AE236: Compressible Fluid Mechanics
Quiz 2
February 11, 2020

Duration: 45 minutes   **Maximum Marks: 10**

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

1. Answer either true or false with a brief explanation: For a given gas at a given state, analytical solution to pressure ratio, density ratio, temperature ratio and downstream Mach number can be written in terms of the upstream Mach number only if we assume an ideal, calorically perfect gas. (1)

2. Consider two flows, one of helium and one of air, at the same Mach number of 5. Which gas will result in the stronger shock? Explain with numbers. (1)

3. Draw the $T - s$ diagram of the normal shock from your notes. Now mark the locus of all points where $M = 1$ and indicate the region in the $T - s$ diagram that corresponds to subsonic and supersonic flow. Explain your reasoning. (2)

4. A normal shock is moving with a speed 550 m/s into still air at $1bar$ and 16^0C. (6)
   (a)Compute the pressure, temperature and velocity downstream of the shock wave.
   (b)Compute the stagnation pressure and temperature downstream of the shock. Are they larger/smaller/equal to the stagnation pressure and temperature upstream of the shock?
   (c) Explain and resolve any inconsistencies that you find in (b) from your understanding of the change of stagnation properties across a normal shock.