

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 4

METALLURGY ENGINEERING

Subject Name: TRANSPORT PHENOMENA IN MATERIALS PROCESSING

Sr. No.	Course content
1.	Fluid Behaviour Definition and classification of fluids. Viscosity, Newtonian and non-Newtonian fluids. Viscous and non-viscous fluids. General features of fluid flow. Laminar and turbulent flow
2.	Mass and Momentum Balance Differential mass balance (continuity equation). Differential momentum balance (equation of motion). Navier Stokes Equation. Application of Differential Balance Equation. Overall mass balance and momentum balance. Euler's equation and its integration to obtain Bernoulli's equation. Flow through fluidised beds.
3.	Heat Transfer (Conductive and Convective) Modes of heat transfer. Conduction of heat through solid. Steady and unsteady state. Fourier law of heat conduction. General equation of heat conduction in cartesian co-ordinate, spherical and cylindrical systems. Convective heat transfer. Free and forced convection. Application dimensional analysis of effective boundary layer.
4.	Heat Transfer (Radiative) Aspects of Radiative Heat Transfer. Reflection, absorption and transmission of radiation. Black body radiation. Planck's Law. Wein's distribution Law. Heat transfer between two bodies by radiation. Lambert's Law.
5.	Mass Transfer Fluid flow and its relevance to mass transfer. General mass transport equation. Modes of mass transfer. Film and boundary layer theories. Diffusion-diffusion convection. Generalised diffusion equation. Diffusivity in gases, liquids and solids. Steady diffusion. Pseudo-steady diffusion. Diffusion through porous solids. Convective mass transfer- Mass transfer in fluid at solid-fluid interface. Mass transfer between two fluids. Mass transfer v/s chemical control, enhancement of process rates. Application to metallurgical system.

REFERENCE BOOKS:

1. Rate Processes in Metallurgy
A. K. Mohanty
2. Principles of Extractive Metallurgy
A. Ghosh and H. S. Ray
3. Elements of Heat and Mass Transfer
Prof. R. C. Patel
4. Fundamentals of Heat and Mass Transfer
Inpropera and Dewitt
5. Rate Phenomena in Process Metallurgy
J. H. Szekely and N. J. Themelis
6. Fundamentals of Momentum, Heat and Mass Transfer
J. R. Welty, C. E. Wicks (Pub.-Wilson Wiley)
7. Chemical Engineering
J. M. Coulson and J. F. Richardson (Pub.- Mc. Hill ELBS)
8. Engineering in Process Metallurgy
RLL Guthrie (Pub.- Oxford).
9. Heat Transfer
Yunus Cengel