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B. M. S. College of Engineering, Bengaluru - 560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 19AE3DCAFM **Max Marks: 100**
Course: Aero Fluid Mechanics **Date: 15.05.2023**

Instructions: 1. Answer any five questions choosing one full from each unit.
2. Missing data, if any may suitable assumed
3. Sketch the figures wherever necessary.
4. Use of logarithmic tables and scientific pocket calculator is allowed

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Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1. a) Calculate the specific weight, density and specific gravity of one litre of a liquid which weighs 7 N. **6**

   b) Define the following **6**

   i) Mass density ii) Specific weight iii) Specific gravity.

   c) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 rpm. Determine the viscosity of the fluid. **8**

UNIT - II

2. a) Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and diameter of CE. **8**

   b) Explain the types of fluid flow. **12**

OR

3. a) Derive continuity equation for three dimensions. **10**

   b) Illustrate about velocity potential function & steam function. **10**

UNIT - III

4. a) Derive Euler's equation of motion. **8**

b) Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2 m/s. Find the total head or total energy per unit weight of the water at a cross-section which is 5 m above the datum line. **6**

c) A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take $C_d = 0.98$. **6**

UNIT - IV

5. a) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. Assume laminar flow. **10**

b) Derive an expression for Darcy-weisbach equation. **10**

UNIT - V

6. a) Drive the stream and protentional functions for doublet flow. **10**

b) Explain about Mach number. **10**

OR

7. a) Find the Mach number when an aeroplane is flying at 1100 km/hr through a still air having a pressure of 7 N/cm^2 and temperature -5°C. Wind velocity may be taken has zero. Take R=287.14 J/Kg K. Calculate the pressure, temperature and density of air at stagnation point on the nose of the plane. Take k = 1.4. **12**

b) An aeroplane is flying at a height of 15 km where the temperature is -50°C. The speed of the plane is corresponding to M = 2.0 Assuming k = 1.4 and R = 287 J/kg K, find the speed of the plane. **8**

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