridge University Press (1967).*
5. *Salterry, J. C., Momentum Energy and Mass Transfer in Continua Robert e. Kridger (1981).*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May includes tutorials/ assignments/ quiz's etc)	25