

**Department of Materials Science and Engineering
Indian Institute of Technology Kanpur**

Course Name: Transport Phenomena
Credits: 3-0-0-0-4
Course No: MSE 626

Prerequisite: None
Category: Compulsory course for all M.Tech. students of MSE Department, to be offered in odd semester

Course Contents:

1. Fluid dynamics (7 Lectures)

Introduction to Transport phenomena in materials processing	1L
Newton's law of viscosity, equation of continuity, Navier Stokes equations	2L
Macroscopic mass and energy balance;	1.5
Characteristics of industrial flows	0.5L
Numerical problems on above topics of interest to metals and materials processing	2L

2. Heat transfer (16 lectures)

Fundamentals of conduction heat transfer; Laws and equations; Steady and unsteady heat conduction	2L
Numerical problems on conductive heat transfer	3L
Fundamentals of convective heat transfer; free and forced convective heat transfer, Convective heat transfer rate laws and heat transfer coefficient	1L
Problems on Convective heat transfer	2L
Fundamentals of Radiation heat transfer and rate laws; view factors	3L
Problems on Radiation heat transfer	1L
Application of heat transfer in: Heat treatment, solidification, cooling of slabs, heat flow through refractory walls etc.	3L

3. Mass Transfer (16 lectures)

Fundamentals of diffusion; rate laws, Uphill diffusion and Kirkendal's effect, steady and unsteady diffusion	4L
Numerical problems on diffusion mass transfer	2L
Fundamentals of convective mass transfer; free and forced convective mass transfer transfer, Convective mass transfer, rate laws and mass transfer coefficient	2L
Problems on Convective mass transport	2L
Application of mass transfer in: case hardening, doping of semi conductors, homogenization, oxidation, absorption/desorption of gases in liquid metals.	6L

Recommended Text books:

1. Transport phenomena: D. R. Geiger and G. H. Poirier
2. Transport phenomena: D. R. Gaskell
3. Engineering in process metallurgy: R. Guthrie
4. Mass transport in solids and fluids: D. S. Wilkinson

Recommended Reference books:

1. Diffusion in solids: P. G. Shewman
2. Atom movements - diffusion and mass transport in solids: J. Philibert
3. Diffusion in solids: field theory, solid-state principles, and applications: M. E. Glicksman