Code No: 07A52102 **R07** **Set No. 2**

III B.Tech I Semester Examinations,November 2010
AERODYNAMICS-II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. What are the fundamental equations that govern a flow field and derive any one equation among them in terms of substantial derivatives. [16]

2. (a) Describe the various forces and moments on an aircraft that can be measured in wind tunnel.
   (b) What is a wind tunnel? Describe a subsonic wind tunnel. [8+8]

3. (a) Explain flow through diffusers with appropriate plots and sketches and enumerate it accordingly.
   (b) Derive momentum equation for quasi-one-dimensional flow along X-direction. [6+10]

4. (a) Write a note on Hodograph and Shock-Polar. Mention their uses briefly.
   (b) With neat sketch explain the reflection of shocks from solid boundaries.[8+8]

5. (a) Consider a supersonic flow past a 20^o expansion corner. Find the pressure measured by the Pitot tube, if at the upstream M_1=3 and P_1= 2.34 atm.
   (b) A uniform supersonic stream with M_1= 3.0, P_1= 1 atm and T_1= 288 K encounters a compression corner which deflects the stream by an angle θ= 20^o. Calculate the shock wave angle and P_2, T_2, M_2, P_{02} and T_{02} behind the shock wave. [7+9]

6. Derive expression for Prandtl-Glauert compressibility correction. [16]

7. (a) With neat sketch, describe the flow over a blunt nosed slab using blast wave analogy.
   (b) State the assumptions used in deriving the Busemann-Newtonian theory. [8+8]

8. (a) Describe the methods used for measuring flow angularity in a supersonic wind tunnel.
   (b) Write a short note on the follwing
      i. Laser - Doppler anemometer
      ii. Horizontal buoyancy
      iii. Flow angularity [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A52102 **R07** **Set No. 4**

III B.Tech I Semester Examinations,November 2010
AERODYNAMICS-II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Derive area-velocity relation and also explain how does it effect the flow in converging-diverging ducts. [16]

2. (a) Obtain the perturbation velocity potential equation for a 3D slender body immersed in a uniform flow.
   (b) What is the significance of linearized velocity potential equation in isentropic flows? State the assumptions used in its derivation. [10+6]

3. Discuss briefly with neat sketches about the following
   (a) Thin Shock Layer
   (b) Entropy layer
   (c) Low density flows
   (d) High Temperature flows and
   (e) Viscous interaction [16]

4. (a) What is Similarity rule and enumerate its significance with the help of an example? How do you define similarity of flows?
   (b) Explain in detail about various methods for measuring test section speed in a wind tunnel. [8+8]

5. (a) Derive oblique shock wave relations and also write about your understanding by expansion .
   (b) Explain theory of intersection of shock. [8+8]

6. (a) Define Mach number, Reynolds number and explain their significance in aerodynamics. Also, explain how these are useful in utilizing the wind tunnel data for the design of an aircraft.
   (b) Define Boundary Layer thickness, Displacement thickness and Momentum thickness. Also, explain how these are useful in Wind Tunnel Testing. [8+8]

7. What do you mean by isentropic process. Derive general isentropic relations for static temeperature rise, static pressure rise and Mach number rise across a gas flow. [16]

8. How is the velocity potential defined, and which equations are fulfilled by the velocity potential for compressible flows? Why it is convient to introduce the velocity potential? Derive velocity potential equation for a subsonic flow. [16]

Code No: 07A52102 **R07** **Set No. 4**

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A52102 **R07** **Set No. 1**

III B.Tech I Semester Examinations,November 2010
AERODYNAMICS-II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Mention and explain briefly the properties of hypersonic flows with neat sketches.
   (b) Mention the basic hypersonic inviscid governing equations and the respective boundary conditions. [8+8]
2. For flow over an airfoil at subsonic speed,derive velocity potential equation. [16]
3. (a) Explain in detail the working and construction of Laser Doppler Anemometer.
   (b) What are the different methods for measuring turbulence? Explain them in detail. [8+8]
4. (a) Write a note on choked flow condition in a Convergent-Divergent nozzle with relative plots.
   (b) A normal shock wave is standing in the test section of a supersonic wind tunnel. At upstream of this wave M_1=3, P_1=0.5 atm, T_1=200 K. Find the flow variables after the shock wave. [6+10]
5. (a) Describe the different balances used for measuring the forces on a model at subsonic speeds.
   (b) Describe Similarity rule. Explain how the forces and moments measured on a model can be used to describe the forces and moments of an airplane. [8+8]
6. (a) If a perfect gas undergoes an isentropic process, derive isentropic variations of the flow variables.
   (b) An airplane is flying at standard sea level conditions.The temperature at a point on the wing is 250 K, what is the pressure at this point. [8+8]
7. What do you understand by regular reflection from a solid boundary. Enumerate the significance of incident shock and reflected shock with appropriate sketches.[16]
8. (a) Discuss about the physical aspects of conical flows and with a schematic illustrate supersonic flow over a cone.
   (b) Discuss about the physical aspects of supersonic flow over cones with a suitable plot. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: 07A52102 **R07** **Set No. 3**

III B.Tech I Semester Examinations,November 2010
AERODYNAMICS-II
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain in detail about any six nondimensional parameters and give their significance.
   (b) What are π - parameters (Pi parameters)? Explain its significance in dimensional analysis? [8+8]
2. What do you understand by speed of sound and derive expression for various forms of speed of sound. [16]
3. (a) Discuss briefly on the qualitative aspects of axi-symmetric flow over a cone in a supersonic flow.
   (b) Mention and explain briefly the properties of supersonic flow with neat sketches. [8+8]
4. (a) What is a Shock-Polar?
   (b) Sketch shock polar diagrams at two values of the initial Mach number. Show the positions of the strong and weak oblique shocks, the normal shock and the infinitesimal wave on the diagrams. [4+12]
5. (a) Explain the working principle of a three component strain gauge balance.
   (b) Describe the differences between open jet and closed jet wind tunnels. [8+8]
6. (a) What do you mean by isentropic flow. Derive isentropic relations for a closed system.
   (b) Define Mach number. Explain about different types of flow regimes with appropriate sketches. [8+8]
7. Write a note on the following
   (a) Perturbation
   (b) Compressibility
   (c) Area rule
   (d) Supercritical airfoil. [4x4]
8. (a) State the assumptions used in deriving the Busemann-Newtonian theory.
   (b) With neat sketch, describe the flow over a blunt nosed cylinder using blast wave analogy. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