SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E - Aeronautical
Title of the paper: Aerodynamics - II
Semester: V — Max. Marks: 80
Sub.Code: 26502 (2004/2005) — Time: 3 Hours
Date: 24-04-2008 — Session: AN

PART – A (10 x 2 = 20)

Answer All the Questions

1. What is a continuum?
2. What are Reynolds and mach number?
3. Write down the four basic equations which satisfy the state points before and after a normal shock wave.
4. What is a shock polar?
5. What is meant by drag force?
6. What is mach angle?
7. Differentiate between normal shock and oblique shock.
8. Define critical mach number.
9. What is supersonic tunnel?
10. Define specific Thrust.

PART – B (5 x 12 = 60)

Answer All the Questions

11. For the adiabatic flow or a perfect gas show that

$$\frac{T}{T_o} = \left[1 - \frac{\gamma-1}{\gamma+1} M * 2\right]$$

(or)

12. The pressure temperature and mach number at the entry of a flow passage are 2.45 bar, 26.5°C and 1.4 respectively. If the exit mach number is 2.5, determine for adiabatic flow of a perfect gas. (γ = 1.3, R = 0.469 kJ/kg K.

13. The ratio of the exit to entry area in a subsonic diffuser is 4.0. The mach number of a jet of air approaching the diffuser at Po =

1.013 bar, T = 290k is 2.2. There is a standing normal shock wave just outside the diffuser entry. The flow in the diffuser is sentropic. Determine at the exit of the diffuser **(a)** mach number **(b)** Temperature **(c)** pressure what is the stagnation pressure loss between the initial and final states of the flow.

(or)

14. Derive the rankine – Hugoniot relation for an oblique shock.

$$\frac{p_2}{p_1} = \left(\frac{\gamma+1}{\gamma-1}\cdot\frac{p_2}{p_1} + 1\right) / \left(\frac{\gamma+1}{\gamma-1} + \frac{p_2}{p_1}\right)$$

Compare graphically the variation of density ratio with the initial mach number in isentropic flow and flow with oblique shock.

15. Describe with the aid of sketches the development of a finite amplitude rarefaction wave show the directions of flow and the wave propagation.

(or)

16. The density ratio across a steep pressure wave moving into stagnant air in a constant area duet is 2.0 calculate (a) the pressure and temperature ratios across the wave and (b) the wave mach number and the mach number of the induced flow.

17. Discuss: (a) Shock induced separation.
(b) Lift and drag divergence.
In high speed flows of Airfoil.

(or)

18. Discuss about the characteristics of swept wings in Airfoils

19. Discuss about ht eindraft and induction tunnel layouts with their design features in high sped wind tunnels.

(or)

20. Explain (a) Transonic tunnels
(b) Supersonic tunnels
(c) Hypersonic tunnels
With their peculiarities.