

22445

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- 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) Dynamic viscosity of fluid
- b) For a water column of height 6 m, Calculate -
- i) Intensity of pressure (Kpa)
- ii) Pressure in mm of Hg.
- c) Define and distinguish between
- i) Steady and unsteady flow
- ii) Uniform and non-uniform flow
- d) State the laws of fluid friction for turbulent flow.
- e) State minor losses of energy of fluid flowing in pipe.

P.T.O.

- f) Suggest the type of turbine to be used for following specific speed:
- i) 8.5 to 30 (10 to 35)
 - ii) 50 to 340 (60 to 400)
 - iii) 300 to 1000
- g) List the four basic components of reciprocating pump.

2. Attempt any THREE of the following: 12

- a) Explain construction and working of Bourdon pressure gauge with a neat sketch.
- b) A circular plate 1.2m diameter is placed vertically in water so that centre of the plate is 2m below the free surface. Determine the depth of centre of pressure and total pressure on the plate.
- c) Describe with sketch, construction and working principle of venturimeter.
- d) Describe the equation for actual discharge through Orifice meter by applying Bernoulli's equation.

3. Attempt any THREE of the following: 12

- a) A venturimeter having throat diameter 6.3cm is provided on a pipe of 15cm diameter. If oil of specific gravity 0.88 is flowing in the upward direction, determine the Ventury head and the discharge if the manometer shows 12.80cm of mercury deflection. If the vertical distance between inlet and throat is 22cm. Determine the actual head of the venturimeter. Assume $C_d = 0.65$.
- b) Explain the terms hydraulic gradient and total energy lines with diagram.

- c) Find the diameter of a pipe of length 9km, when rate of flow of water through the pipe is 255 litre/sec. and head loss due to friction is 6.5m. Take $C = 55$ for Chezy's formula.
- d) Find equation for force and work done for the impact of jet on a series of moving radial vanes (As applied to turbines).
- e) A jet of water 10cm diameter strikes on a flat plate with a velocity of 20m/s. The plate is moving with a velocity of 10m/s in the direction of jet and away from the jet. Find the efficiency of the jet.

4. Attempt any THREE of the following:

12

- a) Describe with neat sketches different types of draft tubes with use.
- b) Compare Francis turbine with Kaplan turbine.
- c) A pelton wheel 2.5m diameter operates under the following conditions.
 - i) Net available head (H) = 400m
 - ii) Speed (N) = 250rpm
 - iii) Coefficient of velocity of the jet (C_v) = 0.98
 - iv) Friction coefficient for vanes (K) = 0.95
 - v) Blade Angle (ϕ) = 15°
 - vi) Diameter of jet (d) = 25cm
 - vii) Mechanical efficiency (η_m) = 0.90

Determine :

- 1) The power developed
- 2) Hydraulic efficiency
- 3) Specific speed

- d) Draw and explain the main characteristics curves of centrifugal pump in discharge Vs overall efficiency.
- e) Write any four operational difficulties commonly experienced in centrifugal pump and their remedies.

5. Attempt any TWO of the following:

12

- a) An orifice meter with 175mm diameter is inserted in a pipe of 400mm. The pressure difference measured by a mercury oil differential manometer gives reading of 500mm of Hg (mercury). Find the rate of flow of oil of specific gravity 0.98 and coefficient of discharge = 0.64.
- b) A pipe of diameter 400mm and length 4000m is used for the transmission of power by water. The total head at the inlet of the pipe is 400m. Find the maximum power available at the outlet of the pipe. If the value of $f = 0.005$.
- c) A jet of water 75mm diameter having a velocity of 20m/s, strikes normally a flat smooth plate. Determine the thrust on the plate:
 - i) If the plate is at rest.
 - ii) If the plate is moving in the same direction as the jet with a velocity of 5m/s.

Also find the work done per second on the plate in each case and the efficiency of the jet when the plate is moving.

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

- a) Compare between impulse turbine and reaction turbine.
(At least six points).
- b) Describe an indicator diagram of a 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 diameter of impeller = 800 mm;
Width of impeller vanes at outlet = 100 mm;
Angle of impeller vanes at outlet = 40° ;
- The impeller runs at 550 r.p.m. and delivers 0.98m^3 of water per second under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine :-
- Monometric efficiency
 - Overall efficiency of the pump, and
 - Mechanical efficiency
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