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16172

3 Hours / 100 Marks

Seat No.

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

**Marks**

**1. Attempt any TEN :**

**20**

- (a) Define weight density and state its S.I. unit.
- (b) Define dynamic viscosity and kinematic viscosity.
- (c) Why mercury is used in manometer ?
- (d) State the advantages of simple U tube manometer over a piezometer.
- (e) State Bernoulli's theorem and write modified Bernoulli's equation with meaning of each term.
- (f) What is flownet ? State its uses.
- (g) What is 'Energy of Flowing Liquid' ?
- (h) State two uses of syphon.
- (i) What is most economical channel section ? Write conditions for rectangular channel section to be economical.
- (j) Define :
  - (i) Wetted perimeter
  - (ii) Hydraulic radius
- (k) Define  $C_c$ ,  $C_v$  and  $C_d$  and state relation between them.
- (l) Write the use of foot valve in the pump.

**2. Solve any FOUR :**

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- (a) Define pressure diagram for vertical contact surface with neat sketch and mention two applications of it.
- (b) A circular plate of 4 m diameter is immersed in water such that its greatest and least depth below the free surface of water are 5 m and 3 m respectively. Calculate
- Total pressure on one face of plate
  - The position of centre of pressure
- (c) Find the intensity of pressure in  $\text{N/m}^2$  on the base of container when,
- water stands to a height of 1.25 m in it
  - when oil for 0.625 m ht. stands on water of 1 m.ht. Draw pressure diagrams to all cases.
- (d) A simple U tube manometer is used to measure water pressure in pipe. The left limb of manometer is connected to pipe and right limb is open to atmosphere. The mercury level in left limb is 80 mm below centre of pipe and in right limb 40 mm above the centre of pipe. Calculate water pressure in pipe.
- (e) State four different types of flow of liquid with one practical example of each.
- (f) A partition wall 3 m long divides storage tank. On one side there is turpentine of Sp. Gr.0.87 upto a depth of 3.5 m. On the other side there is paraffin oil of Sp. Gr. 0.8 stored to a depth of 2.5 m. Determine resultant pressure on partition wall.

**3. Solve any FOUR :**

16

- (a) A differential U tube mercury manometer connected at two points P and Q on horizontal pipe carrying liquid of Sp. Gr. 0.8. It shows a difference in mercury level as 15 cm. Find the difference in pressure at the two points in  $\text{N/m}^2$ .
- (b) Two horizontal plates are placed 12.5 mm apart. The space between them being filled with oil of viscosity 14 poise. Calculate shear stress in oil if upper plate moves with velocity 2.5 m/sec.

- (c) State Pascal's law and its practical applications.
- (d) A liquid weigh 25 kN and occupies  $3.75 \text{ m}^3$  find its specific weight, mass density, specific gravity and specific volume.
- (e) Explain Reynold's number with its equation and give its significance.
- (f) Differentiate between Laminar flow & turbulent flow.

**4. Solve any FOUR :****16**

- (a) A pipeline 60 cm diameter bifurcates into two branches 40 cm and 30 cm diameter. If the rate of flow in main pipe is  $1.5 \text{ m}^3/\text{sec}$  and velocity of flow in 30 cm diameter pipe is 7.5 m/sec. determine rate of flow in 40 cm diameter pipe.
- (b) A compound pipe having following sections, 45 cm diameter for 1000 m, 30 cm dia. for 750 m and 15 cm dia. for 500 m is required to replace by a pipe of uniform diameter. Find the diameter of new pipe assuming length to remain the same. Also determine the discharge through the pipe. Take  $f = 0.01$  and pressure head at inlet is 45 m of water while at the delivery end is 5 m of water.
- (c) Define friction factor and state any four factors affecting friction factor.
- (d) What are the component parts of centrifugal pump ? Explain the function of each part.
- (e) Two reservoirs are connected by a pipeline consisting of two pipes one of 15 cm. diameter and length 6 m and other of 22.5 cm. diameter and 16 metre length. If the difference of water level in two reservoirs is 6 m. Calculate discharge.
- (f) Water is flowing through a rectangular channel of width 8 m and bed slope 1 in 1000. Depth of flowing channel is 5 m. Find the discharge through channel. Take  $C = 50$ .

**P.T.O.**

**5. Solve any FOUR :****16**

- (a) Explain the phenomenon of water hammer.
- (b) Explain with neat sketch, hydraulic jump. State its uses.
- (c) A rectangular Notch 2.5 m long is discharging water under a head of 22 cm. Find the discharge in lit/sec. over the notch. Take  $C_d = 0.6$
- (d) Differentiate between open channel flow and pipe flow.
- (e) Water discharge at the rate of  $0.0982 \text{ m}^3/\text{sec}$ . through 12 cm. diameter vertical sharp edged orifice placed under a constant head of 10 m. A point on the jet measured from vena contracta of the jet has co-ordinates 4.5 m horizontal and 0.54 m vertical. Find the coefficients  $C_c$ ,  $C_d$  &  $C_v$  of orifice.
- (f) Find the discharge over the triangular notch of an angle of  $60^\circ$  when the head over the notch is 20 cm. Take  $C_d = 0.625$ .

**6. Attempt any TWO :****16**

- (a) A trapezoidal channel of most economical section has side slope 1.5 horizontal to 1.0 vertical. It is required to discharge  $16 \text{ m}^3/\text{sec}$ . with bed slope 0.5 meter in 3.2 km. Design the section using Manning's formula. Take  $N = 0.015$ .
  - (b) Draw a neat sketch of Reciprocating pump showing its various component parts. Mention function of each component.
  - (c) A venturimeter  $150 \times 75 \text{ mm}$  placed vertically with the throat 22.5 mm above the inlet conveys oil of Sp. Gr. 0.78 at  $29 \text{ lit/sec}$ . Calculate the difference of pressure between inlet and throat. Take  $C_d = 0.96$ .
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