Code No: R05312103 **R05** **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

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1. (a) If $\gamma = 1.2$ and the fluid is a perfect gas, what Mach number will give a temperature ratio of $T/T_t = 0.909$? What will the ratio of p/p_t be for this flow.
   (b) Carbon dioxide with a temperature of 335 K and a pressure of 1.4×10^5 N/m^2 is flowing with a velocity of 200 m/s. Determine [16]
      i. the sonic velocity and Mach number
      ii. the stagnation density.
2. (a) What are the physical aspects of conical flow?
   (b) Compare graphically the theta-beta relation for a Mach number in case of a wedge and a cone. [6+10]
3. Consider a subsonic flow with an upstream Mach number of M. This flow moves over a wavy wall with a contour given by $y_w = h\cos(2\pi x/l)$ where y_w is the ordinate of the wall, h is the amplitude, and l is the wavelength. Assume h is small. Using the small perturbation theory, derive an equation for the surface pressure coefficient. [16]
4. (a) Describe the difference between a supersonic nozzle and subsonic nozzle?
   (b) Air enters a converging-diverging nozzle with negligible velocity at an absolute pressure of 1.0 MPa and a temperature of 60^{o}C. If the flow is isentropic and the exit temperature is -11^{o}C. What is the Mach number at the exit? [6+10]
5. (a) What is the effect of deflections of the wind tunnel balance components on the force measurement? How can it be nullified in order to have the correct measurement?
   (b) Describe automatic beam balance. [10+6]
6. (a) What is the significance of hypersonic small disturbance equations?
   (b) What is hypersonic similarity? What is its significance? [8+8]
7. Describe the measurement of air speed in supersonic range? Derive the formula used in order to calculate the speed. [16]
8. (a) Observation of an oblique shock in air as shown in the figure 8a reveals that a Mach 2.2 flow at 550 K and 2 bar abs. Is deflected by 14^0. What are the conditions after the shock? Assume that the weak solution prevails.

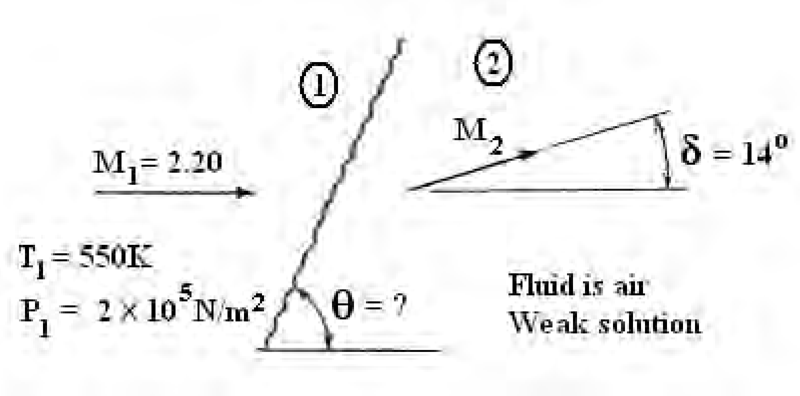

Figure 8a

(b) For a two-dimensional oblique shock in air where $M_1 = 2.0$ and the deflection angle is 10^0, calculate the two possible shock angles in degrees. [10+6]

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Code No: R05312103 **R05** **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

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1. (a) What is the significance of hypersonic small disturbance equations?
   (b) What is hypersonic similarity? What is its significance? [8+8]

2. (a) Describe the difference between a supersonic nozzle and subsonic nozzle?
   (b) Air enters a converging-diverging nozzle with negligible velocity at an absolute pressure of 1.0 MPa and a temperature of 60^{o}C. If the flow is isentropic and the exit temperature is -11^{o}C. What is the Mach number at the exit? [6+10]

3. (a) What is the effect of deflections of the wind tunnel balance components on the force measurement? How can it be nullified in order to have the correct measurement?
   (b) Describe automatic beam balance. [10+6]

4. Consider a subsonic flow with an upstream Mach number of M. This flow moves over a wavy wall with a contour given by $y_w = h\cos(2\pi x/l)$ where y_w is the ordinate of the wall, h is the amplitude, and l is the wavelength. Assume h is small. Using the small perturbation theory, derive an equation for the surface pressure coefficient. [16]

5. (a) If $\gamma = 1.2$ and the fluid is a perfect gas, what Mach number will give a temperature ratio of T/T_t = 0.909? What will the ratio of p/p_t be for this flow.
   (b) Carbon dioxide with a temperature of 335 K and a pressure of 1.4×10^5 N/m^2 is flowing with a velocity of 200 m/s. Determine [16]
      i. the sonic velocity and Mach number
      ii. the stagnation density.

