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Total Number of Pages: 02

B.Tech
PCME4201

3rd Semester Back Examination 2017-18
Fluid Mechanics And Hydraulic Machines
BRANCH: AERO, CIVIL, MECH, MINERAL, MINING
Time: 3 Hours
Max Marks: 70
Q.CODE: B863

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

- Explain the significance of kinematic viscosity.
- Explain the principle involved in measuring pressure and pressure difference using manometer.
- With the help of a neat sketch, define metacentre and metacentric height.
- When will *streamlines*, *streaklines* and *pathlines* coincide?
- Write down the expression for depth of centre of pressure for a vertically immersed plane and surface inclined at angle ' θ ' with horizontal.
- What are the limitations of Bernoulli's equation?
- What do you mean by *equivalent pipe*?
- Explain, why the casing of a reaction turbine is spiral shape with uniform change in area?
- What are the function of guide blades in a reaction turbine?
- Write the function of air vessel used in reciprocating pump.

Q2 a) A glass tube of 8 mm internal diameter is immersed in a liquid at 20°C. The specific weight of the liquid is 20601 N/m³. The contact angle is 60° and Surface tension is 0.1 N/m. Calculate the capillary rise and also the radius of curvature of the meniscus. (6)

- b) A rectangular plate of 0.80 m × 0.80 m dimensions weighing 500 N slides down an inclined plane making 30° angle with horizontal, at a velocity of 2 m/s. If the 2 mm gap between the plate and inclined surface is filled with lubricating oil, find its viscosity. (4)**

Q3 a) A circular plate of diameter 2 m is submerged in water vertically such that its top surface is 1 m below the free surface of the water. Determine the total pressure force on the plate and the position of the centre of pressure. (5)

- b) A ship of weight 32000 kN is floating in sea water. The centre of buoyancy is 1.6 m below its centre of gravity. The moment of inertia of the ship area at the water level is 8320 m⁴. Find the metacentric height. Take specific weight of sea water is 10.1 kN/m³. (5)**

Q4 a) Derive Euler's equations of motion for a streamline. (5)

- b) A vertical pipeline 10 cm diameter at the top tapers uniformly to 20 cm at bottom. The length of the pipeline is 2 m. If the discharge through the pipeline is 30 litres/sec find the difference in pressure. Neglect friction. (5)**

Q5 a) Obtain expression for Darcy-Weisbach friction factor, f for laminar flow in a pipe. (5)

- b) Find the acceleration and vorticity components at a point (1,1,1) for the following flow field: (5)**
 $u = 3x^2 + 2y$; $v = 2xy + 4y^2 + 3zy$; $w = -3z^2 + 2xz - 9y^2z$

Q6 a) A pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at the rate of 750 lits/sec under a head of 35 m. If the bucket deflects the jet through an angle of 160^0 , find the power and efficiency of the turbine. Take the coefficient of velocity as 0.98. (6)

b) Explain with the help of a sketch the working of a *reciprocating pump*. (4)

Q7 a) With a sketch, explain the constructional features of a modern Francis turbine. (4)

b) A centrifugal pump impeller is 40 cm in outer diameter and 2.5 cm wide at exit and its blade angle is 150^0 . When run at a speed of 2100 r.p.m, the flow rate through the pump is 80 lit/sec. (6)
Calculate the radial, relative and absolute fluid velocities at the impeller exit.

Q8 Write short notes on any two of the following. (5 x 2)

a) Fluid classification

b) Pitot tube

c) Multistage centrifugal pumps

d) Indicator diagram