HEAT AND MASS TRANSFER

Course Type	Course Code	Name of Course	L	T	P	Credit
DC	FMC202	Heat and Mass Transfer	3	0	0	9

Course Objective
Fundamentals of heat and mass transfer phenomena and its application in metals processing
Learning Outcomes
Governing equations for solving microscopic and macroscopic problems related to fluid flow, heat and mass transfer with applications in metals processing.

Unit No.	Topics to be Covered	Lecture Hours	Learning outcomes
1	Introduction to heat and mass transfer	4	Students will be introduced to the course and about significance and scope of studying heat and mass transfer in the society
2	Introduction to heat transfer, modes of heat transfer, laws of heat transfer; General heat transfer equation;	5	Students will learn about introduction of various modes of heat transfer
3	Steady and unsteady conduction;	5	Students will learn about different scenarios of conduction heat transfer, and will be able to solve numerical problems based on the same
4	Fluid mechanics: Continuity equation; Navier-Stokes equation; turbulence; Engineering Bernoulli's equations; Darcy's law	4	Students will learn about basics of fluid mechanics and will be able to solve numerical problems based on the same as a prerequisite to understanding convective heat and mass transfer
5	Natural and forced convection; heat transfer in turbulent flows; heat transfer coefficient	5	Students will learn about different scenarios of convection heat transfer and will be able to solve numerical problems based on the same
6	Radiation heat transfer	5	Students will learn about different scenarios of radiative heat transfer and will be able to solve numerical problems based on the same
7	Phase transformation; solidification of metals; furnace design	2	Student will learn about various applications of heat transfer
8	Solid state diffusion: Diffusive and convective fluxes; diffusion mechanisms; diffusion coefficient; Kirkendall effect; uphill diffusion; steady and unsteady diffusion; estimation of diffusion coefficients; Carburization; phase transformation; homogenization of alloys	5	Students will learn about different scenarios of solid state mass transfer and will be able to solve numerical problems based on the same
9	Convection mass transfer: Natural and forced convection mass transfer; general mass transfer equation; diffusion through stagnant and moving gas film; mass transfer coefficient and its applications; degasification	4	Students will learn about different scenarios of convective mass transfer and will be able to solve numerical problems based on the same
10	Interphase mass transfer: Two-resistance mass transfer theory; mixed control reactions; oxidation of metals; vaporization	3	Students will learn about interface mass transfer and will be able to solve numerical problems based on the same
	Total	42	

Text Books:

1. **Fundamentals of Heat and Mass Transfer F. Incropera and D. DeWitt John Wiley and Sons**
2. Transport phenomena in metals processing D. R. Poirier, G. H. Geiger Springer International Publishers

Reference Books:

1. Engineering in process metallurgy R. I. L. Guthrie Oxford University Press
2. Elements of chemical reaction engineering H. Scott Fogler Prentice Hall