U.S.N.										

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

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. Semester: III
Branch: Aerospace Engineering Duration: 3 hrs.
Course Code: 19AE3DCAFM Max Marks: 100
Course: AERO - FLUID MECHANICS

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Define the following **10**
   i) Specific weight
   ii) Buoyancy
   iii) Solids and fluids
   iv) Newtonian and non-Newtonian fluid
   v) Dynamic viscosity and kinematic viscosity

   b) If the velocity distribution over a plate is given by $u = y^2 - \frac{3}{2}y$ **10**
   in which u is in m/s at a distance y meter above the plate. Determine the shear stress at y = 0 m, y = 0.5 m and y = 1 m. Take dynamic viscosity as 0.863 N.s/m^2.

UNIT - II

2 a) Define the following **10**
   i. Stream line
   ii. Path line
   iii. Streak line
   iv. Velocity potential function
   v. Stream function

   b) Derive continuity equation for a 3 dimensional flow and deduce an expression considering unsteady and incompressible flow. **10**

OR

3 a) i) Briefly describe about velocity potential function and stream function and its relations in terms of equation. **10**
   ii) The stream function for a dimensional flow is given by $\Psi = 2xy$. Calculate the resultant velocity at P (3,4). Also, the velocity potential function ϕ.

   b) Define **10**
   i) Stream line, streak line and path line with a neat sketch
   ii) Lagrangian and Eulerian descriptions of fluid flow

UNIT - III

4   a)   Differentiate between venturi meter and orifice meter with neat sketches.   **10**

b)   i)   State and explain about the Buckingham's pi-theorem.   **10**

ii) Check the dimensional homogeneity of the following common equations in the field of hydraulics

$$P_1 + \frac{1}{2}\rho V^2 + \rho g z = C$$

UNIT – IV

5   a)   Write a short note on development of flow in pipes.   **8**

b)   Derive an expression for Darcy-Weisbach equation and Chezy's formula.   **12**

UNIT - V

6   a)   Find the displacement thickness, the momentum thickness and energy thickness $\frac{u}{U} = \left(\frac{y}{\delta}\right)^2$ **10**

for the velocity distribution in the boundary layer given by u

Where u is the velocity at a distance y from the plate $u=U$ at $y=\delta$ and is boundary layer thickness.

b)   Explain the propagation of sound waves in different Mach regions.   **10**

OR

7   a)   Prove that velocity of sound c=$\sqrt{\gamma RT}$ where, R is gas constant, T is the temperature and γ is specific heat ratio.   **10**

b)   i)   Define rotational and irrotational flows?   **10**

ii) Explain the terms favorable and adverse pressure gradient. Describe flow separation phenomenon with appropriate diagram.

iii) Define Mach number and what is the significance of it?

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