

FLUID MECHANICS

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

- 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 x 1 m x 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.

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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.
