Hall Ticket No | | | | | | | | | | | Question Paper Code: AME008

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular) - May, 2018

Regulation: IARE – R16

MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

Time: 3 Hours **(ME)** **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Define the following fluid properties giving their physical units of measure: Density, Weight density, Specific volume and Specific gravity. **[7M]**

   (b) Explain the working of Piezometer. The pressure intensity at a point in a fluid measures 3.942 N/cm^2. Evaluate the corresponding height of fluid for
   i. Water ii. Kerosene with specific gravity of 0.82 iii. Mercury with specific gravity of 13.6. **[7M]**

2. (a) Differentiate between U-tube and Differential Manometer. With a neat sketch. **[7M]**

   (b) Explain Newton's law of Viscosity. A plate 0.025 mm distance from a fixed plate moves at 0.6 m/s velocity on application of 2 N per unit area (2 N/m^2) to maintain this speed. Evaluate the dynamic viscosity of the fluid. **[7M]**

UNIT – II

3. (a) Explain the terms with relevant illustrations: i. Path line ii. Steak line iii. Stream line **[7M]**

   (b) Water is flowing through a 5 cm diameter pipe at 29.43 N/cm^2 pressure (gauge) and mean flow velocity of 2.0 m/s. Assess the total head or total energy per unit weight at a point 5 m above the datum line assuming density of water as 1000 kg/m^3. **[7M]**

4. (a) State Bernoulli's theorem. Mention the assumptions made. Explain any two important applications of Bernoulli's theorem in engineering practice. **[7M]**

   (b) i. State the momentum equation for flow through a pipe bend.
   ii. A 300 mm diameter pipe carries water under a head of 20 meters with a velocity of 3.5 m/s. If the axis of the pipe turns through 45^o, find the magnitude and direction of the resultant force at the bend. **[7M]**

UNIT – III

5. (a) What do you understand by the terms boundary layer and boundary layer theory for flow over a flat plate? Sketch the three different regions of flow on the flat plate indicating the growth of boundary layer thickness. **[7M]**

   (b) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300 mm and length 400 m. The flow rate of water through the pipe is 300 liter/s. Consider all losses and take friction factor f=0.008 **[7M]**

6. (a) Explain with illustrations the following terms: i. Total Energy line ii. Darcy Weisbach Equation **[7M]**

(b) Determine the thickness of the boundary layer at the trailing edge of smooth plate 4 m in length and 1.5 m in width, when the plate is moving with a velocity of 4 m/s in stationary air medium. Take kinematic viscosity of air as $1.5\,X\ 10^{-5} m^2/s$ and boundary layer thickness to be equal to $\frac{0.37\,x}{(\mathrm{Re}_x)^{\frac{1}{5}}}$. **[7M]**

UNIT – IV

7. (a) Define the terms:
i. Impact of jets ii. Turbo Machinery iii. Governing of turbines. **[7M]**

(b) A Pelton wheel has a mean bucket diameter of 1 m and runs at 1000 RPM with a net head of 700 m. If the side clearance angle is 15^0 and nozzle discharges 0.1 m^3/s of water, evaluate
i. Power available at nozzle ii. Hydraulic efficiency of turbine. **[7M]**

8. (a) Define the terms:
i. Cavitation ii. Surge tank iii. Water hammer **[7M]**

(b) A 50 mm diameter jet of water strikes a fixed plate in such a position that the angle between jet direction and normal to the plate is 30^0. If the force exerted is 1471.5 N, evaluate the rate of water flow through the nozzle. Determine the work done by the plate due to jet impingement. **[7M]**

UNIT – V

9. (a) Explain the important parts of the Centrifugal pump with a neat sketch. **[7M]**

(b) Discuss Net Positive Suction Head (NPSH) with reference to Pump design **[7M]**

10. (a) Explain the working of a Reciprocating pump indicating its important parts. **[7M]**

(b) Make a detailed comparison between Reciprocating Pumps and Centrifugal pumps. **[7M]**

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