Roll No. | | | | | | | | | | |

B.E / B.Tech (Part Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

CIVIL ENGINEERING

Second Semester

PTCE 8202 - FLUID MECHANICS

(Regulation 2013)

Time : 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Differentiate between solid and fluid
2. State Pascal's law
3. What is flow net?
4. Write the applications of Bernoulli's equation
5. Distinguish between distorted and undistorted model?
6. List the seven fundamental dimensions
7. What do you mean by eddy and vena contracta in pipe flow?
8. Distinguish between pipes in series and parallel?
9. What is boundary layer?
10. State the applications of momentum integral equation

Part – B (5 x 16 = 80 marks)

11. (i) Explain with the neat sketch surface tension and capillarity and obtain necessary expressions. (8)
(ii) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size 0.8 m X 0.8 m and an inclined plane with angle of inclination 30 degree to horizontal. The weight of the square plate is 300 N. and slides down with uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm. (8)

12. a) A horizontal venturimeter with inlet and throat diameter 300 mm and 100 mm respectively is used to measure the flow of water. The pressure intensity at inlet is 130 kN/m^2 while the vacuum pressure head at throat is 350 mm of mercury. Assuming 3 percent of head lost between the inlet and throat, find the value of coefficient of discharge for the venturimeter and also determine the rate of flow.

(OR)

b) (i) Derive an expression for a three dimensional continuity equation in cartesian coordinates. (8)
(ii) The water is flowing through a taper pipe of length 50 m having diameters 40 cm at the upper end and 20 cm at the lower end, at the rate of 60 lit/s. The pipe has a slope of 1 in 40. Find the pressure at the lower end if the pressure at the upper end is 24.525 N/cm^2. (8)

13. a) Using Buckingham's pi theorem, show that the discharge consumed by an oil ring is given by

$$Q = Nd^3\phi\left[\frac{\mu}{\rho Nd^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{w}{\rho N^2 d}\right]$$

Where d is the internal diameter of the ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and w is the specific weight of oil.

(OR)

b) (i) A solid sphere of diameter 100 mm moves in water at 5 m/s. It experiences a drag of magnitude 19.62 N. What would be the velocity of 5 m diameter sphere moving in air in order to ensure similarity? What will be the drag experienced by it? Take density of air as 1.2 kg/m^3 and kinematic viscosity of air is three times the kinematic viscosity of water. (8)

(ii) A 1in 25 model of a flying boat is towed through water. The prototype is moving in sea water of density 1024 kg/m^3 at a velocity of 15 m/s. find the corresponding speed of the model. Also determine the resistance due to waves on model, if the resistance due to waves of prototype is 523 N. (8)

14. a) Derive an expression for Hagen Poiseuille's formula for laminar flow through pipes.

(OR)

b) The difference in water surface level in two tanks, which are connected by three pipes in series of lengths 300m, 170m and 210m and diameters 300mm, 200mm and 400mm respectively, is 12m. Determine the rate of flow of water if co-efficient of friction is 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses (ii) neglecting minor losses.

15. a) In the boundary layer over the face of a high spillway the velocity distribution was observed to have the following form: $u / U = (y / \delta)^{0.22}$. The free stream velocity U at a certain section was observed to be 30 m/s and a boundary layer thickness of 60 mm was estimated from the velocity distribution measured at the section. The discharge passing over the spillway was 6m^3/s per meter length of spillway. Calculate the displacement thickness, the energy thickness and the loss of energy up to the section under the consideration.

(OR)

b) (i) Derive Von-Karman momentum equation for boundary layer flow. (12)
(ii) Write short note on boundary layer separation and its prevention. (4)