Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Tutorial-5 Date: 16th February 2022

Instructions:

- *Answer all the questions*
- *Please write your solutions/explanations on an A4 size paper with your own handwriting*
- *Scan all pages as a single pdf file and upload in google classroom before 8 PM same day*
- *This will give you **1 point** towards your total evaluation*
- *Late submission lead to deduction of **half mark.***

1. A piston-cylinder device initially contains 0.07 m^3 of nitrogen gas at 130 kPa and 120°C. The nitrogen is now expanded polytropically to a state of 100 kPa and 100°C. Determine the boundary work done during this process.

2. Carbon dioxide contained in a piston-cylinder device is compressed from 0.3 to 0.1 m3. During the process, the pressure and volume are related by $P = aV^{-2}$, where a = 8 kPa-m6. Calculate the work done on the carbon dioxide during this process.

3. A piston-cylinder device contains 0.15 kg of air initially at 2 MPa and 350°C. The air is first expanded isothermally to 500 kPa, then compressed polytropically with a polytropic exponent of 1.2 to the initial pressure, and finally compressed at the constant pressure to the initial state. Determine the boundary work for each process and the net work of the cycle.

4. 1.5-kg water that is initially at 1 MPa and 30 percent quality occupies a spring-loaded piston-cylinder device. This device is now cooled until the water is a saturated liquid at 100°C. Calculate the total work produced during this process, in kJ.