6. Describe the measurement of air speed in supersonic range? Derive the formula used in order to calculate the speed. [16]

7. (a) What are the physical aspects of conical flow?
   (b) Compare graphically the theta-beta relation for a Mach number in case of a wedge and a cone. [6+10]

8. (a) Observation of an oblique shock in air as shown in the figure 8a reveals that a Mach 2.2 flow at 550 K and 2 bar abs. Is deflected by 14^0. What are the conditions after the shock? Assume that the weak solution prevails.

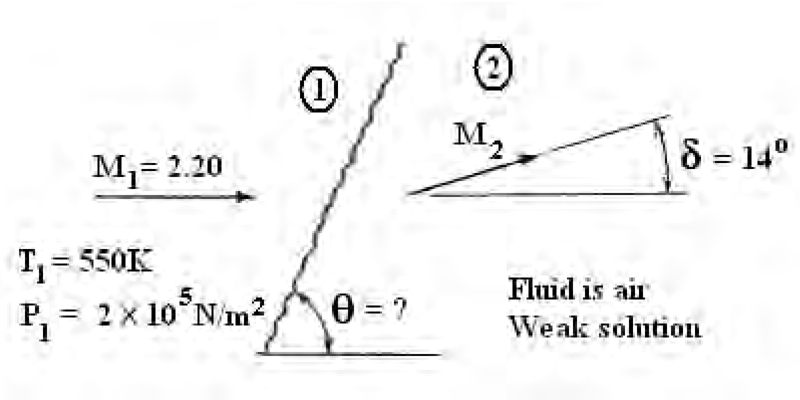

Figure 8a

(b) For a two-dimensional oblique shock in air where $M_1 = 2.0$ and the deflection angle is 10^0, calculate the two possible shock angles in degrees. [10+6]

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Code No: R05312103 **R05** **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

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1. (a) What is the effect of deflections of the wind tunnel balance components on the force measurement? How can it be nullified in order to have the correct measurement?
   (b) Describe automatic beam balance. [10+6]

2. Describe the measurement of air speed in supersonic range? Derive the formula used in order to calculate the speed. [16]

3. (a) If $\gamma = 1.2$ and the fluid is a perfect gas, what Mach number will give a temperature ratio of $T/T_t = 0.909$? What will the ratio of p/p_t be for this flow.
   (b) Carbon dioxide with a temperature of 335 K and a pressure of 1.4×10^5 N/m^2 is flowing with a velocity of 200 m/s. Determine [16]
      i. the sonic velocity and Mach number
      ii. the stagnation density.

4. (a) What are the physical aspects of conical flow?
   (b) Compare graphically the theta-beta relation for a Mach number in case of a wedge and a cone. [6+10]

5. (a) Describe the difference between a supersonic nozzle and subsonic nozzle?
   (b) Air enters a converging-diverging nozzle with negligible velocity at an absolute pressure of 1.0 MPa and a temperature of 60^{o}C. If the flow is isentropic and the exit temperature is -11^{o}C. What is the Mach number at the exit? [6+10]

6. (a) Observation of an oblique shock in air as shown in the figure 6a reveals that a Mach 2.2 flow at 550 K and 2 bar abs. Is deflected by 14^0. What are the conditions after the shock? Assume that the weak solution prevails.

