2 November 2015

CHE 260 – Thermodynamics and Heat Transfer

Mid-Term Exam – 2015

You have 110 minutes to do the following five problems. You may use your textbook and any type of non-communicating calculator. All questions are worth equal marks.

1) A diffuser has air entering at 100 kPa and 300 K with a velocity of 200 m/s. The inlet cross-sectional area of the diffuser is 100 mm^2. At the exit the area is 860 mm^2, and the exit velocity is 20 m/s. Determine the exit pressure and temperature of the air.

2) A cylinder fitted with a frictionless piston contains 2 kg of superheated refrigerant R-134a vapour at 320 kPa, 100°C. The cylinder is now cooled so that the R-134a remains at constant pressure until it reaches a quality of 75%. Calculate the work done and the heat transfer during this process.

3) Argon in a light bulb is at 110 kPa, 70°C. The light is turned off and the argon cools to the temperature of the surrounding atmosphere that is at 20°C. Find the entropy generated per unit mass of argon.

4) Two steady flow streams of water, one of saturated water vapour at 0.6 MPa and the other of superheated steam at 0.6 MPa and 600°C, mix in an adiabatic chamber to produce a single flow out at 0.6 MPa, 400°C. Find the total entropy generation for this process per unit mass of water leaving the chamber.

5) Carbon dioxide enters an adiabatic compressor at 100 kPa, 300 K and exits at 1000 kPa, 520 K. Find the isentropic efficiency of the compressor and the entropy generated in it per unit mass of gas flowing through it.