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Fourth Semester B.E. Degree Examination, December 2012
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

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.

PART – A

1 a. Distinguish between the following and mention their units:
i) Specific weight and mass density.
ii) Surface tension and capillarity.
iii) Dynamic viscosity and kinematic viscosity. **(09 Marks)**

b. Obtain an expression for capillarity rise. **(03 Marks)**

c. In a 50mm long journal bearing arrangement, the clearance between the two at concentric condition is 0.1mm. The shaft is 2.0mm in diameter and rotates at 3000 rpm. The dynamic viscosity of the lubricant used is 0.01 pas and the velocity variation in the lubricant is linear. Considering the lubricant to be Newtonian, calculate the frictional torque the journal has to overcome and the corresponding power loss. **(08 Marks)**

2 a. Obtain an expression for the force exerted and centre of pressure for a completely submerged inclined plane surface. **(10 Marks)**

b. A cylindrical roller gate 3m in diameter is placed on the dam is such a way that water is just going to spill. If the length of the gate is 6m, calculate the magnitude and direction of the resultant force due to water acting on it. **(10 Marks)**

3 a. Define the terms:
i) Centre of buoyancy
ii) Metacentre
iii) Metacentric height. **(04 Marks)**

b. A solid cylinder of diameter 4m has a height of 3m. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. Take specific gravity of the cylinder as 0.6. **(08 Marks)**

c. Explain the different types of fluid flows. **(08 Marks)**

4 a. Obtain an expression for Bernoulli's equation from Euler's equation of motion and also mention the assumptions made. **(10 Marks)**

b. A pipe 300m long has a slope of 1 in 100 and tapers from 1m diameter at the high end to 0.5m at the low end. Quantity of water flowing is 5400 litres per minute. If the pressure at the high end is 70 kPa, find the pressure at the low end. **(10 Marks)**

PART – B

5 a. Derive an expression for discharge through venturimeter. **(10 Marks)**

b. The resisting force 'F' of a supersonic plane dunning flight can be considered as dependent upon the length of aircraft 'l', velocity 'v', air viscosity 'μ', air density 'ρ' and bulk modulus of air 'K'. Express the functional relationship between these variables and the resisting force. **(10 Marks)**

6 a. Derive Darcy-Weisbach equation for loss of head in a pipe due to friction. **(10 Marks)**

b. A 5cm diameter pipe takes off abruptly from a large tank and rum 8m, then expands abruptly to 10cm diameter and runs 45m, and next discharge directly in to open air with a velocity of 1.5 m/s. Compute the necessary height of water surface above the point discharge. Take t = 0.0065 in the Darcy equation. **(10 Marks)**

7 a. Prove that the maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of the flow. **(10 Marks)**

b. An oil of viscosity 10 poise flow between two parallel fixed plates which are kept at a distance of 50mm apart. Find the rate of flow of oil between the plates if the drop of pressure in a length of 1.2m be 0.3 N/cm^2. The width of the plates is 200mm. **(10 Marks)**

8 a. Define:

i) Lift and drag.

ii) Displacement, momentum and energy thickness.

iii) Mach number, mach cone and mach angle. **(10 Marks)**

b. A man descends to the ground from an aeroplane with the help of a parachute while is homispherical having a diameter of 4m against the resistance of air with a uniform velocity of 25 m/s. Find the weight of the man if the weight of the parachute is 9.81 N. Take $C_D = 0.6$ and density of air = 1.25 kg/m^3. **(10 Marks)**

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