ME 223 (R-20)

Total No. of Questions : 10] [Total No.of Pages : 02

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

Second Semester

MECHANICAL ENGINEERING

FLUID MECHANICS & HYDRAULIC MACHINES

Time : **Three Hours** Maximum : **70** Marks

Answer ONE question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp.gr. 0.9 is flowing. The centre 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.

(OR)

2. a) Differentiate between : (i) Liquids and gases (ii) Real fluid and ideal fluids (iii) Specific weight and specific volume of a fluid.

   b) A glass tube of internal diameter 4 mm is immersed in a liquid of specific gravity 12.2 and surface tension 0.55 N/m. The angle of contact with the glass is 120^{o}. Calculate capillary rise or depression in the tube.

UNIT - II

3. Derive Euler's and Bernoulli's equations of motion for flow along a stream line.

(OR)

4. a) A pipe of diameter 200 mm conveys a discharge of 2250 litres of water per minute and has a pressure of 15.70 kPa at a certain section. Find the total energy head with respect to a datum of 5 metres below the pipe.

   b) Explain impulse momentum principle.

UNIT - III

5. a) Derive the expression for the force exerted by the jet of water on a fixed curved plate in the direction of the jet.

   b) A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction jet. The jet is deflected through an angle of 165^{o}. Assuming the plate smooth find : Force exerted on the plate in the direction of jet, Power of the jet and Efficiency of the jet.

P.T.O.

(OR)

6. A pipeline is 15 cm in diameter and is at an elevation of 100 m at section A. At section B, it is at an elevation of 107.0 m and has a diameter of 30 cm. When a discharge of 50 lit/sec of water is passed through this pipe, the pressure at section. A is observed to be 30 KPa. The energy loss in the pipe is 2 m. Calculate the pressure at B when the flow is (i) from A to B, (ii) from B to A.

UNIT - IV

7. a) Differentiate between impulse and reaction turbines.

   b) A Pelton turbine is required to develop 9000 KW. When working under a head of 300 m the impeller may rotate at 500 rpm. Assuming a jet ratio of 10 and an overall efficiency of 85% calculate (i) Quantity of water required. (ii) Diameter of the wheel (iii) Number of jets (iv) Number and size of the bucket vanes on the runner.

(OR)

8. a) Define a centrifugal pump. Explain the working of a single-stage centrifugal pump with sketches.

   b) The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. The vane angles at inlet and outlet are 20^o and 30^o 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.

UNIT - V

9. a) Define physically and mathematically the concept of displacement, momentum and energy thickness of a boundary layer.

   b) Oil with a free stream velocity of 1.5m/sec flow over a thin plate 1.4 m wide and 2.2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity of oil as 0.80 and kinematic viscosity as 0.1 stroke.

(OR)

10. a) Explain Buckingham's Pi theorem.

    b) What are the different dimensionless numbers. Explain briefly.