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JAYA GROUP OF INSTITUTION-THIRUNINRAVUR
8th SEM – B.E. / B.Tech
INTERNAL ASSESSMENT-2(MODEL EXAM-II)

Sub. Name: Hypersonic aerodynamics

Sub. Code: AE2031

Duration: 180 minutes

Date: 9/3/2015

Branch: Aeronautical

Max.Marks: 100

Part A

10X2=20

1. What is a boundary layer?
2. What is self similar hypersonic boundary layer?
3. Define aerodynamic heating.
4. Give the expression for boundary layer for hypersonic flow.
5. Write down the assumptions made in a viscous interaction flow.
6. Define Reynolds number.
7. What is a viscous interaction?
8. Write down the condition for self similar and non self similar flow.
9. Explain the effects of shock wave interaction.
10. Describe the importance of hypersonic similarity parameter in viscous interaction.

Part B

5X16=80

11. (a). Derive the boundary layer equation for hypersonic flow.

(Or)

(b). Show that

$$\rho u \frac{\partial u}{\partial x} + \rho v \frac{\partial u}{\partial y} = -\frac{\partial p}{\partial x} + \frac{\partial}{\partial y} \left[\mu \left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y} \right) \right] + \frac{\partial}{\partial x} \left[\mu \left(\frac{\partial u}{\partial x} + \frac{\partial u}{\partial x} \right) \right]$$

12. (a). Discuss in detail about the self similar hypersonic boundary layer problems

(Or)

(b). Derive the governing equation for a thin boundary layer in a hypersonic flow.

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13. (a). Prove that

boundary layer energy equation.

$$S_f = \frac{1}{\rho_e u_e (h_{aw} - h_w)} \frac{k}{c_p} \frac{u_e \rho_e}{\sqrt{2\xi}} g'(\xi, 0)$$

using

(Or)

(b). Discuss in detail about the solving methods of non self similar hypersonic boundary layers.

14. (a). How does a viscous interaction occur in a hypersonic flow? Explain in detail.

(Or)

(b). Discuss about similarity parameter in hypersonic viscous interaction.

15. (a) (i) Explain about strong and weak viscous interactions.

(Or)

(b). Write in detail about shock wave boundary layer interaction.