Thermodynamics (MEL2020)
Indian Institute of Technology Jodhpur

Tutorial-6 Date: 23rd 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. Steam flows steadily through an adiabatic turbine. The inlet conditions of the steam are 6 MPa, 400°C, and 80 m/s, and the exit conditions are 40 kPa, 92 percent quality, and 50 m/s. The mass flow rate of the steam is 20 kg/s. Determine (a) the change in kinetic energy, (b) the power output, and (c) the turbine inlet area.

2. A well-insulated rigid tank contains 2 kg of a saturated liquid-vapor mixture of water at 150 kPa. Initially, three-quarters of the mass is in the liquid phase. An electric resistor placed in the tank is connected to a 110-V source, and a current of 8 A flows through the resistor when the switch is turned on. Determine how long it will take to vaporize all the liquid in the tank. Also, show the process on a T-v diagram with respect to saturation lines.

3. Air at 80 kPa and 127°C enters an adiabatic diffuser steadily at a rate of 6000 kg/h and leaves at 100 kPa. The velocity of the air stream is decreased from 230 to 30 m/s as it passes through the diffuser. Find ***(a)*** the exit temperature of the air and (***b***) the exit area of the diffuser.

4. Helium is to be compressed from 120 kPa and 310 K to 700 kPa and 430 K. A heat loss of 20 kJ/kg occurs during the compression process. Neglecting kinetic energy changes, determine the power input required or a mass flow rate of 90 kg/min.