

CEPC3006 CONTINUUM TRANSPORT PHENOMENA (3-0-0)

Overall course Objective:

The main objective of the course is to introduce students to principles of momentum, energy and mass transport in various systems by developing a unified, fundamental approach based on conservation laws and physical principles.

Module I: (12 Hrs)

Momentum Transport: Viscosity and the mechanism of momentum transport, Shell momentum balances and Velocity distributions in laminar flow. The equation of changes for Isothermal systems. Velocity distributions with more than one independent variable. Inter phase transport in isothermal systems.

Module II: (12 Hrs)

Energy Transport: Thermal conductivity and mechanism of energy transport, shell energy balances and temperature distributions in solids and laminar flow, the equations of change for non - isothermal systems, temperature distribution with more than one independent variable, Inter phase transport in non-isothermal systems.

Module III: (12 Hrs)

Mass Transport: Diffusivity and the mechanism of mass transport, concentration distributions in solids and laminar flow, the equations of change for multi component systems. concentration distributions with more than one independent variable, inter phase transport in non-isothermal mixtures.

Course Outcomes:

Upon successful completion of this course, a student will have/be able to:

- CO1: Understand the analogy among momentum, heat and mass transport.
- CO2: Develop differential momentum, heat, and mass balances for 1-D steady state problems using conservation principles.
- CO3: Identify the similarity among the correlations for flow, heat and mass transfer at interface.
- CO4: Apply the transport phenomena knowledge in his/her academic and professional project work for designing different process equipment effectively.
- CO5: Solve complex engineering problems by solving coupled mass, momentum and energy transport equations.

Textbook:

1. Transport Phenomena, 2nd ed. by R B Bird, W E Stewart, and E N Lightfoot, John Wiley & Sons.
2. Analysis of Transport Phenomena, William M. Deen, Oxford University Press

Reference Books:

1. Fundamentals of Momentum, Heat, and Mass Transfer, 5th ed. by J Welty, C E Wicks, and R E Wilson, and G L Rorrer, Wiley.
2. Introduction to Transport Phenomena: Momentum, Heat, and Mass by B Raj, PHI.

Digital learning resources:

1. Transport Phenomena by Prof. Sunando Dasgupta, Department of Chemical Engineering, IIT Kharagpur, Link: <https://nptel.ac.in/courses/103/105/103105128/>
2. Transport phenomena of nonnewtonian fluids by Prof. Nanda Kishore, Department of Chemical Engineering, IIT Guwahati, Link: <https://nptel.ac.in/courses/103/103/103103146/>