Register Number | | | | | | | |

SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E-AERO
Title of the Paper: Aerodynamics – II — Max. Marks: 80
Sub. Code: 526502-626501 — Time: 3 Hours
Date: 12/11/2010 — Session: FN

PART - A (10 X 2 = 20)

Answer ALL the Questions

1. What are the equations required to define completely the compressible flow?
2. Why should passage area increase with velocity in supersonic flow?
3. What is shock polar? How is it useful?
4. What is Rayleigh flow?
5. What are the rules for reflection of shock and expansion waves?
6. Write the wave equation for supersonic small perturbation theory. What are its solutions?
7. What is the need for the linear theory of supersonic flows?
8. Explain shock stall.
9. What is the basic optical principle of Schlieren technique?
10. What is the specific advantage of an induction tunnel?

PART – B (5 x 12 = 60)

Answer All the Questions

11. Discuss the performance of a convergent-divergent nozzle under constant stagnation pressure and variable back pressure.

(or)

12. Starting from the energy equation for adiabatic flow derive a relation between the flow Mach number and the characteristic Mach number.

13. Derive the Rankine-Hugoniot pressure density relationship for the shock and explain its significance.

(or)

14. Derive Prandtl relation for a normal shock and explain its significance.

15. The exit pressure and Temperature are 125kPa and 20°C respectively as air flows through a 25cm diameter pipe at 1200m^3/min. The pipe is 60m long. Assuming the friction factor f=0.005 estimate the inlet pressure and temperature.

(or)

16. The pressure and temperature of the air at inlet to a constant area duct are 120kPa and 150°C respectively, with an inlet Mach number of 3.0. Heat is transferred to the air as it flows through the duct leading to an exit Mach number of 1.5. Find (i) the pressure and temperature at exit. (ii) the maximum amount of heat that can be transferred to the air if no shocks occur in the flow. (iii) the exit pressure and temperature with the maximum heat transfer.

17. Derive an expression for the C_L and C_D of a symmetric diamond profile in supersonic flow at small angle of attack.

(or)

18. (a) Write short note on critical Mach number and suggest methods to improve the critical Mach number.
    (b) Explain Transonic and supersonic area rules.

19. What are the special problems of operating a wind tunnel in Transonic, Supersonic and hypersonic Mach numbers?

(or)

20. Write a note on the optical methods of flow visualization in supersonic wind tunnel and explain any one in detail.