



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech Chemical Engineering
Branch Code:CHE	Pattern:2023
Name of Course:Transport Phenomena	Course Code:2307306C
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains two page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.

Marks CO

Question No. 1

- 1a) Explain Newton's law of viscosity. (6) CO1, CO2

Question No. 2

- 2a) Explain Prandtl number in detail. Give its physical significance in heat and momentum transfer. (6) CO1, CO2

Question No. 3

- 3a) Derive the expression of molar flux and concentration profile for diffusion through stagnant gas. (8) CO1, CO2

OR

- 3b) What is the rate of evaporation of chloropicrin into air at 298 K? Total pressure = 770 mm Hg, diffusivity = $0.088 \text{ cm}^2/\text{sec}$, vapor pressure = 23.81 mm Hg $Z_2 - Z_1 = 11.14 \text{ cm}$, density of chloropicrin = 1.65 g/cm^3 , $S = 2.29 \text{ cm}^2$. (8) CO1, CO2
- 3c) Derive the expression of molar flux and concentration profile for diffusion with heterogeneous slow chemical reaction. (8) CO1, CO2

OR

- 3d) Explain mass balance equation and stepwise procedure to solve mass transfer problems. (8) CO1, CO2

Question No. 4

- 4a) A Newtonian fluid is confined between two parallel and vertical plates. The surface on the left is stationary and the other is moving vertically at a constant velocity V_0 . Assuming that the flow is laminar, solve for the velocity profile (8) CO3

OR

- 4b) Derive Navier Stokes Equation. (8) CO3

4c) Using equation of change, solve the flow of falling film problem to get velocity profile. (8) CO3

OR

4d) Derive equation of continuity for incompressible fluid. (8) CO3

Question No. 5

5a) What pressure gradient is required to cause diethylaniline, $C_6H_5N(C_2H_5)_2$ to flow in a horizontal, smooth, circular tube of inside diameter $D = 3$ cm at a mass rate of 1028 g/s at $20^\circ C$? At this temperature the density of diethylaniline is $\rho = 0.935$ g/cm³ and its viscosity is $\mu = 1.95$ cp. (8) CO1, CO4

OR

5b) Derive expression for average velocity of turbulent flow in pipe. (8) CO1, CO4

5c) Derive Blake Kozeny equation for Laminar flow in packed bed. (8) CO1, CO4

OR

5d) Explain friction factor. Derive the expression for fanning friction factor. (8) CO1, CO4

..... End of question paper.....