CBCS SCHEME

USN | | | | | | | | | | 17AU42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following fluid properties:
(i) Density (ii) Weight density (iii) Specific volume
(iv) Specific gravity (v) Viscosity **(10 Marks)**

b. Define capillarity and also derive the expression for capillary rise. **(05 Marks)**

c. Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above the atmosoheric pressure. **(05 Marks)**

OR

2 a. State and prove the Pascal's law. **(08 Marks)**

b. A hydraulic press has a ram of 30 cm diameter and a plunger of 5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 400 N. **(04 Marks)**

c. Derive an expression for the force exerted on a submerged vertical plane surface by the static liquid. **(08 Marks)**

Module-2

3 a. Define the following:
(i) Buoyency (ii) Center of buoyancy
(iii) Metacentre (iv) Meta centric height **(10 Marks)**

b. A solid cylinder of diameter 4m and height of 4m. Find the metacentric height of the cylinder if the specific gravity of the material of the cylinder = 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. **(10 Marks)**

OR

4 a. List and explain the types of fluid flow. **(10 Marks)**

b. Derive the continuity equation for 3-dimension Cartesian coordinates. **(10 Marks)**

Module-3

5 a. What is Euler's equation of motion? How will you obtain Bernoulli's equation from it? **(10 Marks)**

b. The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 mt above datum and section 2 is 4 mt above. If the pressure at section '1' is 39.24 N/cm^2. Find the intensity of pressure. **(10 Marks)**

OR

6 a. Sketch and derive the relation for actual discharge through venturimeter. **(10 Marks)**

b. List out the merits and demerits of orifice meter. **(02 Marks)**

c. An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge is fitted upstream and downstream of the orifice meter. **(08 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

7 a. What are the methods for dimensional analysis and explain any one. (08 Marks)

b. Using Buckingham's π - theorem, show that the velocity through a circular orifice is given by $V = \sqrt{2gH}\,\phi\left[\frac{D}{H}, \frac{\mu}{\rho VH}\right]$ where H is the head causing flow 'D' is diameter of orifice, μ is coefficient of viscosity, 'ρ' is the mass density and 'g' is the acceleration due to gravity. (12 Marks)

OR

8 a. List out the energy losses in pipes. (04 Marks)

b. Derive the Darcy equation for loss of head due to friction in pipe. (10 Marks)

c. A cruid oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres per second. Find the head lost due to friction for a length of 50 m of the pipe. (06 Marks)

Module-5

9 a. Define Reynold's number. What is its significance? (06 Marks)

b. An oil viscosity 0.1 NS/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 liter/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall. (10 Marks)

c. Explain the terms: (i) Drag (ii) Lift (iii) Boundary layer (iv) Energy thickness (04 Marks)

OR

10 a. A man weighing 90 kg and descends to the ground from an aeroplane with the help of parachute against the resistance of air. The velocity with which the parachute, which is hemispherical in shape, comedown is 20 m/s. Find the diameter of the parachute. Assume $C_D = 0.5$ and density of air = 1.25 kg/m^3. (08 Marks)

b. Define the terms subsonic flow and supersonic flow. (06 Marks)

c. Calculate the match number at a point on a jet propelled aircraft which is flying at 1100 km/hr at a sea level where air temperature is 20°C. Take K = 1.4 and R = 287 J/kgK. (06 Marks)

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