Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Seventh Semester

Chemical Engineering

CH3702 – Transport Phenomena

Regulations - 2021

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BTL*	*CO*	*Marks*
1.	Define Newtonian fluids.	L1	1	2
2.	What are the units of kinematic viscosity?	L1	1	2
3.	What is thermal conductivity? Write 3D form of Fourier's law of conduction.	L2	2	2
4.	Explain the terms: forced and free convection.	L2	2	2
5.	Explain diffusion.	L2	3	2
6.	State Fick's second law of diffusion.	L1	3	2
7.	Write Navier-Stokes equation & Euler's equation.	L2	4	2
8.	Write down the dimensionless numbers.	L2	4	2
9.	Explain Analogy between heat and mass transfer.	L2	5	2
10.	Compare laminar flow with turbulent flow.	L2	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			*Questions*	*BTL*	*CO*	*Marks*
11.	a	i	Derive the velocity profile for flow through a circular tube and find the average velocity and maximum velocity for flow through a circular tube.	L3	1	10
		ii	Explain the shear stress versus shear strain curve for Newtonian and non-Newtonian fluid.	L3	1	6
			Or			
	b		Derive the momentum balance equation for laminar flow in an annulus and discuss the effect of geometry on velocity profile.	L3	1	16
12.	a		Derive the equations for temperature profile and heat flow at the surface for heat conduction with an electrical source.	L3	2	16
			Or			
	b		Derive the equations for temperature profile and heat flow at the surface for heat conduction with chemical heat source.	L3	2	16
13.	a		Derive the equation for diffusion through a stagnant gas film.	L3	3	16
			Or			
	b		Derive the concentration profile in the gas film for diffusion with heterogeneous chemical reaction.	L3	3	16

14.	a	i	Write the dimensionless numbers correlating mass transport, heat transport and momentum transport processes.	L2	4	8
		ii	Write short notes on Hagen-Poiseuille equation.	L2	4	8
			Or			
	b		Derive and explain the energy equation for non-isothermal flow including viscous dissipation and pressure work terms.	L2	4	16
15.	a		Discuss the analogies between momentum, heat, and mass transfer (Reynolds, Prandtl, Chilton-Colburn).	L3	5	16
			Or			
	b		Compare laminar and turbulent flow transport mechanisms and explain how time-smoothed equations of change are used in turbulence analysis.	L3	5	16