Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Assignment-7 Date: 24th February 2022

Maximum points: 1 **Instructions:**

- *Answer all the questions*
- *Please write your solutions/explanations on a paper with your handwriting*
- *Scan all pages as a single pdf file and upload in google classroom before 27-02-22*
- *This will give you **1 point** towards your total evaluation,*
- ***Late submission lead to deduction of half mark. (This is Very Important)***

1. Air is contained in a piston-cylinder device at 600 kPa and 927°C, and occupies a volume of 0.8 m^3. The air undergoes and isothermal (constant temperature) process until the pressure in reduced to 300 kPa. The piston is now fixed in place and not allowed to move while a heat transfer process takes place until the air reaches 27°C. (a) Sketch the system showing the energies crossing the boundary and the ***P-V*** diagram for the combined processes. ***(b)*** For the combined processes determine the net amount of heat transfer, in kJ, and its direction. Assume air has constant specific heats evaluated at 300 K.

2. Steam enters a nozzle at 400°C and 800 kPa with a velocity of 10 m/s, and leaves at 300°C and 200 kPa while losing heat at a rate of 25 kW. For an inlet area of 800 cm^2, determine the velocity and the volume flow rate of the steam at the nozzle.

3. Argon gas enters an adiabatic turbine steadily at 1600 kPa and 450°C with a velocity of 55 m/s and leaves at 150 kPa with a velocity of 150 m/s. The inlet area of the turbine is 60 cm^2. If the power output of the turbine is 190 kW, determine the exit temperature of the argon.

4. An adiabatic gas turbine expands air at 1300 kPa and 500°C to 100 kPa and 127°C. Air enters the turbine through a 0.2-m^2 opening with an average velocity of 40 m/s, and exhausts through a 1-m^2 opening. Determine ***(a)*** the mass flow rate of air through the turbine and (***b***) the power produced by the turbine.