22445

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

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 out the various measuring devices used for measuring fluid pressure.

b) Calculate pressure head of Kerosene of specific gravity 0.81 and carbon tetra chloride of specific gravity 1.6, if equivalent pressure head of water is 100 m.

c) Define the terms:

(i) Hydraulic gradient line

(ii) Total Energy line

d) State laws of fluid friction for laminar flow.

e) State the function of draft tube and name any two types of draft tube.

f) Define the following terms related to pumps:

(i) NPSH

(ii) Cavitation

g) State the methods of priming a centrifugal pump.

Marks

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

a) Compare the physical properties of water with mercury at atmospheric condition on the basis of:

(i) Kinematic viscosity

(ii) Surface tension (mention value)

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 at the inlet and the vena-contracta of orifice.

d) Explain with neat sketch the procedure for measuring velocity in pipe using pitot tube.

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

a) Interpret on the flow of fluid as turbulent or laminar in following situations:

(i) Viscous liquid like engine oil travelling on a smooth surface.

(ii) Water falling from top of a water fall.

(iii) Glycerine oil travelling on a smooth surface kitchen floor.

(iv) Water flowing at high pressure through sewage pipe.

b) Explain the causes of water hammer in pipes and the procedure for reducing its effect.

c) The population of a city is 800000 and it is to be supplied with water from a reservoir 6.4 km away. Water is to be supplied at the rate of 140 litres per head per day and half the supply is to be delivered in 8 hours. The loss of head due to friction in the pipeline is 60 m. Find the diameter of the pipe. Take f = 0.04.

d) Explain velocity diagram for the jet striking tangentially at the tips of a moving an unsymmetrical curved vanes.

Marks

e) A jet of water moving at 20 m/s impinges on a symmetrical curved vane shaped to deflect the jet through 120° (that is the vane angle θ and ϕ are equal to 30°). If the vane is moving at 5 m/s, find the angles of the jet so that there is no shock at inlet. Also determine the absolute velocity of exit in magnitude and direction, and the work done.

4. Attempt any <u>THREE</u> of the following: **12**

a) State the function of each element of a hydroelectric power plant, with the help of a neat sketch.

b) State the name of turbine for following conditions:

(i) High head, minimum discharge

(ii) Low head, maximum discharge

(iii) Specific speed varying for 60 to 400 metric units

(iv) Medium head and discharge.

c) Draw a characteristic curve of a Kaplan turbine showing part load performance.

d) Define submersible pump and jet pump with one application each.

e) State the remedial action done for each of the given below commonly experienced troubles during the operation of the centrifugal pumps:

(i) Pump fails to start pumping

(ii) Pump working , but not up to capacity and pressure.

(iii) Pump starts and then stops pumping.

(iv) Pump takes too much power.

Marks

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

a) A pipe carrying water has a 30 cm × 15 cm ven-turimeter, which is positioned inclined at 30° to the horizontal. The flow is upwards. The converging cone is 45 cm in length and the Cd of the meter is 0.98. A differential U-tube manometer with mercury as indicating fluid is connected to the inlet and to the throat and shows a differential column height of 30 cm.

(i) Calculate the discharge of the pipe.

(ii) If the pressure in the inlet section is 50 kPa determine the pressure at the throat.

(iii) Find the head loss in the converging section of the venturimeter.

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) Explain the expression of force exerted by the impact of jet on an inclined fixed plate and also draw a neat sketch for the same. Also find the work done.

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

a) A Pelton wheel has a mean bucket speed of 12 m/s and is supplied with water at a rate of 750 litres per second under a head of 35 m. If the bucket deflects the jet through an angle of 160°, find the power developed by the turbine and its hydraulic efficiency. Take the coefficient of velocity as 0.98. Neglect friction in the bucket. Also determine the overall efficiency of the turbine, if its mechanical efficiency is 80%.

b) Draw indicator diagrams of a 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 = 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 0.98 cubic metres of water per second under an effective head of 35 m. A 500 kW motor is used to derive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at inlet.