Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCHC501	Advanced Transport Phenomena	3	1	0	4

Course Objective

- To provide basic unifying principles of the conservation of momentum, energy and mass with emphasis on similarities and differences amongst various transport mechanisms.
- To apply them to solve problems encountered in chemical engineering processes.

Learning Outcomes

- Students will be able to formulate and solve differential momentum, heat, and mass balances occurring in laminar and turbulent conditions.

Unit No.	Description of Lectures	Contact Hours	Learning Outcomes
1.	**Vector analysis**: Vector and tensor operations, vector calculus, curvilinear coordinate systems.	6 L + 2 T	Proficiency in Vector operations
2.	**Momentum transport:** Continuum hypothesis, Newtonian and non -Newtonian fluids, diffusive and convective fluxes.	3 L + 1 T	Knowledge on transport fundamental
3.	**Equations of change**: Shell balance method, Navier-Stokes equation and their solution techniques under different boundary conditions. Similarity solution, eigenvalue problems	9 L + 3 T	Formulation of Differential equations and its solution in Momentum Transport
4.	**Boundary layer theory**: Blasius exact solution method, potential flow, stream function and stream potential,	6 L + 2 T	Knowledge on boundary layer theory
5.	**Energy transport** Energy equation, forced and natural convection. Solution of heat flow under steady and unsteady state conditions.	9 L + 3 T	Formulation of Differential equations in Heat Transport
6.	**Mass transport:** Diffusion, application of shell balance method and equations of change Concentration distributions for isothermal and non-isothermal mixtures. Steady and unsteady state	6 L + 2 T	Formulation of Differential equations in Mass transport
7.	**Turbulence:** Turbulence, Time averaging, Reynolds averaged model.	3 L + 1 T	Knowledge of turbulence modelling
	Total	56	

Textbooks:
1. Deen, W. M. (1998). *Analysis of Transport Phenomena*. Oxford Univ. Press.
2. Bird, R. B., Stewart, W. E. and Lightfoot, E. N. (2007). *Transport Phenomena*. 2nd Ed. McGraw Hill.

Reference Books:
1. Leal L.G. (2008). *Advanced Transport Phenomena: Fluid Mechanics and Convective Transport Processes*. Cambridge Univ. Press.