Code No: **20ME4T02** **R20**

II B. TECH II SEMESTER REGULAR EXAMINATIONS, JUNE - 2022
FLUID MECHANICS AND HYDRAULIC MACHINES
(MECHANICAL ENGINEERING)

Time: 3 hours Max. Marks: 70

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Elaborately explain the following i) viscosity and ii) surface tension. [6M]

   b) An infinite plate is moved with velocity of 0.3 m/s over a second plate on a layer of liquid. For small gap width 0.3 mm, we assume a linear velocity distribution in the liquid. The liquid viscosity is 0.65 Centipoise and its specific gravity is 0.88. Determine: [8M]
      a) The absolute viscosity of the liquid,
      b) The kinematic viscosity of the liquid,
      c) The shear stress on the upper plate,
      d) The shear stress on the lower plate,

(OR)

2. a) How do you classify the fluid flows? [6M]

   b) 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. [8M]

UNIT-II

3. a) Derive Darcy's Weisbach equation for pipe flows. [7M]

   b) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp. gr. 0.8. The discharge of oil through venturimeter is 60 litres/s. Find the reading of the oil-mercury differential manometer. Take C_d = 0.98. [7M]

(OR)

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

   b) The difference in water surface levels in two tanks which are connected by three pipes in series of lengths 300 m, 170 m, 210 m and of diameters 300 mm, 200 mm, 400 mm respectively is 12 m. Determine the rate of flow of water, if coefficient of friction are 0.005, 0.0052, 0.0048 respectively. [8M]

UNIT-III

5. a) Explain the development of Boundary layer on a flat plate. [7M]
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b) Find the ratio of displacement thickness to momentum thickness and momentum thickness to energy thickness for the velocity distribution in the boundary layer is given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ [7M]

(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. [7M]

b) A jet of water of diameter 40 mm strikes a fixed plate in such a way that the angle between the plate and the jet is 20^0. The force exerted in the direction of the jet is 1400 N. Determine the water flow rate. [7M]

UNIT-IV

7. a) What is the necessity of draft tube and different types of draft tubes? [6M]

b) Derive condition for the maximum efficiency of a reaction turbine. [8M]

(OR)

8. a) Write short notes on unit quantities. [6M]

b) The following data is related to a Pelton wheel: Head at the base of the nozzle = 80 m; Diameter of the jet = 100 mm; Discharge of the nozzle = 0.3 m^3/s; Power at the shaft = 206 kW; Power absorbed in mechanical resistance = 4.5 kW. Determine (i) Power lost in the nozzle and (ii) Power lost due to hydraulic resistance in the runner. [8M]

UNIT-V

9. a) Explain the working of single-stage centrifugal pump with a neat sketch. [7M]

b) A centrifugal pump running at 1450 rpm has an impeller diameter of 0.4 m. The backward curved blade outlet angle is 30° to the tangent. The flow velocity at outlet is 10 m/s. Determine the static head through which water will be lifted. In case, a diffuser reduces the outlet velocity to 40% of the velocity at the impeller outlet, what will be the increase in the static head? [7M]

(OR)

10. a) How do you classify reciprocating pumps? [6M]

b) A single acting reciprocating pump, running at 120 rpm has a piston diameter of 200 mm and stroke length 300 mm. The suction and delivery heads are 4 m and 20 m respectively. If the efficiency of both suction and delivery strokes is 75%, determine Power required by the pump [8M]

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