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

005 / PCC-CE305 - Fluid Mechanics-I

P. Pages : 2 | **GUG/W/23/13713**

Time : Three Hours | Max. Marks : 80

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Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) What is capillarity? Derive an expression for a capillarity rise in a tube of radius ‘r’ when it is immensed in a liquid having unit weight “w” and surface tension “s”. The angle of contact between the glass tube and liquid is θ. **8**

b) Two horizontal plates are place 1.25 cm apart the space between them being filled with oil of viscosity 14 poise.
Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. **8**

OR

2. a) Explain different types of similarity. **8**

b) Define the following dimensionless number. **8**
i) Reynolds number.
ii) Froud number.
iii) Match number.
What are their significances for fluid flow problems.

3. a) Define atmospheric, Vacuum, gauge and absolute pressure and establish relationship between them with neat sketch. **8**

b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing the other end of manometer is open to atmosphere. Find the vacuum pressure in the pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in left from the centre of pipe is 15 cm below. **8**

OR

4. a) Explain briefly the following types of equilibrium . **8**
i) Stable Equilibrium.
ii) Unstable Equilibrium
iii) Neutral Equilibrium

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

5. a) Define and explain: **8**
i) Steady and unsteady flow.
ii) Rotational & Irrotational flow
iii) Uniform and Non-uniform flow
iv) Laminar and Turbulent flow

b) The stream function for a two-dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ. **8**

OR

6. a) The head of water over a rectangular notch is 900mm. The discharge is 300 litres/s. Find the length of the notch, when Cd = 0.62. **8**

b) State and prove Bernoulli's equation. List the assumption which are made while deriving Bernoulli's equation. **8**

7. a) An oil of viscosity $0.1\,\mathrm{Ns/m^2}$ and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and length 300 m. The rate of flow of fluid through the pipe is 3.5 lit/sec. Find the pressure drop in a length of 300m and also the shear stress at the pipe wall. **8**

b) An oil of viscosity 10 poise flows between two parallel fixed plates which are kept at a distance of 50 mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2 m be $0.3\,\mathrm{N/cm^3}$. The width of plate is 200mm. **8**

OR

8. a) Explain in details: **8**

i) Boundary layer thickness.
ii) Displacement thickness.
iii) Laminar sublayer.
iv) Turbulent boundary layer.

b) Write a note on boundary layer separation. What is the effect of pressure gradient on boundary layer separation. **8**

9. a) Explain major and minor losses in pipe flow. **8**

b) A syphon of dia meter 200 mm connect two reservoirs having a difference in elevation of 20m. The length of syphon is 500 m. and the summit is 3.00 m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100m. Determine the discharge through the syphon and also pressure at the summit. Neglect minor losses. The co-efficient of friction F = 0.005. **8**

OR

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

i) Characteristics of turbulent flow.
ii) Prandtl's mixing length theory.

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

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