Code: 15A01305

R15

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

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) Why the viscosity of a liquid decrease with increase in temperature? Exaplain.

(b) Enunciate the hydrostatic paradox.

(c) Summarize the conditions for stable equilibrium and neutral equilibrium of a floating body.

(d) Discuss uniform and non uniform flow.

(e) Define energy correction factor.

(f) Express the assumptions made in deriving Bernoulli's equation.

(g) Differentiate Pitot tube and Pitot static tube.

(h) What are hydraulic coefficients? List them.

(i) Compare minor losses and major losses in pipe flow.

(j) Examine the use of Pandtl mixing length theory.

PART - B

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

UNIT - I

2 (a) The pressure outside the droplet of water of diameter 0.5 mm is 101.3 kPa. Calculate the pressure in kPa within the droplet if surface tension is given as 0.0725 N/m.

(b) A shaft of dia 120 mm is rotating in a journal bearing of diameter 122 mm with a speed of 360 rpm. The gap between shaft and bearing is filled with oil of viscosity 6 poise. Find the power required to rotate the shaft if the length of the bearing is 100 mm.

OR

3 (a) State and prove the hydrostatic law.

(b) Determine the total pressure acting on a thin circular plate of diameter 2 m which is placed vertically in water such that its centre is 2 m below the water surface. Also determine the point of centre of pressure.

UNIT - II

4 (a) Define the terms buoyancy and centre of buoyancy.

(b) A block of wood having diameter 1.0 m and height 0.8 m having density 600 kg/m^3 floats in water with its axis perpendicular to water surface. Determine the metacentric height of the block.

OR

5 (a) Distinguish between streamline, streak line and path line.

(b) The stream function for a two dimensional flow is given by $\Psi = 2xy$. Calculate the resultant velocity at the point $P(3,\ 4)$. Also find the velocity potential ϕ.

Contd. in page 2

UNIT - III

6 250 lt/sec of water is flowing through a pipe having diameter 300 mm. If the pipe is bent by 135° (that is change from initial to final direction), find the magnitude and direction of resultant force acting on the bend. Take the pressure of water flowing through the duct as 40 N/cm^2.

OR

7 A 30 x 12 cm venturimeter fitted along a vertical pipeline carries oil of specific gravity 0.86. The flow is upwards and the difference in height between the throat section and entrance section being 25 cm the differential U tube mercury manometer shows a gauge deflection of 20 cm. Estimate: (i) The discharge of the oil through the pipe. (ii) Pressure difference between entrance section and throat section. Take the coefficient of discharge as 0.95 and specific gravity of Hg as 13.6.

UNIT - IV

8 (a) Differentiate between large and small orifice.

(b) Derive an expression for discharge through a large rectangular orifice in terms of coefficient of discharge, width of the orifice and liquid heights.

OR

9 (a) Prove that the condition for maximum discharge through a broad crested weir is h = 2/3 H where h is the head of water at the middle of the weir and H is the height of water above its crest.

(b) The head of water over a triangular notch of angle 60° is 50 cm and coefficient of discharge is 0.62. The flow measured by it is to be within an accuracy of 1.5% up or down. Determine the limiting value of head.

UNIT - V

10 An oil with a viscosity of 0.40 N-s/m^2 and density 900 kg/m^3 flows in a pipe of diameter 2 cm and length 10 m. Determine (i) What pressure drop, P_1-P_2 is needed to produce a flow rate of 2x10^{-5} m^3/s if the pipe is horizontal? (ii) How steep a hill, the inclination angle θ must the pipe be laid on, if the oil is to flow through the pipe at the same rate as above but with $P_1 = P_2$.

OR

11 A pipe joins two reservoirs whose head differences is 10 m. The pipe has 0.2 m diameter, 1000 m length and has a “f” value of 0.008.

(i) What is the flow in the pipeline?

(ii) It is required to increase the flow to the downstream reservoir by 30%. This is to be done by adding a second pipe of the same diameter that connects at some point along the old pipe and runs down to the lower reservoir. Assuming the diameter and the friction factor are the same as the old pipe, how long should the new pipe be.

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