Register Number: ………………….

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fifth Semester

AERONAUTICAL ENGINEERING

U07AR503: Aerodynamics II

Time: Three Hours   **Maximum Marks: 100**

Answer ALL the questions:-

PART A (10 x 1 = 10 Marks)

1. A gas is said to be thermally and calorifically perfect if the temperature is up to

   a)500 K   b)1000K   c)1500K   d) 2000K

2. A device converts enthalpy energy of a flowing fluid into kinetic energy

   a) Diffuser   b) Effuser   c) Compressor   d) Nozzel

3. A compressible flow with friction refers to

   a) Rally   b) Fannow   c) Prantdl Meyer   d) Expansion

4. A flow past convex corners assume to be

   a) Adiabatic   b) Fannow   c) Isotropic   d) Rally

5. A small perturbation potential theory is known as

   a)Ackerts theory   c) Supersonic flow thoery

   b)Thin aerofoil theory   d) Hugonoit theory

6. The profile of a diamond point aerofoil is

   a)Subsonic   b)Transonic   c) Hypersonic   d) Supersonic

7. The Mach number at which the flow over an aerofoil is completely supersonic is known as

   a)Lower critical Mach number   c) Critical Mach number

   b) Upper critical Mach number   d) Drag divergence Mach number

8. Advantages of swept wing is

   a)Increases the drag   c) Delays critical Mach number

   b) Increases the speed   d) Increases lift

9. A device used to produce high velocity of supersonic flow over a short span of time

   a) Shock tube   b) Pitot tube   c) Diffuser   d) Effuser

10. The peculiarity of transonic tunnel is

   a)Chocking   b) Simple design   c) Easy starting   d) No chocking

PART B (10 x 2 = 20 Marks)

11. State the purpose of CD nozzle

12. Define: mach angle and mach cones

13. What is shock polar?

14. Write down the integral form of continuity equation.

15. How do the total conditions vary across a normal shock wave?

16. Define the term pressure coefficient,

17. What is the need for swept wing?

18. What is drag divergence mach number?

19. State the basic principle involved in optical methods of supersonic flow visualization.

20. Why is it necessary to preheat the air in hypersonic tunnel?

PART C (5 x 14 = 70 Marks)

21. a) Air is compressed isentropically by a centrifugal compressor of pressure ratio 5 and inlet temperature of 15°C.Calculate the following: (i) Change in temperature; (ii) Change in internal energy; (iii) Work input to the compressor

(OR)

b) Derive the Area-Velocity Area mach no. relation.

22. a) Derive the Prandtl's relation for the flow across a normal shock and explain its significance.

(OR)

b) With a neat line sketch explain the difference between Normal shock and Oblique shock.

23. a) (i) Derive Hugonoit equation and prove that it relates only thermodynamic quantities across the shock. (7)

(ii) A pitot tube is inserted into airflow where the static pressure is 1 atm. Calculate the flow mach number when the pitot tube measures (a) 1.3 atm, (b) 2.8 atm & (c) 14 atm (7)

(OR)

b) (i) Using small perturbation potential theory derive an equation for linearized pressure coefficient . (7)

(ii) At the chocked flow condition 5 kgs of air at 10 bar and 200ºc expands through a CD nozzle. Determine the throat area of the nozzle. (7)

24. a) Explain the briefly. (i) Praadtl-Meyer expansion wave   (ii) Tuaasom's area rule

(iii) Swept wing   (iv) method of characteristics

(OR)

b) (i) Explain briefly the flow physics of normal and oblique shock waves. (7)

(ii) An aircraft flies at a mach number of 1.2 at an altitude of 16000 meters (P = 0.103 bar, T = 216.65K). The compression in its engine is partly achieved by a normal shock wave at the entry of its diffuser. Determine immediately downstream of the shock (a) mach number (b) temperature of air (c) pressure of the air (d) stagnation loss across the shock. (7)

25. a) Briefly explain the factors considered for the design of high speed wind tunnel and sketch a typical hypersonic wind tunnel.

(OR)

b) Explain any one method of flow visualization with a neat sketch.

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