H.T NO.										

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MLR INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

II B.Tech I Sem Supplementary Examinations- January-2017

MECHANICS OF FLUIDS AND HYDRAULIC MACHINERY

(MECH)

Time: 3 hours Max.Marks :75

Note: 1. This question paper contains two parts A and B.
2. Part A is compulsory which carries 25 marks. Answer all questions in part A.
3. Part B consist of 5 units. Answer any one full question from each unit. Each question Carries 10 marks and may have a, b, c as sub questions.

PART-A

1. a) Define weight density and specific gravity of a fluid. [2M]
   b) Define stream function and velocity potential function. [2M]
   c) List the various minor losses in pipe flow. [2M]
   d) What is a draft-tube? Why is it used in a reaction turbine? [2M]
   e) Define suction head and delivery head of a centrifugal pump. [2M]

2. a) Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9. [3M]
   b) Derive the one-dimensional continuity equation. [3M]
   c) What are the different methods of preventing the separation of boundary layer? [3M]
   d) What is Cavitation? How can it be avoided in reaction turbines? [3M]
   e) What is priming of a centrifugal pump? Why is it necessary? [3M]

PART-B

3. a) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of sp. gr. 0.8 and having vaccum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vaccum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left limb from the centre of pipe is 15 cm below. [7M]
   b) Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2above atmospheric pressure. [3M]

OR

4. a) A plate 0.025 mm distant from a fixed plate, moves at 50 cm/s and requires a force of 1.471 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates in poise. [4M]
   b) Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water in such a way that the centre of the plate is 3 m below the free surface of water. Find the position of centre of pressure also. [6M]

5. a) Explain the classification of fluid flows. [5M]
   b) The stream function for a two-dimensional flow is given by $\psi = 2xy$, calculate the velocity at the point P (2,3). Find the velocity potential function Φ. [5M]

OR

6. a) Derive the Bernoulli's equation for steady flow of an incompressible fluid. [6M]
   b) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through the pipe is 40 lit/s. [4M]

7. a) A 30cm x 15 cm venturimeter is inserted in a vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find the discharge. Take $C_d = 0.98$. [4M]
   b) Derive the Darcy-Weisbach equation for the loss of head due to friction in pipes. [6M]

OR

8. a) Explain the terms 'hydraulic gradient line' and 'total energy line'. [4M]
   b) What is 'boundary layer'? Explain the growth of boundary layer along a flat plate with a neat sketch. [6M]

9. a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. [4M]
   b) A jet of water having a velocity of 40 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at an angle of 90^0 to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that water enters and leaves the vane without shock. [6M]

OR

10. a) Explain the classification of hydraulic turbines. [5M]
    b) Define specific speed of a turbine. Derive an expression for the specific speed. [5M]

11. a) Explain the working of a single-stage centrifugal pump with a neat sketch. [5M]
    b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm 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. Water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. [5M]

OR

12. a) Describe the principle and working of a reciprocating pump with a neat sketch. [5M]
    b) A single-acting reciprocating pump, running at 50 r.p.m., delivers 0.01 m^3/s of water. The diameter of the piston is 200 mm and stroke length is 400 mm. Determine:
       (i) Theoretical discharge of the pump, [5M]
       (ii) Co-efficient of discharge and
       (iii) Slip and percentage slip of the pump.

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