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10CT63

Sixth Semester B.E. Degree Examination, Jan./Feb.2021
Fluid Mechanics and Hydraulic Structures

Time: 3 hrs.

Max. Marks:100

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

PART - A

- 1 a. Explain the various types of fluids, with a neat diagram. (05 Marks)
b. Define surface tension & capillarity. Derive an expression for capillary rise. (07 Marks)
c. The space between two square flat parallel plates is filled with oil. Each side of the plate is 60cm the thickness of the oil film is 12.5mm. The upper plate which moves at 2.5m/s requires a force of 98.1N to maintain the speed. Determine : i) The dynamic viscosity of the oil in poise ii) The kinematic viscosity of the oil in stokes if the sp. gr. of oil is 0.95. (08 Marks)
- 2 a. State and prove Pascal's law. (06 Marks)
b. A u-tube containing mercury is connected to a pipe in which oil of specific gravity 0.9 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to atmosphere? Find the vacuum pressure in the pipe if the difference of mercury in the two limbs is 150 mm and the height of the oil in the left limb for the centre of pipe is 125 mm? Sketch the arrangement. (06 Marks)
c. A circular plate of 1.5 m in diameter is immersed inclined in water so that the greatest and lowest depth of plate from the water surface is 1.8 m and 0.9 m respectively. Determine the force on the face of the plate and point where this force acts. (08 Marks)
- 3 a. Derive Darcy-Weisbach equation for loss of head due to friction in a pipe. (07 Marks)
b. A 300 m long pipe has a slope of 1 in 100 and tapers from 1.2 m diameter at the higher end to 0.6 m at the lower end. The discharge is 5400 liters/minute. If the pressure at high end is 68.7 kPa, find the pressure at lower end. Neglect losses. (06 Marks)
c. Two pipes A and B are connected in parallel between two points. Pipe A is 150 m long and 150 mm in diameter while pipe B is 100 m long and 120 mm diameter. Both the pipes have same friction factor $f = 0.018$. The total discharge carried by both pipes is 50 lps. Calculate discharges in each pipe. (07 Marks)
- 4 a. Define the following : i) Orifice and mouth piece ii) Coefficient of velocity iii) Broad crested weir. (06 Marks)
b. Derive an expression for the discharge over a rectangular notch. (07 Marks)
c. An orifice is fitted at the bottom or one side of tank having water to a depth of H m. Derive an expression to estimate the coefficient of velocity experimentally. (07 Marks)

PART - B

- 5 a. Find the force exerted by fluid jet on stationary flat plate inclined at angle ' θ ' to the jet. (06 Marks)
b. A jet of water 75 mm diameter strikes normally a flat smooth plate with a velocity of 20 m/s. Find the thrust on the plate: (i) if the plate is at rest; (ii) if the plate is moving in the same direction as the jet with a velocity of 5m/sec. Also find the work done per second on the plate for each case. (06 Marks)
c. A metal plate of 10 mm thickness and 0.20 m square is hung so that it can swing freely above the upper horizontal edge. A horizontal jet of water of 20 mm diameter impinges with its axis perpendicular and 50 mm below the edge of hinge and keeps it steadily inclined at 30° the vertical. Find the velocity of jet if the specific weight of metal is 75.54 kN/m^3 . (08 Marks)

- 6 a. Sketch and explain the working of a Kaplan turbine. (10 Marks)
b. A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flossing at the rate of 700 lps under a head of 30 m. The bucket deflects the jet though an angle of 160° . Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume nozzle coefficient as 0.98. (10 Marks)
- 7 a. What is meant by most economical section of a channel? Derive the condition for the maximum velocity in the circular channel. (08 Marks)
b. Establish the relationship between Chezy's and Manning's formulae. (06 Marks)
c. Explain the following terms :
i) Steady flow and unsteady flow ii) Uniform flow and non uniform flow
iii) Laminar flow and Turbulent flow. (06 Marks)
- 8 a. With a sketch, explain the static head and manometric head of a centrifugal pump. (06 Marks)
b. Explain cavitation and priming devices of centrifugal pump. (06 Marks)
c. Explain the problems and remedies of centrifugal pump. (08 Marks)
