

17421**21415****3 Hours / 100 Marks**

Seat No.

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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.

Marks**1. (A) Attempt any SIX :****12**

- (a) Differentiate real and ideal fluid.
- (b) Define kinematic and dynamic viscosity. Give units of them.
- (c) Define atmospheric and vacuum pressure.
- (d) Why mercury is used in manometer ?
- (e) State Darcy Weisbach equation for frictional loss in pipe.
- (f) Explain phenomenon of water hammer.
- (g) Define Cd, Cv, Cc & state relation between them.
- (h) State situation where venturimeters, weir, current meter and flumes are used.

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(B) Attempt any TWO :

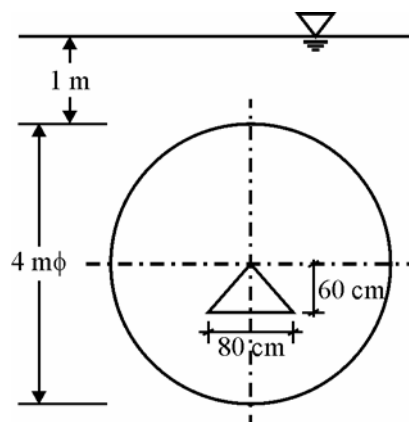
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- (a) A shaft of 150 mm diameter rotates at 75 rpm in a 500 mm long bearing. Taking that two surfaces are uniformly separated by a distance of 1 mm and considering linear velocity distribution having viscosity of $0.005 \text{ N}\cdot\text{s}/\text{m}^2$. Find the power absorbed in the bearing.
- (b) Define compressibility. How it is related to bulk modulus of elasticity ? Name some hydraulic problems where compressibility of water is taken into account.
- (c) A concrete dam of rectangular section 15 m deep and 8 m wide containing water upto 13 m. Find
- total pressure of water on 1m length.
 - depth of centre of pressure above base.
 - the point at which resultant cuts the base.

2. Attempt any FOUR :

16

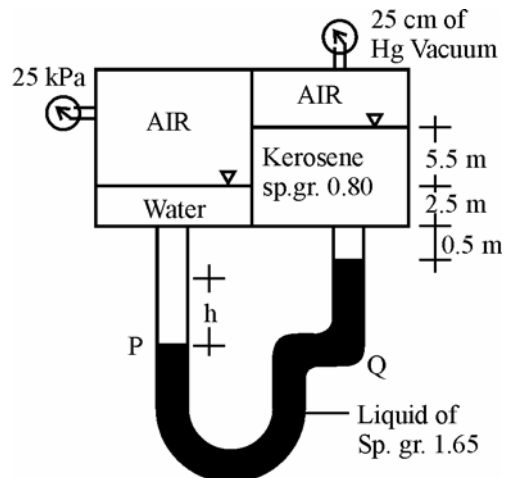
- (a) A circular plate of 4 m diameter is immersed vertically in water so that its upper edge is 1 m below the water. The plate is having a triangular hole which has a base of 80 cm and height of 60 cm in such a position that its vertex coincides with the centre of plate as shown in Fig. Find total pressure acting on the plate and its centre of pressure.



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- (b) Define Pascal's law and state its applications and limitations.
- (c) A pipe line which is 2 m in diameter contains a gate valve. The pipe contains oil of specific gravity of 0.80. The pressure at the centre of pipe is 6 N/cm^2 . Find the force exerted by the oil upon the gate and position of the centre of pressure.
- (d) Calculate height 'h' as shown in Fig..

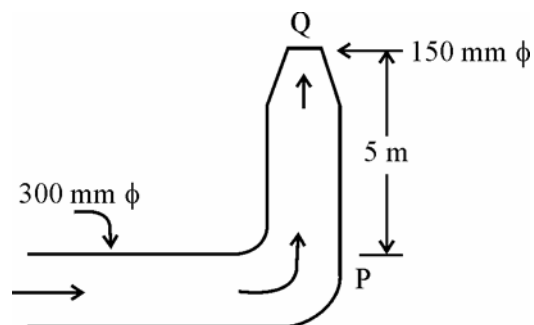


- (e) Classify and define types of fluid flow.
- (f) Define and draw flow net. State properties and applications of flow net.

