17411

21415

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 dynamic viscosity and kinematic viscosity.

(ii) Define total pressure and centre of pressure.

(iii) Define Laminar flow and steady flow.

(iv) What is meant by impact of jet.

(v) State Bernoulli's theorem.

(vi) State the advantages of use of air vessel in reciprocating pump.

(vii) State the principle of reaction turbine.

(viii) What is priming?

Marks

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

(i) Differentiate between simple manometer and differential manometer.

(ii) Convert 25 N/cm^2 pressure in equivalent column of mercury and water.

(iii) State Darcy's and Chezy's equation for frictional losses in flow through pipes. State the meanings of each term used in it.

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

a) Explain the concept of absolute pressure, atmospheric pressure, gauge and vacuum pressure. State the relation between them.

b) Derive the equation of actual velocity of fluid flow for pitot tube.

c) A 7 cm diameter jet having a velocity of 30 m/s strikes a flat plate which is inclined at 45° the axis of the jet. Find the normal pressure on the plate if:

(i) plate is stationary

(ii) plate is moving with a velocity of 15 m/s.

d) An isosceles triangular plate base 1.2 m and height 3 m is immersed vertically in such a way that the apex is in the downward direction and the side of base is parallel and 40 cm below free water surface level. Determine the total pressure and centre of pressure.

e) State the different types of minor losses in flow through pipes. Give appropriate formulae and sketch (any four)

f) Explain construction and working of Bourdon pressure gauge with a neat sketch.

Marks

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

a) Compare impulse turbine with reaction turbine.

b) A Francis turbine operating under a head of 60 m runs at 420 rpm. If the outer diameter is 90 cm and inner diameter is 40 cm and the discharge is radial, determine the vane angle at inlet and outlet if velocity of flow is constant and equal to 12 m/s.

c) With neat sketch explain construction and working of Pelton wheel.

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 40 m and velocity of vanes is such that the efficiency is maximum. Find the work down on vane per kg of water.

e) Explain the phenomenon of capillary rise with reference to surface tension.

f) A closed tank contains 0.6 m of mercury, 1.6 m of water, 2.7 m of oil of specific gravity 0.9 and air space above the oil. If the pressure at the bottom of the tank is 4 kg/cm^2 gauge, what should be the reading of the gauge at the top of the tank?

Marks

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

a) What is the function of draft tube in reaction turbine? State and draw the sketches of different types of draft tubes. Explain any one in detail.

b) The internal and external diameters of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

c) What is multistage pumps? Describe multistage pump with:

(i) Impellers in parallel

(ii) Impellers in series

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

a) Define the following terms with respect to centrifugal pump:

(i) Manometric head

(ii) NPSH

b) What is the air vessel? Explain how air vessel helps to obtain continuous supply of water at a uniform rate in reciprocating pump.

c) Explain hydraulic gradient line and total energy line related to flow through pipes.

d) Explain construction and working of jet pump with neat sketch.

e) Draw a neat sketch of venturimeter. State why the length of divergent cone is more than convergent cone.

f) (i) State and explain the condition for maximum power transmission through pipe.

(ii) State the law's of fluid friction for turbulent flow.

Marks

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

a) (i) Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the centre of the pipe. Neglect the minor losses and take $f = 0.009$.

(ii) Explain general layout of Hydroelectric power plant.

b) (i) A pitot tube directed into a water stream having a velocity of 2.7 m/sec. It has gauge difference of 30 mm on the water-mercury manometer. Find the coefficient of velocity.

(ii) An orificemeter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter shows readings 19.62 N/cm^2 and 9.81 N/cm^2 respectively. The coefficient of discharge for meter is 0.6. Find the discharge of water through pipe.

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