Roll No……..….. **Total No. of Printed Pages: 1**

Total No. of Questions: [09]

B. Tech. (Aerospace Engg.) (Semester – 7th)
HYPERSONIC AERODYNAMICS
Subject Code: BASES1702
Paper ID: [19113032]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) Define hypersonic flow.
b) What is a thin shock layer?
c) Differentiate between low-density and high-density hypersonic flows.
d) Explain hypersonic flight path.
e) Define entropy layer.
f) What are hypersonic flight similarity parameters?
g) What is tangent cone method?
h) What is an expansion wave?
i) Define the term "inviscid flow."
j) What is the significance of entropy in hypersonic flows?

Section – B **(5 marks each)**

Q2. Explain the modified Newtonian Law and its application in hypersonic aerodynamics.

Q3. A hypersonic vehicle follows a tangent wedge profile with a wedge angle of 20°. Calculate the surface pressure using Newtonian theory (assume freestream pressure is 40 kPa).

Q4. Describe the concept of shock expansion methods for surface flow property calculations.

Q5. Explain how the tangent cone method is used to determine surface flow properties.

Q6. A hypersonic flow has a Mach number of 8. Calculate the pressure coefficient using modified Newtonian Law (assume freestream pressure is 30 kPa).

Section – C **(10 marks each)**

Q7. Discuss the characteristics of hypersonic flight paths and their importance in aerospace engineering.

Q8. A hypersonic aircraft experiences a shock wave with a pressure increase from 40 kPa to 120 kPa. Calculate the change in entropy assuming isentropic flow conditions.

Q9. Explain the shock wave and expansion wave relations for inviscid hypersonic flows in detail.