

Day: Monday  
Date: 26/11/2018

W-2018-2887

Time: 02.30 PM TO 05.30 PM  
Max. Marks: 80

**N.B.:**

- 1) Q. No. 1 and Q. No. 5 are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each section.
- 2) Both the sections should be written in **SEPARATE** answer books
- 3) Draw neat labeled diagrams **WHEREVER** necessary.
- 4) Assume suitable data if, necessary.
- 5) Use of non-programmable pocket calculator is **ALLOWED**.
- 6) Figures to the **RIGHT** indicate **FULL MARKS**.

**SECTION-I**

- Q.1** a) What is Newton's law of viscosity? Explain its significance. (05)  
b) What is microscopic mass and momentum balance? Define in detail. (05)  
c) What is the mechanism of energy transport? (04)
- Q.2** a) What is the expression for maximum flow through circular tube? Derive the same. (07)  
b) What is Euler's equation? What is its significance? (06)
- Q.3** a) What is pressure gradient is required to cause diethylaniline to flow in a horizontal, smooth circular tube of I.D. = 3 cm at a mass rate of 1028 g/s at 20 °C? At this temperature the density of diethylaniline is  $\rho = 0.935 \text{ g/cm}^3$  and its viscosity is  $\mu = 1.95 \text{ cp}$ ? (07)  
b) How flow around the spheres depends upon velocity and friction factor? Explain creeping flow condition. (06)
- Q.4** a) What is free convection? Derive the expression for heat loss through horizontal pipe by free convection. (07)  
b) How thermal conductivity of gases and fluids is dependent upon temperature and pressure? (06)

**SECTION - II**

- Q.5** a) Which are the conventional definitions for heat transfer in fluids? (05)  
b) What is the Fick's law of diffusion? What is its significance? (05)  
c) What is the analogy between heat and mass transfer? (04)
- Q.6** a) Derive the correlation for heat transfer coefficient around a submerged sphere. (07)  
b) How to define the heat transfer coefficient for free convection? (06)
- Q.7** a) Derive the correlation defining the mass transfer coefficient for diffusion with homogeneous chemical reaction. (07)  
b) Derive the expression for the diffusivity for diffusion through a stagnant gas film. (06)
- Q.8** a) Define binary mass transfer coefficient in one phase. Derive its correlation. (07)  
b) Define mass transfer coefficient for high mass transfer rates. Derive its correlation. (06)

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