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

005 / PCC-CE305 - Fluid Mechanics-I

P. Pages : 2 **GUG/S/23/13713**

Time : Three Hours * 2 4 4 9 * 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.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Define & explain newton's law of viscosity. What is the effect of temperature of fluid viscosity? **8**

b) Determine the capillarity in a glass tube of 2mm diameter when immersed in water & mercury. The surface tension for water & mercury are 0.072 N/m & 0.52 N/m respectively. Assume specific gravity of mercury as 13.6. **8**

OR

2. a) What do mean by dimensionless numbers? Derive the expression for- **8**
i) Reynold's number ii) Mach number

b) State and explain Buckingham Π theorem. **8**

3. a) Define & explain the following terms: **8**
i) Total Pressure ii) Centre of pressure

b) What are the gauge pressure and absolute pressure at a point 3m below the free surface of a liquid having a density of $1530\,kg/m^3$. If Atmospheric pressure is equivalent to 750 mm of mercury? The specific gravity of mercury is 13.6 and density of water is equal to 1000 kg/m^3. **8**

OR

4. a) Obtain an expression for determination of metacentric height for the floating body use experimental method. **8**

b) Show that a cylindrical buoyancy at 1m diameter and 2m height weighing 9.81kN will not float vertically in sea water of specific gravity $10.150\,N/m^3$. **8**

5. a) What are the conditions for flow to be the irrotational? Show that the equipotential lines are orthogonal to stream lines at all the points of intersection. **8**

b) List out various forces influencing motion. Derive Euler's equation of motion along a stream lines. **8**

OR

6. a) State Bernoulli's theorem for steady flow of an incompressible fluid. derive an expression for Bernoulli's theorem from first principle and assumptions made for such derivation. **8**

b) A Cipolletti weir with crest width of 400mm discharge water, the head over the crest being 250mm. If a channel to approach is 600mm wide and 450mm deep, find the discharge. **8**

7. a) Describe Reynold's experiments to demonstrate the various types of flow. **8**

b) Oil of viscosity is $0.2\frac{N-sec}{m^2}$ and SP. gravity of 0.8 flows through a 180mm diameter pipe. **8**

If the head loss in 300mm length of pipe is 18m. Estimate.

i) Shear stress at a radial distance if 50mm from the axis of pipe
ii) Shear stress along the pipe wall
iii) Check whether the flow is laminar.

OR

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

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

b) What do you mean by separation of boundary layer? What is the effect of pressure gradient on boundary layer separation? **8**

9. a) Explain Hydraulic gradient line & energy gradient line for flow through pipe with gradient to horizontal and having reducing area. **8**

b) From a Reservoir two parallel pipe of diameter 150mm and 200mm each 100m long convey a total discharge of 0.12 cum/sec. Find the head loss due to friction. If however the two pipe are arranged in series to convey the same discharge what would be the head loss due to friction take f = 0.0075. **8**

OR

10. a) A syphon of a diameter 200mm connects two reservoir having a difference in elevation of 15m. The total length of syphon is 600mm and summit is 4m above the water level in the upper reservoir. If the separation take place at 2.8m of water absolute, Find the maximum length of syphon from upper reservoir to the summit. Take f = 0.004 and Atmospheric pressure 10.3m of water. **8**

b) Write short notes on **any two** of the following. **8**

i) Write down Karman Prandtl velocity distribution equations for smooth and rough boundaries, equation for mean velocity for pipes, Darcy flow.

ii) Prandtl's mixing length theory.

iii) Characteristics of turbulent flow.

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