

Vidyalankar

S.Y. Diploma : Sem. IV [CE/CS/CR/CV]

Hydraulics

Prelim Question Paper

Time: 3 Hrs.]

[Marks : 100

- Instructions :**
- (1) All Questions are Compulsory.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

1. Attempt any **TEN** of the following :

[20]

- (a) Define mass density and state its SI unit.
- (b) State four application of Hydraulics in environmental engineering.
- (c) Define ideal fluid and real fluid.
- (d) State Newton's law of viscosity.
- (e) A pressure of 1.2 pascal applied to 650 litres of liquid caused a volume reduction by 1.5 litres. Calculate bulk modulus of elasticity for liquid.
- (f) Define pressure and state its unit.
- (g) How will you measure negative pressure?
- (h) Define Reynolds number.
- (i) Mention necessity of inverted manometer.
- (j) Write modified Darcy-Weisbach equation.
- (k) Define Froude's number.
- (l) List four uses of pitot tube.

2. Attempt any **FOUR** of the following :

[16]

- (a) State Pascal's law and its practical application.
- (b) A circular plate 1.5 m diameter is placed vertically in water so that the centre plate is 2.5 m below the free surface. Determine the total pressure on the plate and depth of centre of pressure.
- (c) Draw a neat sketch of pressure diagram showing variation of pressure on vertical side wall of tank and horizontal bottom of tank containing liquid of specific weight 'r' upto a height of 'h'.
- (d) Convert the pressure of 0.5 N/mm^2 in metres of liquid of specific gravity 0.7.
- (e) A differential manometer connected at the two points A and B on a horizontal pipe. Carrying specific gravity 0.8 shows a difference in mercury levels as 15 cm. Find the difference in pressure at the two points in m of oil and N/m^2 .
- (f) What is Piezometer and where it is used?

3. Attempt any **FOUR** of the following :

[16]

- (a) A conical tube is fixed vertically with its smaller end upward having diameter 150 mm and 300 mm at bottom. Length of pipe is 10 m. Pressure at bottom is 300 Kpa and velocity at bottom is 3 m/s. Find pressure at top of pipe if loss head is 2 m of water.

- (b) A sloping pipeline has diameter of 1m at higher end and 50 cm at lower end. It carries liquid at sp.gr.0.75 at 48000 lpm. The pressure at lower end is 1200 kN/m^2 . Determine the pressure at higher end of pipe.
- (c) Explain the terms
 - (i) Pipes in parallel
 - (ii) Equivalent pipe
- (d) Three pipes having same length and same friction factor having different diameter 250 mm, 100 mm, 75 mm respectively when three pipes are connected in parallel gives total discharge $0.75 \text{ m}^3/\text{s}$. Find out discharge in each pipe.
- (e) Explain syphon pipe with sketch.
- (f) Explain with neat sketch different types of open channel. (any four)

4. Attempt any **FOUR** of the following :

[16]

- (a) Define steady, unsteady, uniform and non-uniform flow in open channel.
- (b) Design a trapezoidal channel to carry a maximum discharge of 5 cumecs. The longitudinal slope is 1 : 4000 side slopes 1 : 1, $N = 0.02$, $b = 3d$.
- (c) Define Froude's number. What is Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF) in open channel? How it is classified according to Fr No. ?
- (d) Define specific energy. Explain specific energy diagram.
- (e) A tank has two identical orifices in one of its vertical sides. The upper orifice is 2 m below the water surface and lower orifice is 4 m below the water surface. Find the point at which two jets will intersect, if the coefficient of velocity is 0.92 for both orifices.
- (f) A $30 \times 15 \text{ cm}$ venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.90, the flow being upwards. The difference in elevations of the throat section and entrance section of the venturimeter is 50 cm. The differential U-tube mercury manometer shows a gauge deflection of 30 cm. Calculate :
 - (i) discharge of oil
 - (ii) pressure difference between the entrance and throat section $C_d = 0.98$

5. Attempt any **FOUR** of the following :

[16]

- (a) Explain working principle of current meter with sketch. State types of it.
- (b) A weir 6 m long has 70 cm head of water over its crest. Using Francis's formula, find the discharge over the weir. If the approach channel is 7 m wide and 1.5 m deep, calculate the new discharge considering the velocity of approach.
- (c) A reservoir has a catchment area of 30 km^2 . The maximum rainfall over the area is 2.5 cm/hour, 45% of which flows to the reservoir over a weir. Find length of the weir. The head over weir is 80 cm.
- (d) Differentiate between centrifugal and reciprocating pump.
- (e) Enlist operating troubles and remedial measures in centrifugal pump.
- (f) Find the power required to drive a centrifugal pump which delivers 50 LPS of water to height of 20 m through a 150 mm ϕ and 120 m long pipe line. The overall efficiency of pump is 75%. Assume Darcy's $f = 0.06$, total minor loss = 0.35 m.

6. Attempt any **FOUR** of the following :

[16]

- (a) Explain with sketch submersible pump.
- (b) Define : (i) Coefficient of contraction (ii) Coefficient of velocity
(iii) Coefficient of discharge (iv) Coefficient of resistance
- (c) What do you mean by most economical section of an open channel?
- (d) A trapezoidal channel with side slope 3 : 2 has to be designed to convey $15 \text{ m}^3/\text{sec.}$ at a velocity of 2 m/sec. , so that the amount of concrete limits for the bed and sides is minimum. Find :
 - (i) Wetted perimeter
 - (ii) Slope of bed if manning $N = 0.014$
- (e) Define Prismatic and Non Prismatic channel and critical flow and subcritical flow.
- (f) State any four practical applications of hydrostatics.

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