Register No : ______________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL/MAY 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	BLT	CO	Marks
1.	State the newton's law of viscosity.	L1	1	2
2.	Write down the shell momentum balance equation.	L2	1	2
3.	Mention the effect of temperature on thermal conductivity.	L2	2	2
4.	What is Brinkman number?	L1	2	2
5.	List out the boundary conditions used in shell mass balances.	L2	3	2
6.	Define Sherwood number.	L1	3	2
7.	What is substantial time derivative? Give example.	L1	4	2
8.	Define Euler number.	L1	4	2
9.	Define concentration boundary layer.	L1	5	2
10.	Recall the importance of analogy.	L1	5	2

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

Q.No		Questions	BLT	CO	Marks
11.	a	A fluid with constant viscosity and density flows along an inclined flat surface under the influence of gravity with no ripples. Derive the equations for momentum flux and velocity distribution. Mention all your assumptions.	L2	1	16
		Or			
	b	A non-newtonian Fluid, described by Bingham Model, $\tau = \tau_0 - \mu_0 [dv_z / dr]$ if $r > r_0$ and $\tau = 0$ if $\tau \leq \tau_0$ is flowing through a vertical tube as a result of a pressure gradient. The radius and length of the tube are 'R' & 'L' respectively. Derive a relationship between the volumetric flow rate 'Q' and the pressure gradient by shell balance technique. Also show that for $\tau_0 = 0$, the relationship	L3	1	16

reduces to Haegan-Poiseulle Eqn.

12.	a		An electric current passes through a wire of circular cross section with radius R and electrical conductivity K_e. The current density is I. Rate of heat production per unit volume is $S = [I^2 / K_e]$. Surface of the wire is at a temperature T_0. Derive an equation to determine the radial temperature distribution.	L2	2	16
			Or			
	b		Derive an equation for temperature distribution in a cooling rectangular fin. Also obtain the expression for effectiveness of the fin.	L3	2	16
13.	a		Derive the equations for concentration profile and molar flux for diffusion through a stagnant gas film.	L3	3	16
			Or			
	b		Derive an expression for molar flux in the gas film for diffusion with heterogeneous chemical reaction.	L3	3	16
14.	a		Stating clearly all the assumptions, derive the equation of continuity in three dimensional rectangular coordinates.	L3	4	16
			Or			
	b		Derive the Navier-Stokes equation for incompressible fluid in rectangular coordinates.	L3	4	16
15.	a	i	Discuss the various semi-empirical expressions for Reynolds stress.	L2	5	10
		ii	Write a short note on time-smoothed equations of change.	L2	5	6
			Or			
	b	i	Derive the Reynolds analogy equation relates the momentum, heat and mass transport.	L2	5	10
		ii	Explain the thermal and concentration boundary layer thicknesses.	L2	5	6