

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – SUMMER 2013****Subject Code: 142101****Date: 07-06-2013****Subject Name: Transport Phenomenon in Materials Processing****Time: 10:30am – 01:00pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) (i) Explain viscosity? State Newton's Law of Viscosity. Distinguish between kinematic & dynamic viscosity. Derive its unit & dimension. **04**
 (ii) Explain Classification of fluid. **03**
 (b) Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8m * 0.8m and an inclined plane with angle of inclination 30 degree. The weight of square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3m/s. The thickness of oil film is 1.5mm. **07**
- Q.2** (a) State laws of conservation of mass and derive equation of continuity. **07**
 (b) A 30cm diameter pipe conveying water branches into two pipes of diameter 20cm & 15cm, if the average velocity in the 30cm dia pipe is 2.5m/sec, find the discharge in the pipe. Also determine the velocity in 15cm pipe if the average velocity in 20cm dia pipe is 2m/sec. **07**
- OR**
- (b) What is Fourier law of heat conduction? Derive one dimensional heat conduction equation through a large plane wall. **07**
- Q.3** (a) (i) Define convective heat transfer. Explain the difference between free & forced convection with examples. **04**
 (ii) Give correlation of heat transfer coefficient with Nusselt number. **03**
 (b) Calculate thermal conductivity 'k' of the powder if the inner radius & temperature are $R_i = 0.05 \text{ m}$ & $T_i = 450^\circ\text{C}$ & outer radius & temperature as $R_o = 0.10 \text{ m}$ & $T_o = 300^\circ\text{C}$. It is heated with 150 V & 0.75 amp current. **07**
- OR**
- Q.3** (a) Derive Euler's equation and obtain Bernoulli's equation by its integration. **07**
 (b) Water is flowing through a pipe of 5cm diameter under a pressure of 29.43N/cm² & with mean velocity 2 m/sec. Find the total head/ total energy per unit wt of the water at a cross section, which is 5m above the datum line. **07**
- Q.4** (a) Give equation for Newton's law of cooling? Define Reynolds & Grashof numbers. Where these numbers are used? **07**
 (b) Write in brief about Wein's distribution law and Lambert's law **07**
- OR**
- Q.4** (a) What are the various applications of Bernoulli's equation? State & explain how the rate of flow is measured by venturimeter. **04**
 (b) State Newton's second law of motion and derive equation for momentum balance. **07**
- Q.5** (a) Define Diffusivity. Give Fick's first law and second law. **07**
 (b) Distinguish between Steady diffusion & Pseudo-steady diffusion **07**
- OR**
- Q.5** (a) Derive general equation of mass diffusion in stationary media. **07**
 (b) Using differential momentum balance equation, derive Navier-Stokes Equation. **07**