

22445

24225

3 Hours / 70 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. **Attempt any FIVE of the following :** **10**
- a) Define mass density of fluid and state its unit.
 - b) State types of impeller used in centrifugal pump with sketch.
(Any two)
 - c) State the Laws of Fluid Friction for Laminar Flow.
 - d) Calculate the velocity of water flowing through pipe of area 2m^2 and Discharge through pipe is $0.3 \text{ m}^3/\text{sec}$.
 - e) Define the term Atmospheric pressure and Absolute pressure.
 - f) Define viscosity and state its types.
 - g) List the components of Hydroelectric power plant and write the function of surge tank in the plant.

P.T.O.

2. Attempt any THREE of the following :**12**

- a) A simple U-tube manometer is connected to pipe containing pressurize water. The height of water column is 0.4 m above the datum line in left limb. In right limb the rise of mercury column is 0.3 m above datum line. Find the pressure in the pipe.
- b) A circular gate having 2 m diameter is fitted in one of the vertical side of tank. The Depth of water in tank is 6 m. Gate is installed at bottom of tank. Calculate Total pressure and Centre of pressure.
- c) State the Bernoulli's theorem. What are the assumption's of Bernoulli's theorem ?
- d) Explain with neat sketch showing all components the construction of orificemeter and write formula to find discharge using orificemeter.

3. Attempt any THREE of the following :**12**

- a) A venturimeter 30 cm × 15 cm size is inserted in a vertical pipe carrying water flowing in the upward direction. A differential mercury manometer is connected to inlet and throat, gives reading of 20 cm. Find the discharge through venturimeter. If the meter coefficient $C_d = 0.99$.
- b) Define with neat sketch. Hydraulic gradient line and Total energy line.
- c) Determine discharge through a pipe of diameter 200 cm when the difference of pressure head between two ends of pipe 500 m apart is 4 m of water ($f = 0.009$)
- d) A jet of water 12 cm diameter strikes on flat plate with velocity 20 m/sec normally. Also due to force of jet plate is moving with 4 m/sec in a direction of jet find
 - i) Force exerted by jet
 - ii) Work done by jet
- e) Draw a neat sketch of impact of Jet on inclined fixed plate and write the formula to determine force exerted by the Jet and state the meaning of each term.

4. Attempt any THREE of the following : 12

- a) Compare centrifugal pump and reciprocating pump in respect to –
 - i) Working Principal
 - ii) List of components.
 - iii) Priming Process.
 - iv) Application based on Discharge and Head.
- b) What is draft tube used in turbine ? Explain with neat sketch different types of draft tube.
- c) What is Priming ? Explain with types of priming process in centrifugal pump.
- d) A Pelton wheel having semi-circular bucket and working under head of 140 m is running at 600 rpm the discharge through nozzle is $0.5 \text{ m}^3/\text{s}$ and diameter of wheel is 600 mm. Find power develop by nozzle and Hydraulic efficiency if $C_v = 0.98$.
- e) State any four faults and their remedies in centrifugal pump.

5. Attempt any TWO of the following : 12

- a) Draw a neat sketch of Francis turbine, label and write functions of following components.
 - i) Scroll Casing
 - ii) Runner
 - iii) Draft tube
 - iv) Vanes
- b) Compare Pelton wheel turbine, Francis turbine and Kaplan turbines based on –
 - i) Discharge, Head available
 - ii) Intake and exit of water through turbine
 - iii) Energy available at inlet of turbine.
- c) Find the maximum power that can be transmitted by a power station through a pipe 3 km long and 0.2m diameter. The pressure at power station is 60 bars ($f = 0.078$).

6. Attempt any TWO of the following :**12**

- a) What is Air vessel ? Explain the function of Air vessel in Reciprocating Pumps. Sketch the system showing air vessel for single acting reciprocating pump.
 - b) Explain with sketch principle, construction and working of pitot tube. Write formula to find velocity in pitot tube with meanings.
 - c) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1200 rpm works against the total head of 45 m the velocity of flow through the impeller is constant and equal to 2.5 m/s. the vanes are set-back at an angle of 40° at outlet. If the outer diameter of impeller is 500 mm and width at outer is 50 mm. Determine.
 - i) Vane angle at inlet
 - ii) Work done by impeller
 - iii) Manometric efficiency
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