

22445

23124

3 Hours / 70 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 FIVE of the following :** **10**
- a) List different properties of fluid.
- b) For a water column of height 8m,
Calculate -
- i) Intensity of pressure (KPa)
- ii) Pressure in mm of Hg
- c) Define the terms :
- i) Hydraulic gradient line
- ii) Total Energy line
- d) State the various minor losses in the pipe.
- e) State the function of draft tube and name any two types of draft tube.

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- f) State any two applications of centrifugal pump.
- g) Draw indicator diagram for reciprocating pump showing the effect of accelerating head and frictional head.

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

- a) Draw sketch of Bourdon tube pressure gauge and state its advantages.
- b) A rectangular plate 0.6 m wide and 1.2 m deep lies within a water body such that its plane is inclined at 45° to the horizontal and the top edge is 0.70 m below the water surface. Determine the total pressure force on one side of the plate and the location of the centre of pressure.
- c) Explain pressure and velocity variation in convergent tube, throat and divergent tube of venturimeter.
- d) Explain with neat sketch the procedure for measuring velocity in pipe using pitot tube.

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

- a) An oil of specific gravity 0.8 is flowing through venturimeter having inlet diameter 35 cm and throat diameter 20 cm. The oil-mercury differential manometer shows a reading of 30 cm. Calculate discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$
- b) Explain the causes of water hammer in pipes and the procedure for reducing its effect.
- c) Find the diameter of a pipe of length 12 km, when rate of flow of water through the pipe is 265 litre/sec. and head loss due to friction is 5.5 m. Take $C = 55$ for Chezy's formula.
- d) Explain velocity diagram for the jet striking tangentially at the tips of a moving an unsymmetrical curved vanes.
- e) A jet of water strikes on series of cup shaped vanes which defects through 165° . If the velocity of jet is that corresponding to head of 40 m and velocity of vanes is such that efficiency is maximum. Find the work done on vane per kg of water.

4. Attempt any THREE of the following : 12
- a) Draw the layout of hydroelectric power plant and classify the turbines used in it.
 - b) Compare Francis turbine with Kaplan turbine.
 - c) Draw and explain performance characteristic curves of Pelton turbine.
 - d) Define submersible pump and jet pump with one application each.
 - e) Discuss the factors considered for selection of pump.
5. Attempt any TWO of the following : 12
- a) An orifice meter with 150 mm diameter is inserted in a pipe of 350 mm. The pressure difference measured by a mercury oil differential manometer gives reading of 400 mm of Hg (mercury). Find the rate of flow of oil of specific gravity 0.98 and coefficient of discharge = 0.64.
 - b) Explain the terms involved in Darcy's equation, Chezy's equation for frictional loss, also show that for a given total head H , the power transmitted through a pipeline connected to a reservoir is maximum when the loss of head due to friction, $h_f = H/3$ (minor losses can be neglected)
 - c) A jet moving with a velocity of V m/s is made to strike a stationary.
 - i) flat plate normally.
 - ii) flat plate inclined at an angle θ and
 - iii) Symmetrical curved vane at centre with tip angle θ .In which case the force exerted by the jet is maximum ? Justify with suitable sketch and formulas.

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

- a) Explain construction and working of Francis turbine with neat sketch.
 - b) Draw an Indicator diagram of reciprocating pump showing the effect of acceleration and friction head on suction and delivery pipes connected with air vessels and without air vessels.
 - c) A centrifugal pump has the following characteristics : Outer diameter of impeller = 900 mm; wide of impeller vanes at outlet = 40° . The impeller runs at 650 rpm and delivers 1.2 cubic meters of water per second under an effective head of 45 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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