

313309

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 : (i) Surface tension (ii) Kinematic viscosity of fluid.
- (b) Define : (i) Hydraulic efficiency (ii) Mechanical efficiency w.r.t. turbines.
- (c) List the four basic components of reciprocating pump.
- (d) Determine the diameter of droplet of water in mm, if the pressure inside is to be greater than that outside by  $130 \text{ Nm}^2$ . Take ' $\sigma$ ' of water  $7.26 \times 10^{-2} \text{ N/m}$ .
- (e) State the laws of fluid friction for turbulent flow (any four points).
- (f) State Pascal's law.
- (g) State Bernoulli's theorem.



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

- (a) Calculate pressure head of kerosene of specific gravity 0.81 and carbon tetrachloride of specific gravity 1.6, if equivalent pressure head of water is 100 m.
- (b) Define : (i) Steady and Unsteady flow (ii) Laminar and Turbulent flow.
- (c) A circular plate 2 m diameter is placed vertically in water so that centre of the plate is 3 m below the free surface. Determine the depth of centre of pressure and total pressure on the plate.
- (d) Explain the various energies possessed by a flowing fluid.

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

- (a) Explain need of draft tube in reaction turbine. State the types of draft tube used in it.
- (b) Explain concept of cavitation in the turbine.
- (c) Find equation of force and work done for the impact of jet on moving vertical plate.
- (d) Interpret turbulent or laminar flow in following situations :
  - (i) Viscous liquid (oil) travelling on smooth surface.
  - (ii) Water falling from top of water fall.
  - (iii) Water flowing at high pressure through pipe.
  - (iv) Glycerin travelling on smooth kitchen floor.

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

- (a) An orifice meter with orifice diameter 150 mm is inserted in a pipe of 300 mm diameter. The pressure difference measured by a mercury-oil differential manometer gives a reading of 20 cm of mercury. Find the rate of flow of oil of sp. gravity 0.98 when  $C_d$  of meter is 0.6.

- (b) Explain construction & working of Bourdon tube pressure gauge with neat sketch.
- (c) Explain the working of double acting reciprocating pump with neat sketch.
- (d) Explain water hammer in pipes and state its causes.
- (e) A jet of water of diameter 35 mm moving with velocity of 30 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by jet of water in the direction of jet, if jet is deflected through an angles of  $135^\circ$  at outlet of curved plate. If the vane is moving with the velocity of 25 m/s in the direction of jet, find out force exerted.

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

**12**

- (a) Find maximum power can be transmitted by power station through a hydraulic pipe 5 km long and 0.25 m diameter. The intensity of pressure available is 70 bars. Take  $f = 0.0075$ .
- (b) State causes and remedies of faults in centrifugal pump.
- (c) A Pelton wheel has a mean bucket speed of 15 m/s and is supplied with water at a rate of  $0.8 \text{ m}^3/\text{s}$  under a head of 30 m. If the bucket deflects the jet through an angle of  $165^\circ$ , find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine, if its mechanical efficiency is 80%.

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

**12**

- (a) Compare Francis turbine with Kaplan turbine (any six points).
- (b) Describe an indicator diagram of reciprocating pump. Sketch the theoretical indicator diagram for a single acting reciprocating pump not fitted with an air vessel. Also explain clearly the effect of acceleration and friction on both suction and delivery strokes.

- (c) A centrifugal pump has the following characteristics :

Outer dia. of impeller = 800 mm,

Width of impeller vanes at outlet = 100 mm,

Angle of impeller vanes at outlet =  $40^\circ$ .

The impeller runs at 550 rpm and delivers  $0.98 \text{ m}^3/\text{s}$  water under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump.

Assume water enters the impeller vanes radially at inlet.

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