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

**Autonomous Institute Affiliated to VTU**

## January / February 2025 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**

**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<br>i) Solids and fluids<br>ii) Intensive properties and extensive properties. Explain with examples<br>iii) Mass density<br>iv) Specific weight<br>v) Vapour pressure and cavitation | **10** |
| | b) | Derive an expression for total pressure and center of pressure on an inclined surface. | **10** |

**OR**

| | | | |
|---|---|---|---|
| 2 | a) | State Pascal's law and derive an expression for the following<br>i) Pressure at a point<br>ii) Variation of pressure with depth | **12** |
| | b) | Define the following<br>i) Surface tension<br>ii) Pressure<br>iii) Capillarity<br>iv) Buoyancy | **8** |

### UNIT - II

| | | | |
|---|---|---|---|
| 3 | a) | Briefly describe about velocity potential function and stream function and its relations in terms of equation. | **8** |
| | b) | State Pascal's law and derive an expression for the following<br>i) Pressure at a point<br>ii) Variation of pressure with depth | **12** |

**OR**

| | | | |
|---|---|---|---|
| 4 | a) | Derive continuity equation for a 3 dimensional flow and deduce an expression considering unsteady and incompressible flow. | **10** |
| | b) | Explain any five different types of flows in detail with neat sketches. | **10** |

## UNIT - III

| | | | |
|---|---|---|---|
| 5 | a) | State and derive an expression for Bernoulli's equation. Write down all the assumptions involved in its derivation. | **12** |
| | b) | Distinguish between geometric similarity and kinematic similarity. | **8** |

**OR**

| | | | |
|---|---|---|---|
| 6 | a) | Check the dimensional homogeneity for the equation $$P_1 + \frac{1}{2}\rho V^2 + \rho g z = C$$ | **12** |
| | b) | Define the following<br>i) Dimension and different types of dimensions with an example<br>ii) Dimensionless numbers with an example | **8** |

## UNIT – IV

| | | | |
|---|---|---|---|
| 7 | a) | Define Reynold's number and what is the significance of it. Use necessary sketches. | **4** |
| | b) | Deduce an expression for the Hagen-Poiseuille equation considering viscous fluid flow through a circular pipe. | **16** |

**OR**

| | | | |
|---|---|---|---|
| 8 | a) | Derive an expression for Darcy-Weisbach equation with proper assumptions. | **14** |
| | b) | Describe the development of flow in pipes and its significance. | **6** |

## UNIT - V

| | | | |
|---|---|---|---|
| 9 | a) | i) Define rotational and irrotational flows?<br>ii) Explain the terms favorable and adverse pressure gradient. Describe flow separation phenomenon with appropriate diagram.<br>iii) Define Mach number and what is the significance of it? | **8** |
| | b) | Analyze the following boundary layer parameters for the velocity distribution $\frac{u}{U} = 2\left(\frac{y}{\delta}\right)$<br>i) Displacement thickness<br>ii) Momentum thickness<br>iii) Also calculate the ratio of momentum thickness to energy thickness (δ*/θ) | **12** |

**OR**

| | | | |
|---|---|---|---|
| 10 | a) | Explain the propagation of sound waves in different Mach regions. | **10** |
| | b) | Prove that velocity of sound c=$\sqrt{\gamma RT}$ where, R is gas constant, T is the temperature and $\gamma$ is specific heat ratio. | **10** |

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