28 October 2013

CHE 260 – Thermodynamics and Heat Transfer

Mid-Term Exam – 2013

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

1) Argon is compressed in a polytropic process for which $PV^{1.2}$=constant from 120 kPa and 30°C to 1200 kPa in a piston-cylinder device. Determine the work done and heat transferred per unit mass of gas during this process.

2) Refrigerant R-134a, initially in a piston-cylinder device at 240 kPa and 20°C, undergoes an isothermal process until its quality is 20%. Draw this process on a *T-s* diagram. Determine the work done and heat transferred during the process per unit mass of the refrigerant.

3) A steam turbine receives steam at a pressure of 1 MPa and a temperature of 300°C. The steam leaves the turbine at a pressure of 15 kPa. The work output of the turbine is measured to be 600 kJ/kg of steam flowing through the turbine. Determine (a) the isentropic efficiency of the turbine and (b) the quality of steam at the exit of the turbine.

4) Air enters an adiabatic compressor at 100 kPa and 17°C at a rate of 2.4 m^3/s and it exits at 257°C. The compressor has an isentropic efficiency of 84%. Neglecting changes in kinetic and potential energies, determine (a) the exit pressure of air and (b) the power required to drive the compressor.

5) A container filled with 45 kg of liquid water at 95°C is placed in a 90 m^3 room that is initially at 12°C. The room is well sealed and insulated. Thermal equilibrium is established after a while as a result of heat transfer between the water and the air in the room. Using constant specific heats determine (a) the final equilibrium temperature (b) the entropy generated.