Indian Institute of Space Science and Technology

AE 111 - Introduction to Aerospace Engineering (I Semester)

Test 1

Duration: 60 minutes **Total Marks:39**

Name:
SC No:
Batch

1. The fluid is subdivided into fluid particles and every fluid particle is followed as it moves through space and time. Which kind of formulation is this? [1]

   A. Eulerian B. Lagrangian C. Euclidian D. Cartesian

2. Which of these will best define positions of the parcel in increasing time? [1]

   A. Boundary line B. Pathline C. Streakline D. Streamline

3. Which of the following gives the equation of a streamline? (V is the velocity at a point on the streamline and ds is a directed element along the streamline) [1]

   A. $\mathbf{V} \times \mathbf{ds} = 0$ B. $\nabla(\mathbf{V}.\mathbf{ds}) = 0$ C. $\nabla.\mathbf{V} = \mathbf{ds}$ D. $\mathbf{V}.\mathbf{ds} = 0$

4. In an accelerating flow the streamlines [1]

   A. diverge B. converge or diverge depending on pressure C. remain parallel D. converge

5. The path taken by the smoke coming out of a chimney (in concentric circles) represents a [1]

   A. pathline B. streakline C. streamline D. streamtube

6. The Bernoulli's equation is valid for [1]

   A. viscous flow B. unsteady flow C. adiabatic flow D. frictionless flow

7. A reversible process requires that [1]

   A. there be no viscous fiction in the system B. temperature of system and surroundings be equal C. heat transfer occurs from surroundings to system only D. there be no heat transfer

8. An isentropic process is [1]

A. reversible and adiabatic B. reversible and isothermal C. adiabatic D. isothermal

9. The relation between an airplane's true airspeed V_{TAS} and equivalent airspeed V_{EAS} in terms of density ratio, $\sigma = \frac{\rho}{\rho_{SSL}}$, where ρ_{SSL} is the air density at sea-level and ρ is the air density at the height at which the airplane is flying is [1]

A. $\frac{V_{EAS}}{V_{TAS}} = \sigma^2$ B. $\frac{V_{EAS}}{V_{TAS}} = \sigma$ C. $\frac{V_{EAS}}{V_{TAS}} = 1/\sigma$ D. $\frac{V_{EAS}}{V_{TAS}} = \sqrt{\sigma}$

10. Two pipes of diameters d_1 and d_2 converge to form a pipe of diameter d. If the liquid flows with a velocity of v_1 and v_2 in the two pipes (with diameters d_1 and d_2 respectively), what will be the flow velocity in the pipe with diameter d? [2]

$$\frac{d_1^2 v_1 + d_2^2 v_2}{d^2}$$

11. The Euler equation along a streamline is given as [2]

$$dp = -\rho V dV$$

12. The expression for dynamic pressure is $\frac{1}{2}\rho_\infty V_\infty^2$. [1]

13. In incompressible flow, the value of coefficient of pressure at stagnation point equals 1. [1]

14. For an inviscid incompressible flow past a circular cylinder, the velocity at the maximum thickness would be $2V_\infty$. [1]

15. How many Π parameters are needed to express the function $F(a, V, t, \nu, L) = 0$? (a is speed of sound, ν is kinematic viscosity) 2. [2]

16. A sharp nose is kept in a supersonic stream. What kind of shock would be formed? [2]

Oblique.

17. The expression for equivalent airspeed for incompressible flow is [2]

$V_{EAS} = V_{TAS} \cdot \sqrt{\frac{\rho}{\rho_{SSL}}}$ $V_{TAS} = \sqrt{\frac{2(p_0 - p)}{\rho}}$

$V_{EAS} = \sqrt{\frac{2(p_0 - p)}{\rho_{SSL}}}$ ✓

18. The one-dimensional isentropic energy equation is given by [2]

$C_p T + \frac{1}{2} V^2 = \text{Constant}$.

19. Across a shock the pressures increase. [1]

20. Across a shock the velocity decrease. [1]

21. Across an expansion fan the velocity increase. [1]

22. Mach numbers after a normal shock would be Subsonic. [1]

23. Across an expansion fan the density decrease. [1]

24. Across an shock the total pressure decreases and the total temperature remains constant. [2]

25. In supersonic flow, an area increase would result in increase the velocity. [1]

26. The condition of Mach number=1 at the throat of a convergent-divergent nozzle is called choking. [1]

27. The wall shear stress is less in a laminar boundary layer compared to that of a turbulent boundary layer. [1]

28. For similar conditions, the turbulent boundary layer separates later (downstream) than a laminar boundary layer. [1]

29. Define a streamlined body [2]

$D_p < D_f$.

30. Write the expression for lift coefficient [2]

$C_L = \frac{L}{\frac{1}{2}\rho_\infty V_\infty^2 \cdot (\text{Area})}$