11718

3 Hours / 100 Marks   Seat No.

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**

(i) Define : (1) Specific gravity, (2) Kinematic viscosity

(ii) Explain the terms positive gauge pressure and negative gauge pressure.

(iii) Define steady and non-uniform fluid flow.

(iv) Write the formula for force exerted by a jet on moving flat plate, when jet strikes the plate vertically at the centre. State the meaning of each term used in the formula.

(v) State the Bernoulli's theorem.

(vi) State the phenomenon of separation in relation with reciprocating pump.

(vii) State the function of draft tube.

(viii) Explain the need of priming for centrifugal pump.

    (b) **Attempt any TWO of the following :**   **8**

        (i) Convert 2.5 bar pressure in equivalent column of mercury and water.

        (ii) How pressure less than atmosphere is measured with simple U tube manometer ?

        (iii) Explain hydraulic gradient line and total energy line.

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

    (a) Compare simple manometer with differential manometer.

    (b) How discharge is measured by venturimeter ? Explain.

    (c) A jet of water moving with a velocity of 20 m/s impacts at the centre of curred vane moving in the direction of jet with a velocity of 8 m/s. Determine force exerted on the vane and work done by jet.

    (d) A reservoir built 5 km away from town has to supply water at the rate 1000 lit/min. Calculate the size of supply pipe if the head loss due to friction and others in pipe is 20 m. Take coefficient of friction as 0.008.

    (e) State formulae and sketch for minor losses in flow through pipes. (any four)

    (f) A closed tank contains 0.5 m of mercury, 1.5 m of water, 2.5 m of oil of specific gravity 0.8 and air above the oil. If pressure at the bottom of tank is 4 kg/cm^2 gauge, what should be the reading of gauge at the bottom of the tank ?

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

    (a) Explain the concept of cavitation in turbines.

    (b) A pelton wheel having semi-circular buckets is 1 m in diameter. Pressure head at the nozzle when it is closed is 15 bars. The discharge when the nozzle open is 3.5 m^3/min. If the speed is 600 rpm, find power developed by wheel and its hydraulic efficiency. Assume overall efficiency as 85% and $C_V = 0.98$.

    (c) Explain with neat sketch construction and working of Francis turbine.

(d) A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/sec. The curved plate is moving with a velocity of 8 m/sec. in the direction of jet. The jet is deflected through an angle of 165°. Assuming plate to be smooth find :

(i) force exerted on the plate

(ii) efficiency of jet

(e) Explain the concept of surface tension.

(f) A circular plate of 1 m diameter is immersed in water in such a way that its plane makes an angle of 30° with the horizontal and its top edge is 1.25 m below the water surface. Determine the total pressure on the plate and point where it acts.

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

(a) State the necessity of the draft tube in reaction turbine. State and draw the sketches of different types of draft tubes.

(b) A centrifugal pump of 1.75 diameter runs at 210 rpm and pumps 2000 litres of water per second. The angle which the vane makes, at exit, with the tangent to the impeller is 30°. Assuming radial entry and velocity of flow throughout as 2.75 m/sec. Determine power required to drive the pump. If manometric efficiency of the pump is 75%, find average lift of the pump.

(c) Explain with neat sketch :

(i) Submersible pumps

(ii) jet pumps

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

(a) Define following terms for centrifugal pump :

(i) Manometric efficiency   (ii) Static head

(iii) Mechanical efficiency   (iv) NPSH

(b) What is an air vessel ? Explain the function of air vessel for reciprocating pumps.

(c) State and sketch the different types of impellers. Also state their applications.

(d) (i) State the laws of fluid friction for turbulent flow.

 (ii) State Darcy's equation for frictional losses in flow through pipes with the meaning of each term used in it.

(e) How fluid flow velocity is measured by pitot tube ? Explain with neat sketch.

(f) Find the loss of head when pipe of diameter 30 cm is suddenly enlarged to a diameter of 40 cm. The rate of flow of water through the pipe is 300 lit/sec.

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

(a) (i) What is impact of jet ? How hydraulic energy is converted to mechanical energy ? Explain.

 (ii) Explain general layout of hydraulic power plant.

(b) (i) An orificemeter with orifice diameter 12 cm is inserted in a pipe of 20 cm diameter. The pressure difference between upstream and downstream of the orifice is 9.81 N/cm^2. The coefficient of discharge for orificemeter is 0.6. Find the discharge of water through the pipe.

 (ii) A pitot tube directed into a water stream having velocity 2.3 m/sec. Its gauge difference of 30 cm on the water mercury manometer. Find the coefficient of velocity.

(c) Draw and explain indicator diagram showing combined effect of friction and acceleration head for single acting reciprocating pump.

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