Code: 13A01303 **R13**

B.Tech II Year I Semester (R13) 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) Explain why viscosity of gases increases with rise in temperature.

(b) Define centre of pressure and total pressure.

(c) Define metacentre and metacentric height.

(d) Why is convective acceleration zero in case of uniform flow?

(e) Write Bernoulli's equation with each term representing energy per unit volume of fluid.

(f) In venturimeter, why is the pressure difference always measured between inlet and throat.

(g) Define velocity of approach.

(h) What is a suppressed weir?

(i) What is a siphon?

(j) What is the relationship between pressure gradient and shear stress gradient for a two dimensional steady uniform laminar flow?

PART - B

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

UNIT - I

2 (a) State and prove Pascal's law.

(b) A vertical gap 1.2 cm wide of infinite extent contains fluid of viscosity 1 Pa-s and specific gravity 0.90. A metal plate 1 m x 1 m x 0.2 cm is lifted up with a constant velocity of 0.2 m/s through the gap. If the plate is at a distance of 0.4 cm from one of the plane surfaces of the gap, find the vertical force required. Weight of the plate is 50 N.

OR

3 (a) How is the pressure on a immersed curved surface found?

(b) A circular plate 2 m in diameter is submerged in water such that its greatest and least depths below the free surface are 3.5 m and 2.0 m respectively. Find the total pressure on one face of the plate and depth of centre of pressure.

UNIT - II

4 (a) Explain the experimental method of determination of metacentric height.

(b) If $\emptyset = A(x^2 - y^2)$ represents a possible case of flow, find the stream function Ψ.

OR

5 (a) Show that stream lines and equipotential lines always intersect orthogonally, from the first principles.

(b) A solid right triangular prism of equilateral section 1 m side floats in water; density of prism is 800 kg/m^3. Find the maximum length of the prism which will enable the prism to float with its longitudinal axis vertical.

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UNIT - III

6 (a) What do you understand by kinetic energy correction factor (α)? Derive an expression for the same.

(b) Water flows through an inclined venturimeter. The inlet and throat diameters are 10 cm and 5 cm respectively and their height difference is 30 cm. The mercury manometer gives a reading of 10 cm. Estimate the flow rate, coefficient of discharge and pressure difference between inlet and the throat, neglect losses.

OR

7 (a) Derive an expression for actual discharge through an orifice meter.

(b) A vertical pipe carrying oil of S = 0.80 tapers uniformly from 20 cm diameter at the lower section to 10 cm diameter at the upper section. The vertical distance between the sections is 1m. The pressures at lower and upper sections are 6 N/cm^2 and 5 N/cm^2 respectively when the discharge of oil is 30 liters per second. Calculate the loss of head between the two sections. Determine the direction of flow also.

UNIT - IV

8 (a) Derive an expression for discharge through fully submerged orifice.

(b) A suppressed rectangular weir is constructed across a channel of 0.77 m width with a head of 0.39 m and the crest 0.6 m above the bed of the channel. Estimate the discharge over it. Consider velocity of approach and assume $C_d = 0.623$.

OR

9 (a) Write a note on classification of notches and weirs.

(b) In an experiment on determination of hydraulic coefficients of a sharp-edged orifice, 2.5 cm in diameter, it was found that the jet issuing horizontally under a head of 1 m travelled a horizontal distance of 1.6 m from Vena contracta in a course of vertical drop of 0.7 m from the same point. Further, if a flat plate were held normal to the jet at Vena contracta, the force of 5.6 N would be exerted on the plate. Determine C_d, C_v and C_c for the orifice.

UNIT - V

10 (a) Derive an expression for head loss due to sudden expansion in a pipe.

(b) A pipe of 150 mm diameter and length 100 m carries water at 20°C. If the pressure loss in pipeline is 26.613 kN/m^2, find whether the pipe will act as smooth or rough pipe. Also determine maximum velocity and discharge.

OR

11 (a) Write a note on Prandtl's mixing length theory.

(b) Pipes of 50 cm diameter, 1800 m length, 40 cm diameter, 1200 m length and 30 cm diameter, 600 m length are connected is series;
(i) If these pipes are to be replaced by an equivalent pipe of 40 cm diameter, what would be its length?
(ii) What would be the diameter of the equivalent pipe of 3600 m length?

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