TRANSPORT PHENOMENA

Course Code: 15CH1138

L	T	P	C
3	0	0	3

Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Estimate the transport properties and identify the dependence of transport properties on system properties like P, T and composition.

CO 2 Analyze a given problem, choose suitable co-ordinate system and develop the velocity profiles using shell balance approach and solve problems.

CO 3 Derive temperature profiles and solve heat transfer problems using shell energy balance.

CO 4 Develop concentration profiles and solve mass transfer problems using shell mass balance

CO 5 Derive the equations of change and time smoothed equations of change for isothermal, non- isothermal and multi component systems

UNIT-I **(8 Lectures)**

Transport properties, estimation of transport properties, pressure, and temperature and concentration dependence of transport properties.

UNIT-II **(10 Lectures)**

Shell momentum balances and velocity distributions in laminar flow: shell momentum balances and boundary conditions, flow of a falling film, flow through a circular tube, flow through annulus, flow of two adjacent immiscible fluids.

UNIT-III **(12 Lectures)**

Shell energy balances and temperature distributions in solids and laminar flow: shell energy balances; boundary conditions, heat

conduction with an electrical heat source, heat conduction with a nuclear heat source, heat conduction with a viscous heat source, heat conduction with a chemical heat source, heat conduction through composite walls, heat conduction in a cooling fin, forced convection, free convection.

UNIT-IV (8 Lectures)

Concentration distributions in solids and laminar flow: shell mass balances; boundary conditions, diffusion through a stagnant gas film, diffusion with a heterogeneous chemical reaction, diffusion with a homogeneous chemical reaction, diffusion into a falling liquid film (gas absorption), diffusion into a falling liquid film (solid dissolution), diffusion and chemical reaction inside a porous catalyst.

UNIT-V (12 Lectures)

The equations of change for isothermal systems: the equation of continuity, the equation of motion, the equation of mechanical energy, the equations of change in terms of the substantial derivative, use of the equations of change to solve flow problems. Velocity distributions in turbulent flow: comparisons of laminar and turbulent flows, time- smoothed equations of change for incompressible fluids.

The equations of change for non- isothermal systems: the energy equation.

The equations of change for multi component systems: the equations of continuity for a multi component mixture.

TEXT BOOK:

Bird R.B., Stewart W.S., Lightfoot E.N., "Transport phenomena", 2nd Edition, John Wiley and Sons, U.S.A, 2002.

REFERENCES:

1. Welty. J.R, Wicks C.E, Wilson R.E, "Fundamental of Momentum, Heat and Mass Transfer", 4th Edition, John Wiley, 2009.
2. Theodore. L. "Transport Phenomena for Engineers", International text book company, U.S.A., 1971