NIRMA UNIVERSITY
School of Engineering, Institute of Technology
Disciplinary Minor B.Tech. in Chemical Engineering
Third Year/Semester V

Institute:	Institute of Technology
Name of Programme:	B. Tech. (Chemical Engineering)
Course Code:	3CH602DC24
Course Title:	Transport Phenomena
Course Type:	Core
Year of introduction:	2024-25

L	**T**	**Practical component**			
		LPW	**PW**	**W**	**S**
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Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. compare principle underlying between different transport phenomena. (BL4)
2. apply shell balance and boundary conditions for momentum transport systems. (BL3)
3. interpret shell balance for energy and mass transport systems (BL6)
4. solve chemical engineering problems along with appropriate approximations and boundary conditions (BL3)

	Contents	**Teaching hours (Total 45)**
Unit I	**Principle of Transport Processes** Concept and industrial relevance, analogy between different transport phenomena, equations of change for isothermal systems, equations of continuity and motion. Molecular momentum transport, pressure and temperature dependence of viscosity, viscosity prediction for gases, liquids and mixtures, convective momentum transport.	**05**
Unit II	**Shell Momentum Balances and Velocity Distributions in Laminar Flow** Shell momentum balances and boundary conditions, flow of a falling film, flow through circular tube, flow through annulus, flow of two adjacent immiscible fluids, equations of continuity and motion.	**10**
Unit III	**Energy Transport** Molecular energy transport, temperature and pressure dependence of thermal conductivity, thermal conductivity prediction for gases, liquids, solids and mixtures. Shell energy balances and boundary conditions, heat conduction with an electrical heat source, nuclear heat source, viscous heat source, composite walls, cooling fin, forced and free convection.	**10**
Unit IV	**Mass Transport** Kinetic theory of diffusivity Molecular mass transport, temperature and pressure dependence of diffusivity, diffusivity prediction for gases and	**10**

liquids. Shell mass balances and boundary conditions, diffusion through a stagnant gas film, diffusion with a homogeneous chemical reaction, diffusion with heterogeneous slow and instantaneous chemical reactions.

Self Study:
The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial Work:
Tutorial work will be based on the above content of course.

Suggested Readings/ References:
1. R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot, Transport Phenomena, John Wiley & Sons, Inc.
2. Bodh Raj, Introduction to Transport Phenomena: Momentum, Heat & Mass, PHI Learning Private Limited.
3. Christie John Geankoplis, Transport Processes and Separation Process Principles, PHI Learning Private Limited.

L= Lecture, T=Tutorial, P= Practical, C=Credit