3. Attempt any FOUR :

16

- (a) Find the height at which water jet will shoot out of nozzle. Neglect loss of energy. Pressure at P = 20 kN/m^2 .

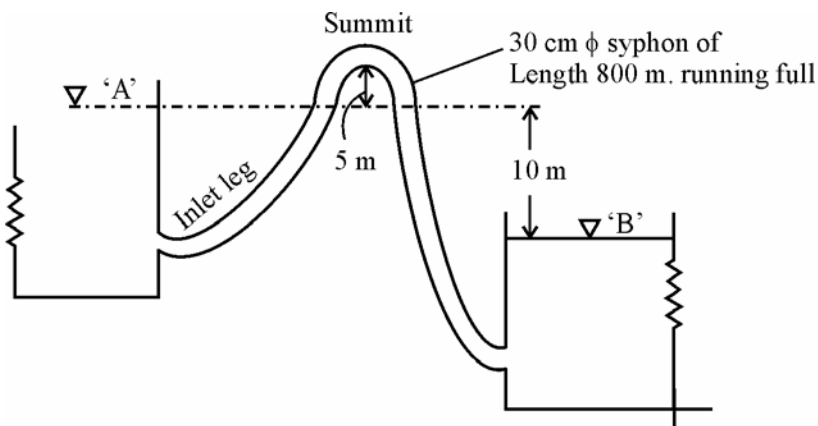


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- (b) A pipe line changes in size from 30 cm ϕ at 'A' to 60 cm ϕ at 'B'. It is used to carry oil of specific gravity 0.80. Point 'A' is 5 m lower than point 'B' and the pressure are 80 kN/m² and 60 kN/m² respectively. If the discharge is 200 LPS. Find the loss of head and direction of flow.
- (c) Explain Moody's diagram and state its applications.
- (d) Find the discharge and maximum length of inlet leg. Permissible pressure at summit is zero.



- (e) Draw Nomogram axis diagram and explain how it is used for design of water distribution pipes.
- (f) State types of open channels. Give hydraulic properties of circular and trapezoidal channel.

4. Attempt any FOUR :

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, $N = 0.02$, $b = 3d$.

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- (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 30×15 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 :**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.

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- (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 $150 \text{ mm } \phi$ 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 TWO :

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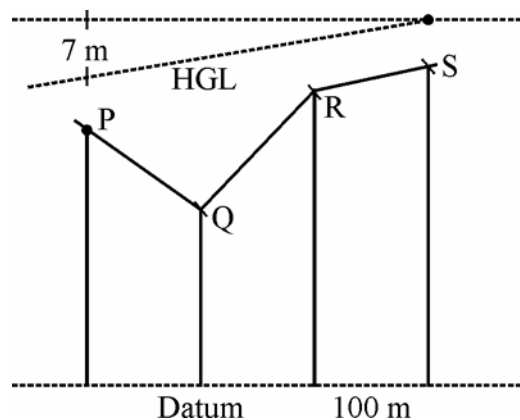
- (a) Derive relation for pressure head difference for U-Tube and inverted U-Tube differential manometer.
- (b) A pipe PQRS of uniform diameter. $PQ = 120 \text{ m}$, $QR = 150 \text{ m}$, $RS = 60 \text{ m}$. RL at P, Q, R, S are $160, 145, 175, 190 \text{ m}$ respectively.

Pressure at P = 0.30 MPa

Pressure at S = 0.07 MPa

Find pressure at Q & R and find direction of flow.

Neglect minor losses.



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- (c) The spillway of a tank discharges with a head of 1.5 m. The length of crest is 10 m. Calculate the dimensions of most economical section of trapezoidal channel with side slopes 1 : 1.5 (V : H) & bed slope 0.5/1000. Assume C_d for weir = 0.78, Manning's $N = 0.016$.
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