Code No: **19MET403** **R19**

II B. TECH II SEMESTER REGULAR EXAMINATIONS, AUGUST 2021
FLUID MECHANICS AND HYDRAULIC MACHINES
(Mechanica1 Engineering)

Time: 3 hours Max. Marks: 60

Note: Answer **ONE** question from each Unit (**5 × 12 = 60 Marks)**

UNIT - I

1. a) Define Pascal's law and derive an expression for the pressure variation in a fluid at rest condition. [6M]

   b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity of 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40cm and the height of fluid in the left from the centre is 15cm below. [6M]

(OR)

2. a) Describe the following terms (i) Path line (ii) Streak line (iii) Stream line [6M]

   b) Define the equation of continuity. Obtain an expression for continuity equation for a one-dimensional flow. [6M]

UNIT – II

3. a) Explain Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression from first principles. [6M]

   b) A horizontal venturimeter with inlet and throat diameters 30cm and 15cm respectively is used to measure the flow of water. The reading of the differential manometer connected to the inlet and the throat is 20cm of mercury. Determine the rate of flow, take C_d=0.98. [6M]

(OR)

4. a) Describe about the laminar and turbulent flow with Reynold's experiment. [6M]

   b) Find the head lost due to friction in a pipe of diameter 300mm and length 50m, through which water is flowing at a velocity of 3m/s using (i) Darcy formula (ii) Chezy's formula for C=60. Take ν for water=0.01 stoke. [6M]

UNIT – III

5. a) Define terms (i) laminar boundary layer, (ii) turbulent boundary layer, and (iii) boundary layer thickness. [6M]

   b) A flat plate 1.5m×1.5m moves at 50km/hr in stationary air of density 1.15kg/m^3. If the co-efficient of drag and lift are 0.15 and 0.75 respectively, determine: (i) The lift force, (ii) The drag force (iii) The resultant force and (iv) The power required to keep the plate in motion. [6M]

(OR)

6. a) Derive an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. [6M]

   b) A jet of water of diameter 50mm strikes a fixed plate in such a way that the angle between the plate and the jet is 30^0. The force exerted in the direction of the jet is 1471.5N. Determine the rate of flow of water. [6M]

UNIT –IV

7. a) Describe different Heads and efficiencies of a Turbine. [6M]

   b) A Pelton wheel has a mean bucket speed of 10m/s with a jet of water flowing at the rate of 700 litres/s under a head of 30m. The buckets deflect the jet through an angle of 160^0. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. [6M]

(OR)

8. a) Define the specific speed of a turbine and derive an expression for the specific speed. [6M]

   b) A turbine is to operate under a head of 25m at 200 r.p.m. The discharge is $9m^3/s$. If the efficiency is 90%, determine: [6M]

   (i) Specific speed of the machine (ii) Power generated and (iii) Type of turbine.

UNIT –V

9. a) Explain the working of single-stage centrifugal pump with a neat sketch. [6M]

   b) The internal and external diameters of the impeller of a centrifugal pump are 200mm and 400mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of the flow is constant. Determine the work done by the impeller per unit weight of water. [6M]

(OR)

10. a) Explain briefly the working principle of reciprocating pump with a neat sketch. [6M]

    b) A double-acting reciprocating pump, running at 40 r.p.m is discharging $1m^3$ of water per minute. The pump has a stroke of 400 mm. The diameter of the piston is 200mm. The delivery and suction head are 20m and 5m respectively. Find the slip of the pump and power required to drive the pump. [6M]

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