

17411

21314

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.
 - (8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. a) Attempt any **SIX** of the following: **12**
- i) Define Specific Weight and Specific Gravity.
 - ii) Define 'Total Pressure' and 'Centre of Pressure'.
 - iii) Define 'Steady Flow' and 'Uniform Flow'.
 - iv) Write the formulae of force exerted by jet of water on moving vertical plate and work done.
 - v) What is 'Continuity Equation' ?

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- vi) What do you mean by 'Negative Slip'?
- vii) Classify the hydraulic turbines.
- viii) Write the types of impellers and casings of centrifugal pump.

b) Attempt any **TWO** of the following: 08

- a) Explain 'Single Column Manometer' in brief.
- b) What is Atmospheric Pressure, Gauge Pressure and Absolute Pressure? State their relation.
- c) Write the equation of power transmission by fluid in pipe and obtain the condition for maximum power transmission.

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

- a) Explain Bourden pressure gauge with a neat sketch.
- b) Derive the equation of actual discharge through venturimeter.
- c) A jet of water of diameter 75 mm moving with velocity of 25 m/s strikes a fixed plate in such a way that angle between jet and plate is 60° . Find the force exerted by jet on plate.
 - i) in the direction normal to plate.
 - ii) in the direction of jet.
- d) Calculate the discharge through a pipe of diameter 200 mm when difference of pressure head between two ends of pipe 500 m apart is 4 m of water. Take value of 'f' = 0.009 in the formula $h_f = 4fLV^2/d \times 2g$.
- e) Explain 'Hydraulic Gradient Line' and 'Total Energy Line'.
- f) Explain simple differential manometer with a neat sketch.

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

- a) Explain general layout of hydraulic power plant.
- b) A pelton wheel is having a mean bucket diameter of 1m and running at 1000 rpm. The net head on pelton wheel is 700 m. If the side clearance angle (ϕ) is 15° and discharge through nozzle is $0.1 \text{ m}^3/\text{s}$. Find
 - i) Power available at nozzle.
 - ii) Hydraulic efficiency of nozzle.
- c) Explain construction and working of Kaplan turbine.
- d) A jet of water of diameter 50 mm moving with velocity of 40 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 angle of 120° at outlet of curved plate.
- 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) What is draft tube ? State the types of draft tube. Explain any one in detail.
- b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. Velocity of flow through impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle at 40° at outlet. If diameter of impeller is 500 mm and width at outlet is 50 mm. Calculate
 - i) Discharge
 - ii) Vane angle at inlet
 - iii) W.D. by impeller on water per second.
 - iv) Manometric efficiency.
- c) What is multistage pumps? Explain construction and working of multistage pumps.

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

- a) Define:
 - i) NPSH
 - ii) Manometric efficiency.
- b) Define cavitation and separation.
- c) Explain methods of priming in brief.
- d) Explain Darcy's and Chezy's equation for frictional losses.
- e) Explain construction and working of 'Orificemeter' with neat sketch.
- f) Explain law's of fluid friction.

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

- a) i) Derive the equation of force exerted by jet on inclined moving plate in direction of jet.
- ii) Differentiate between Francis and Kaplan turbine.
- b) An oil of specific gravity 0.8 is flowing through venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$.
- c) Explain construction and working of single acting and double acting reciprocating pump in brief with neat sketch.
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