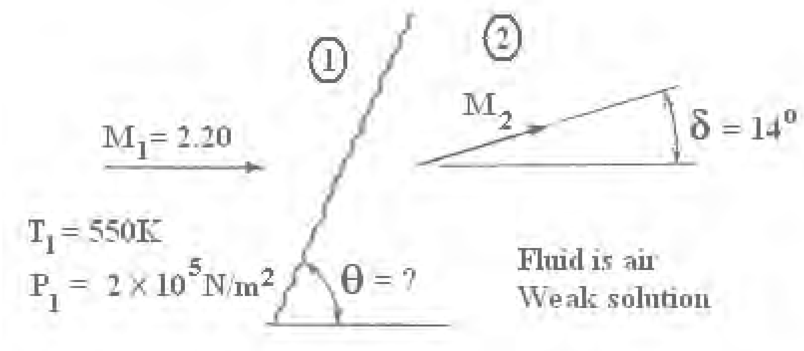

Figure 6a

(b) For a two-dimensional oblique shock in air where $M_1 = 2.0$ and the deflection angle is 10^0, calculate the two possible shock angles in degrees. [10+6]

7. (a) What is the significance of hypersonic small disturbance equations?

   (b) What is hypersonic similarity? What is its significance? [8+8]

8. Consider a subsonic flow with an upstream Mach number of M. This flow moves over a wavy wall with a contour given by $y_w = h\cos(2\pi x/l)$ where y_w is the ordinate of the wall, h is the amplitude, and l is the wavelength. Assume h is small. Using the small perturbation theory, derive an equation for the surface pressure coefficient. [16]

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Code No: R05312103 **R05** **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

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1. (a) What are the physical aspects of conical flow?
   (b) Compare graphically the theta-beta relation for a Mach number in case of a wedge and a cone. [6+10]
2. (a) What is the significance of hypersonic small disturbance equations?
   (b) What is hypersonic similarity? What is its significance? [8+8]
3. (a) What is the effect of deflections of the wind tunnel balance components on the force measurement? How can it be nullified in order to have the correct measurement?
   (b) Describe automatic beam balance. [10+6]
4. Describe the measurement of air speed in supersonic range? Derive the formula used in order to calculate the speed. [16]
5. (a) Describe the difference between a supersonic nozzle and subsonic nozzle?
   (b) Air enters a converging-diverging nozzle with negligible velocity at an absolute pressure of 1.0 MPa and a temperature of 60^{o}C. If the flow is isentropic and the exit temperature is -11^{o}C. What is the Mach number at the exit? [6+10]
6. (a) Observation of an oblique shock in air as shown in the figure 6a reveals that a Mach 2.2 flow at 550 K and 2 bar abs. Is deflected by 14^0. What are the conditions after the shock? Assume that the weak solution prevails.

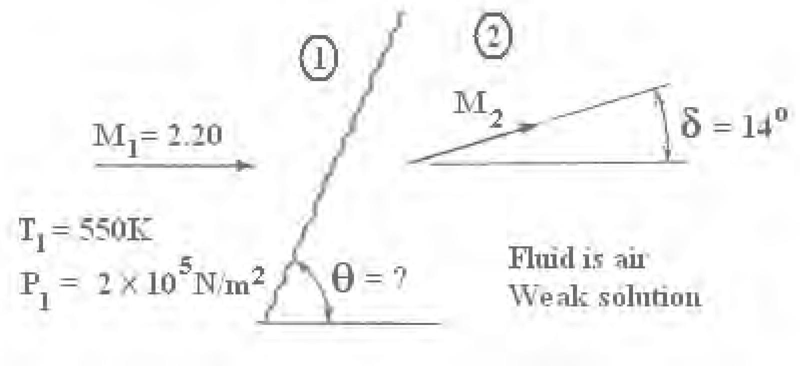

Figure 6a

   (b) For a two-dimensional oblique shock in air where $M_1 = 2.0$ and the deflection angle is 10^0, calculate the two possible shock angles in degrees. [10+6]

7. (a) If $\gamma = 1.2$ and the fluid is a perfect gas, what Mach number will give a temperature ratio of $T/T_t = 0.909$? What will the ratio of p/p_t be for this flow.

   (b) Carbon dioxide with a temperature of 335 K and a pressure of 1.4×10^5 N/m^2 is flowing with a velocity of 200 m/s. Determine [16]

      i. the sonic velocity and Mach number

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8. Consider a subsonic flow with an upstream Mach number of M. This flow moves over a wavy wall with a contour given by $y_w = h\cos(2\pi x/l)$ where y_w is the ordinate of the wall, h is the amplitude, and l is the wavelength. Assume h is small. Using the small perturbation theory, derive an equation for the surface pressure coefficient. [16]

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