AE236: Compressible Fluid Mechanics
Quiz 2
February 17, 2022

Duration: 50 minutes **Maximum Marks: 15**

Answer all questions briefly and to the point. All the best!

1. A normal shock wave with pressure ratio of 4.5 impinges on a plane wall. Determine the static pressure ratio for the reflected normal shock wave. The air temperature in front of the incident wave is 280 K. (3)

2. A reentry vehicle (RV) is at an altitude of 15000 m and has a velocity of 1850 m/s. A bow shock envelops the RV. Neglecting dissociation, determine the static and stagnation pressure and static and stagnation temperature just behind the shock wave of the RV centerline where the shock wave may be treated as normal shock. Assume that the air behave as perfect gas, with $\gamma = 1.4$ and $R = 287\ J/kg - K$. (4)

3. A normal shock wave moves through a duct of a constant cross-section with a velocity of 490 m/s. The air in the duct is stationary and is at a pressure and temperature of 0.1 MPa and 300 K respectively. Determine the velocity of air after the passage of the shock. Also, find the pressure, temperature, Mach number and stagnation temperature imparted behind the wave. (4)

4. A weak shock is generated by a piston in a tube containing still air at 300 K. If the temperature of the air traversed by the shock is 5% more than the initial temperature, determine the piston speed and the shock Mach number. (4)