CEPC3005 TRANSPORT PHENOMENA (3-0-0)

Course Objective:
The course aims to provide fundamental understanding of momentum, heat, and mass transport processes occurring in chemical and mineral engineering systems.

Module I (06 Hours)
Introduction to Transport Processes: Scope and importance of transport phenomena, Classification of fluids, ideal & real, Newtonian & Non-Newtonian, Newton's law of viscosity. Types of fluid flow – streamline & turbulent, continuity equation for incompressible and compressible fluid and its application. Concept of velocity bounds layer.; Bernoulli's equation and its application for flow measurement by venturi meter, orifice meter, pilot tube and rotameter.

Module II (06 Hours)
Dimensional analysis by Rayleigh's method of indices and Buckingham's π theorem. Example of analysis of pressure gradient, mass transfer co-efficient & convective heat transfer co-efficient, concept of similarity and dimensionless criteria. Dimensionless groups & their significance. Pressure drop & friction factor in various configurations, flow in packed bed & fluidized bed. Free and partially restricted jets, high velocity fluid jets.

Module III (06 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 & massive body heating & cooling. Finite difference method in solving unsteady state heat conduction.

Module IV (06 Hours)
Natural and forced convection, concept of heat transfer co-efficient, thermal boundary layers, some examples 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. Overall Heat transfer co-efficient.

Module V (06 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.

Course Outcome:
CO1:To understand the fundamentals of transport processes and it application in engineering
CO2:To apply dimensional analysis for simplification and interpretation of engineering problems
CO3:To acquire knowledge on heat transfer and solve problems related to it
CO4:To analyze the concept of convection and radiation applied to engineering
CO5:To understand and apply mass transfer principles under steady and unsteady conditions

Text Books:

1. Bird R.B., Stewart W.E., Lightfoot E.N. & Klingenberg D.J., Introductory Transport Phenomena, John Wiley & Sons Inc
2. Brodkey R.S. & Hershey H.C., Transport Phenomena: A Unified Approach, McGraw-Hill

Reference Books:

1. Welty J., Wicks C.E., Wilson R.E & Rorrer G., Fundamentals of Momentum, Heat and Mass Transfer, Wiley
2. Deen W.M., Analysis of Transport Phenomena, Oxford University Press