5th Semester	RML5D003	Transport Phenomena	L-T-P 3-0-0	3 Credits

Module I: **(10 Hours)**

Classification of fluids, ideal & real, Newtonian & Non-Newtonian, Newton's law of viscosity.Types of fluid flow – streamline & turbulent, continuity equation for incompressible andcompressible fluid and its application. Concept of velocity bounds layer.; Bernoulli's equation andits application for flow measurement by venturimeter, orifice meter, pilot tube and rotameter.

Module II: **(8 Hours)**

Dimensional analysis by Rayleigh's method of indices and Buckingham's π theorem. Example ofanalysis of pressure gradient, mass transfer co-efficient & convective heat transfer co-efficient,concept of imilarly and dimensionless criteria. Dimensionless groups & their significance. Pressuredrop & friction factor in various configurations, flow in packed bed & fluidized bed. Free andpartially restricted jets, high velocity fluid jets.

Module III: **(8 Hours)**

Heat Transfer: Internal & External modes of heat transfer, steady state heat conduction in monolayer and composite flat walls & cylinders. Unsteady state heat conduction, thin & massivebody heating & cooling. Finite difference method in solving unsteady state heat conduction.

Module IV: **(8 Hours)**

Natural and forced convection, concept of heat transfer co-efficient, thermal boundary layers, someexamples of connective co-relations. Law of radiation – Steffan-Boltzmann's law, Kirchoff's law&Lambarth's law, Black & grey body concepts, view factor, Radiation from flames & gases.Radiation between simple surfaces with & without absorbing gas media. Radiation shields. OverallHeat transfer co-efficient.

Module V: **(6 Hours)**

Mass transfer: Mass Transfer: Law of diffusion and their application, concept of mass transfer coefficient & concentration boundary layer, Interfacial mass transfer, overall mass balance.

Books:

[1] R. B. Bird, W. E. Stewart and E. N. Lightfoot, Transport Phenomena, Wiley, 1960
[2] G. H. Geiger and D. R. Poirier, Transport Phenomena in Metallurgy, Addison-Wesley, 1973.
[3] J. R. Welty, R. E. Wilson and C. E. Wicks, Fundamentals of Momentum Heat and Mass Transfer, Wiley, 1976

Digital Learning Resources:

Course Name:	Transport phenomena
Course Link:	https://nptel.ac.in/courses/103/105/103105128/
Course Instructor:	Prof. Sunando Dasgupta, IIT Kharagpur