22PCM308T					Transport Phenomena					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	3	25	50	25	--	--	100

COURSE OBJECTIVES

- Understand the concepts of transport phenomena and gains fundamental knowledge in fluid flow, heat transfer and mass transport.
- Identifying and analysing the dynamic models for the fluids by applying transport phenomena basics of multidisciplinary concepts, approximations and constraints.
- Interpreting fluid, energy and mass flow directions by simplifying the generalized equations of change.
- Simplifying complex problems pertaining to petrochemical field.
- Design and development of time average momentum, energy and mass transport linear profiles in turbulent flow patterns.
- Recognize and expertise in using of relations and analogies of all the three transport entities.

UNIT I: Transport phenomena by molecular motion **12 Hr.**

Vectors/Tensors, Newton's law of viscosity, Newtonian & Non-Newtonian fluids, rheological models, Temperature, pressure and composition dependence of viscosity, Kinetic theory of viscosity, Fourier's law of heat conduction, Temperature, pressure and composition dependence of thermal conductivity, Kinetic theory of thermal conductivity, Fick's law of diffusion, Temperature, pressure and composition dependence of diffusivity, Kinetic theory of diffusivity.

UNIT II: Momentum transport **14 Hr.**

Shell Momentum balances, boundary conditions, velocity profiles, average velocity, momentum flux at the surfaces of Newtonian and non-Newtonian for flow of a falling film, flow through circular tube, slits, flow through an Annulus, Adjacent flow of two Immiscible fluids. Equations of Change (Isothermal), equation of continuity, equation of motion, equation of energy (isothermal) their applications in fluid flow problems. Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, dimensional analysis of equations of change, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

UNIT III: Heat transport **12 Hr.**

Shell energy balances, boundary conditions, temperature profiles, average temperature, energy fluxes at surfaces for different types of heat sources such as electrical, nuclear viscous and chemical, Equations of change (non-isothermal), equation of motion for forced and free convection, Equation of energy (non-isothermal).

UNIT IV: Mass transport **14 Hr.**

Shell mass balances, boundary conditions, concentration profiles, average concentration, mass flux at surfaces for Diffusion through stagnant gas film, Diffusion with homogeneous and heterogeneous chemical reaction, Diffusion in to a falling liquid film, Diffusion and chemical reaction in porous catalyst and the effectiveness factor, equation of continuity for binary mixtures, equation of change to setup diffusion problems for simultaneous heat and mass transfer

Max. 52 Hr.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Estimate the transport properties and describe the governing laws and also to examine the dependency of process parameters on each transport property.

CO2: Solve differential equations arising in transport problems by setting up shell momentum balance and recognise initial and boundary conditions.

CO3: Interpret and develop the general equations of change based on conservation of mass and transport entities.

CO4: Simplify the general equations of change for solving momentum flow and mass flow problems.

CO5: Solve a time periodic linear momentum and mass transfer problems.

CO6: Analyse the momentum, heat and mass transport problems involved in processes.

TEXT/REFERENCE BOOKS

(1) R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley, II Edition 2006.

(2) Robert, S. Brodkey, Harry C. Hershey, "Transport Phenomena A Unified Approach", Brodkey Publishing 2003.

(3) L.S. Sissom and D.R. Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hr.**
Part A: 10 Questions each carrying 5 marks	50 Marks
Part B: 5 Questions each carrying 10 marks	50 Marks