B.E. / B.Tech. (Civil Engineering) Model Curriculum Semester-III

005 / PCC-CE305 - Fluid Mechanics-I

P. Pages : 2 **GUG/W/24/13713**

Time : Three Hours * 5 3 9 0 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.

1. a) Write short notes on: **8**

i) Surface tension

ii) Capillarity

iii) Newton's law of viscosity

iv) Types of fluid

b) Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9. **8**

OR

2. a) Write a short note on: **8**

i) Geometric similarity.

ii) Dynamic similarity

iii) Reynold's number

b) Explain Buckinghams π theorem. **8**

3. a) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3m below the free surface of water. Find the position of centre of pressure also. **8**

b) Define and explain following term: **8**
i) Total pressure
ii) Centre of pressure

OR

4. a) Derive the expression for metacentric height for floating body. **8**

b) A solid cylinder a diameter 4.0 m has a height of 4m. Find the metacentric height of the cylinder if the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical state whether the equilibrium is stable or unstable. **8**

5. a) Derive Eular's equation of motion along a streamline. **8**

b) The velocity components in a two-dimensional flow field for an incompressible fluid are as follow **8**

$$u = \frac{y^3}{3} + 2x - x^2y \text{ and}$$

$$v = xy^2 - 2y - \frac{x^3}{3}$$

Obtain an expression for the stream function ψ.

OR

6. a) An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d = 0.98. **8**

b) Derive the expression for discharge over a triangular notch. **8**

7. a) A fluid of viscosity $0.7\ Ns/m^2$ and sp. Gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as $196.2\ N/m^2$. **8**

Find :

i) The pressure gradient
ii) The average velocity
iii) Reynold's number of the flow

b) Explain Reynold's experiment. **8**

OR

8. a) Explain hydrodynamically smooth and rough boundaries. **8**

b) Explain in detail boundary layer separation and its control. **8**

9. a) Three pipes of length 800 m, 500 m and 400 m and of diameters 500 mm, 400 mm and 300 mm respectively are to connected in series. These pipes are to be replaced by a single pipe of length of 1700 m. Find the diameter of the single pipe. **8**

b) Derive expression for Dupit's equation. **8**

OR

10. a) Explain Karman Prandtl velocity distribution equation for smooth and rough boundaries. **8**

b) Derive Darcy's Weisbach equation for head loss in pipe due to friction. **8**

****