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11819

3 Hours / 100 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. (A) Attempt any SIX of the following :

12

- (a) Define Density and Specific gravity.
- (b) Define fluid pressure intensity and pressure head.
- (c) State the Bernoulli's theorem.
- (d) State the types of fluid flow.
- (e) Describe 'Continuity Equation'.
- (f) Define slip and 'Negative Slip'.
- (g) Classify the hydraulic turbines.
- (h) Explain the meaning of 'Impact of Jet'.

- (B) Attempt any TWO of the following :** **8**
- (a) Enlist types of manometers and explain any one of them with neat sketch.
 - (b) Define atmospheric pressure, gauge pressure and absolute pressure. State relationship between them.
 - (c) Explain 'Hydraulic Gradient Line' and 'Total Energy Line'.
- 2. Attempt any FOUR of the following :** **16**
- (a) Explain Bourdon pressure gauge with a neat sketch.
 - (b) Explain with neat sketch principle of working of orifice meter.
 - (c) A Jet of water 95 mm diameter is moving with velocity of 25 m/s, strikes a stationary flat plate. Find the normal force of plate when (i) Plate is normal to jet (ii) The angle between jet and plate is 30° .
 - (d) State the equation for hydraulic power transmission by fluid through pipe and obtain the condition for maximum power transmission.
 - (e) Explain Darcy's and Chezy's equation for frictional losses in flow through pipes.
 - (f) Explain a differential manometer with a neat sketch.
- 3. Attempt any FOUR of the following :** **16**
- (a) Draw and explain general layout of hydroelectric power plant.
 - (b) A Pelton wheel having semi-circular bucket is 1 m in diameter. Pressure head at nozzle when it is closed is 15 bar. The discharge when nozzle is open is $3.5 \text{ m}^3/\text{min}$. If speed is 600 RPM, calculate power developed and hydraulic efficiency.
 - (c) Draw a neat labelled sketch of Kaplan turbine and explain its unique feature.

- (d) A Jet of water strikes on series of cup shaped vanes which deflect it through 165° . If the velocity of jet is that corresponding to a head of 40 m and velocity of vanes is such that the efficiency is maximum. Find the work done on vane per kg of water.
- (e) Define surface tension and capillarity.
- (f) A circular plate 3 m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4 m and 1.5 m respectively. Determine the total pressure and position of centre of pressure.

4. Attempt any TWO of the following :

16

- (a) Define draft Tube. State the types of draft tubes. Explain any one in detail with sketch.
- (b) The outer diameter of an impeller of a centrifugal pump is 400 mm and outlet width 500 mm. The pump is running at 800 rpm and is working against a total head of 15 m. The vane angle at outlet is 40° and monomeric efficiency is 75%, determine
- Velocity of flow at outlet
 - Velocity of water leaving the vane
 - Angle made by the absolute velocity at outlet with direction of motion.
 - Discharge.
- (c) Define the term 'Multistage pump'. Explain construction and working of multistage pump.

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

- (a) Define for centrifugal pump :
 - (i) NPSH
 - (ii) Monomeric efficiency
- (b) Enlist methods of priming of centrifugal pump.
- (c) Explain phenomenon of cavitation in reaction turbines.
- (d) Calculate the power transmitted by 250 mm diameter pipe of length 500 m carrying water under a head of 100 m. Take friction factor 0.0015.
- (e) Explain construction and working of 'Venturimeter'.
- (f) State Law's of fluid friction for laminar flow. (any four)

6. Attempt any TWO of the following :**16**

- (a) (i) Derive an expression for force exerted by the jet on stationary inclined flat plate in direction of jet.
 - (ii) Differentiate between Francis and Kaplan Turbine. (any four points)
 - (b) A venturimeter is installed in a pipe line of 30 cm diameter, the difference of pressure at entrance and throat read by mercury manometer is 5 cm. When the water flows at a rate of $0.05 \text{ m}^3/\text{sec}$. If the discharge coefficient of meter is 0.96. Determine the diameter of throat.
 - (c) Explain construction and working of single acting reciprocating pump in brief with neat sketch. Draw an indicator diagram for it assuming air vessels on both suction and discharge side.
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