

17411

21718

3 Hours / 100 Marks

Seat No.

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*Instructions :* All Questions are *compulsory*.

**Marks**

1. (A) Attempt any SIX of the following :

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- (a) Define specific gravity and specific volume.
- (b) Define fluid pressure intensity and pressure head.
- (c) State the Bernoulli's theorem.
- (d) Sketch and label Bourden pressure gauge.
- (e) Define total pressure and centre of pressure.
- (f) State any four functions of air vessels in reciprocating pump.
- (g) Classify hydraulic turbines.
- (h) Define cavitation in centrifugal pump.

(B) Attempt any TWO of the following :

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- (a) Explain concept of Absolute vacuum, Gauge pressure Atmospheric pressure and absolute pressure with the help of diagram.
- (b) Describe the procedure of pressure measurement using simple U-tube manometer.
- (c) A pipe is used for energy transmission. Length and diameter of pipe are 80 m and 50 cm respectively. Flow rate is 105 lit/s. Calculate friction loss. Neglect minor losses. Take  $f = 0.03$ .

**2. Attempt any FOUR of the following :****16**

- (a) Derive the equation for total pressure on an inclined immersed surface.
- (b) Applying Bernoulli's equation derive the equation for discharge through a venturimeter.
- (c) A jet of water 50 mm in diameter strikes on a fixed plate normally with a velocity of 25 m/s. Find the force exerted on flat plate.
- (d) Find the maximum power that can be transmitted by a power station through a hydraulic pipe of 3 kilometers long and 200 mm diameter. The pressure of water at the power station is 1500 kPa. Take  $f = 0.01$
- (e) Explain with sketch – Hydraulic Gradient Line and Total Energy Line.
- (f) Prove that the centre of pressure of a fully submerged uniformly thick plane lamina is always below the centre of gravity of the lamina.

**3. Attempt any FOUR of the following :****16**

- (a) Sketch layout of hydroelectric power plant and write any four features of it.
- (b) A Pelton wheel develops 2000 kW under a head of 100 meters' and with an overall efficiency of 85%. Find the diameter of the nozzle if the co-efficient of velocity for the nozzle is 0.98.
- (c) State any two functions of Draft tube. Explain the types of Draft tube. (Any Two)
- (d) A jet of water of diameter 7.5 cm moving with a velocity of 25 m/s strikes a fixed plate in such a way that the angle between the jet and plane is  $60^\circ$ . Find the force exerted by the jet on the plate,
  - (i) in the direction normal to the plane.
  - (ii) in the direction of the jet.

- (e) Define :
- (i) Viscosity
  - (ii) Kinematic Viscosity
- (f) The discharge through an horizontal trapping is  $0.06 \text{ m}^3/\text{s}$ . The diameter at the inlet and outlet are 250 mm & 200 mm respectively. If the water enters the pipe at a pressure of 9.81 bar, calculate the outlet pressure.

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

**16**

- (a) With labelled sketch explain the working of Kaplan turbine.
- (b) A centrifugal pump is to discharge  $0.130 \text{ m}^3/\text{s}$  at a speed of 1200 rpm against a total head of 20 meter. The impeller diameter is 250 mm, its width at outlet is 40 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.
- (c) Define in connection with centrifugal pump :
- (i) Manometric efficiency
  - (ii) Mechanical efficiency
  - (iii) Overall efficiency
  - (iv) Net positive suction head

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

**16**

- (a) What is multistaging of centrifugal pumps ? Explain pumps in parallel and pumps in series.
- (b) Sketch indicator diagram of single acting reciprocating pump with frictional head in suction and delivery pipe.

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- (c) What is cavitation in centrifugal pump ? How it is prevented ?
- (d) Describe Chezy's equation for head loss due to friction.
- (e) Explain construction and working principle of pitot tube.
- (f) Define loss of energy of fluid in a pipe. What are major losses and minor losses ?

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

**16**

- (a)
    - (i) Obtain an expression for impact of jet of a liquid on a fixed curved plate when the jet strikes at the centre of the curved plate.
    - (ii) Draw inlet and outlet velocity triangles for bucket in Pelton wheel with the meaning of terms.
  - (b) A horizontal venturimeter 160 mm × 80 mm is used to measure the flow of an oil of specific gravity 0.8. Determine the deflection of the oil-mercury gauge, if the discharge of the oil is 50 litres/s. Take co-efficient of venturimeter as 1.
  - (c) Define slip and negative slip of reciprocating pump. Explain the working of double acting reciprocating pump with neat sketch.
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