Code: 13A01303

R13

B.Tech II Year I Semester (R13) Regular Examinations December 2014

FLUID MECHANICS

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is Pascal's law?

(b) Give the position of centre of pressure with respect to centre of gravity in general. Also give the reason.

(c) Define and differentiate path line and streak line.

(d) Define buoyancy.

(e) Give any two assumptions of Bernoulli's equation.

(f) How does a pitot tube works?

(g) Define the terms nappe and sill.

(h) Find the discharge through a totally drowned orifice 2.0 m wide and 1 m deep, if the difference of water levels on both the sides of the orifice be 3 m. Take $c_d = 0.64$.

(i) When do you prefer pipes in series and pipes in parallel?

(j) When do you call a boundary as a hydro-dynamically rough boundary?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) When the pressure of liquid is increased from 3.5 MN/m^2 to 6.5 MN/m^2 its volume is found to decrease by 0.09 percent. What is the bulk modulus of elasticity of the liquid?

(b) A circular plate 1.5 m diameter is submerged in water with its greatest and least depths below the surface being 2.5 m and 1.25 m respectively. Determine the total pressure on one face of the plate and the position of centre of pressure.

OR

3 Define total pressure and centre of pressure. Also derive the expressions for the same when a plane surface is immersed in water at an angle θ with free water surface and deduce the same for a case of vertically immersed plane surface.

UNIT - II

4 A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if its size is 2 m × 1 m × 0.8 m.

OR

5 An open circular cylinder of 15 cm diameter and 100 cm long contains water up to a height of 80 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills.

Contd. in page 2

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UNIT - III

6 (a) Give the necessity of energy correction factor and derive the expression for the same.

(b) What is momentum principle? Explain its application to pipe bend.

OR

7 Explain the principle of venturimeter. Also derive the expression for rate of flow using a venturimeter when there is a flow through a pipe line.

UNIT – IV

8 (a) What is an orifice? Give the classification of orifices.

(b) The head of water over the centre of an orifice of diameter 20 mm is 1 m. The actual discharge through the orifice is 0.85 lps. Find the coefficient of discharge.

OR

9 A rectangular notch of crest width 0.4 m is used to measure the flow of water in a rectangular channel 0.6 m wide and 0.45 m deep. If the water level in the channel is 0.225 m above the weir crest, find the discharge in the channel. For the notch assume C_d = 0.63 and take velocity of approach into account.

UNIT – V

10 (a) A pipe 50 mm diameter is 6m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe, the change of section being sudden? Take f = 0.04 for the pipes of both diameters.

(b) Explain Reynold's experiment.

OR

11 (a) List out the various minor losses that may occur when fluid is flowing through a pipe line. Also give the formulae to calculate the losses.

(b) Oil of viscosity 0.1 Pa.s and specific gravity 0.90 flows through a horizontal pipe of 25 mm diameter. If the pressure drop per metre length of the pipe is 12 kPa determine the rate of flow in N/min, the shear stress at the pipe wall, Reynold's number of the flow and the power required per 50 m length of pipe to maintain the flow.

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