17411

21819

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) Convert height of 760 mm of mercury into height of water column.

(iii) Define steady and unsteady flow.

(iv) Force exerted by jet is, $F = \rho a v^2$. Write meaning of each term in it.

(v) Define rate of flow (Discharge). Write continuity equation.

(vi) Define slip, when negative slip occurs.

(vii) Show inlet and outlet sides of conical draft tube with the help of neat diagram.

(viii) State the meaning of 'NPSH' with reference to centrifugal pump.

Marks

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

(i) A vertical plate 3 m × 2 m is immersed in water in such a way that, 2 m edge of plate is parallel to and at a depth of 1.5 m below free water surface. Calculate total pressure and depth of center of pressure.

(ii) Define:

1) Atmospheric pressure

2) Gauge pressure

3) Absolute zero pressure

4) Vacuum pressure

(iii) Derive equation for power transmission through pipe of diameter 'd' and length 'L' through which a water of constant head 'H' is flowing with a velocity of 'v'. (Consider head loss due to friction only).

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

a) Find pressure of flowing water in a pipe at point 'A' which is connected to simple U-tube mercury manometer as shown in Fig. No. 1.

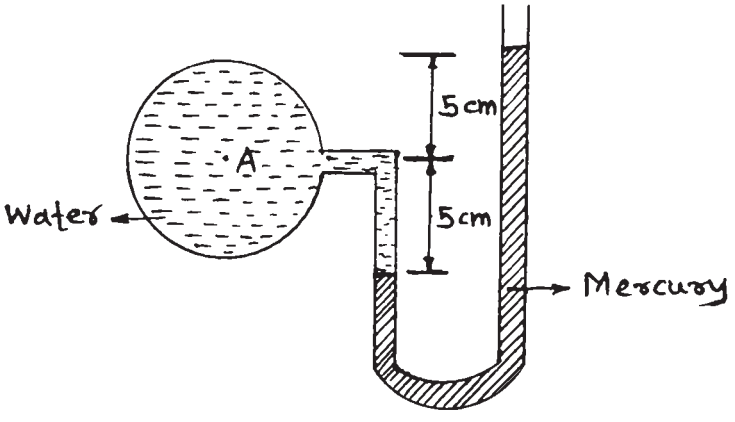

Fig. No. 1

b) State and explain Bernoulli's theorem with assumptions made.

c) A jet of water 50 mm in diameter under a constant head of 50 m impinges on a fixed flat plate normally. Find force exerted by the jet on the plate. Take co-efficient of velocity is 0.95.

Marks

d) Write Darcy's and Chezy's equation for frictional head losses and write meaning of each term in it.

e) Write laws of fluid friction for laminar and turbulent flow (any four each).

f) Explain Bourdon's tube pressure gauge with neat labeled diagram.

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

a) Differentiate between impulse turbine and reaction turbine.

b) Two jets strike the buckets of a Pelton turbine which is having shaft power as 15,500 kW. The diameter of each jet is 200 mm. If net available head on the turbine is 400 m, find overall efficiency of the turbine assuming Cv = 1.0

c) Explain working principle, construction and working of Pelton wheel turbine with neat labeled diagram.

d) A jet of water of diameter 10 cm strikes a flat plate normally with a velocity of 15 m/s. The plate is moving with a velocity of 6 m/s in the direction of jet and away from it. Find:

(i) Force exerted by the jet on the plate.

(ii) Work done by the jet on the plate per second.

e) Define:

(i) Specific gravity

(ii) Mass density

(iii) Surface tension

(iv) Specific volume

f) A left limb of a simple U-tube mercury manometer is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.

Marks

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

a) Explain:

(i) Classification of Hydraulic Turbines

(ii) Importance of draft tube in reaction turbine.

b) Explain principle of working, construction and working of a centrifugal pump with neat labeled diagram.

c) A centrifugal pump is to discharge 0.130 m^3/s at a speed of 1200 rpm against a total head of 20 m. The impeller diameter is 250 mm, its width at outlet is 40 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.

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

a) What is priming? Explain self priming method with neat diagram.

b) Differentiate between centrifugal pump and reciprocating pump.

c) Draw performance and operating characteristic curves of a centrifugal pump.

d) Enlist various minor losses in flow through pipes. Write equations of any four losses.

e) Explain working principle, construction of pitot tube. How pitot tube is used for measuring local velocity of flowing fluid?

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

Marks

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

a) (i) Derive expression for force exerted by jet on fixed symmetrical curved blade, when jet strikes the blade normally.

(ii) Draw a neat labeled diagram of Layout of Hydro-electric power plant.

b) Water flows down an inclined tapering pipe 45 m long at a slope of 1 in 10. The areas at the upper and lower ends of pipe are 8 m^2 and 3 m^2 respectively. If the velocity at lower end is 4.5 m/s and the pressure at upper end is 100 kPa. Calculate the pressure at the lower end and rate of flow through pipe.

c) Explain working principle, construction and working of a double acting reciprocating pump with neat labeled diagram. Also write advantages of double acting reciprocating pump over single acting reciprocating pump.