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**Eighth Semester B.E. Degree Examination, June/July 2023**  
**Transport Phenomena**

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Write a note on Time-independent fluid and Time-dependent fluids. (10 Marks)  
 b. Write Bingham model and Ellis model for non-newtonian fluid. (10 Marks)

**OR**

- 2 a. Explain Newton's law of viscosity. (10 Marks)  
 b. Write a note on Fanning friction factor. (10 Marks)

**Module-2**

- 3 Derive an equation for flow through a circular tube. (20 Marks)

**OR**

- 4 a. Obtain an expression for overall heat transfer coefficient for a composite wall. (10 Marks)  
 b. Explain the Fourier's law of heat conduction. (10 Marks)

**Module-3**

- 5 Obtain an equation for temperature and heat flux with an electrical heat source. (20 Marks)

**OR**

- 6 a. Differentiate between forced and free convection heat transfer. (10 Marks)  
 b. Explain effectiveness of a Fin. (10 Marks)

**Module-4**

- 7 a. Explain concentrations, velocities and mass fluxes. (10 Marks)  
 b. Describe the Fick's law of diffusion. (10 Marks)

**OR**

- 8 Derive an equation for diffusion with heterogeneous chemical reaction. (20 Marks)

**Module-5**

- 9 a. Explain types of time derivatives and vector notation. (10 Marks)  
 b. Derive an equation for differential equation of continuity. (10 Marks)

**OR**

- 10 Write short notes on:  
 a. Reynold's analogy.  
 b. Prandtl's analogy.  
 c. Chilton's analogy.  
 d. Colburn analogy. (20 Marks)