Final Exam – MEN211 (Thermodynamics II)
Spring 2006 - June 20, 2006

1. Acetylene (C_2H_2) gas at 25°C is burned with 140% theoretical air, which enters the burner at 25°C, 100 kPa, 80% relative humidity. The combustion products form a mixture of CO_2, H_2O, N_2, O_2, and NO in chemical equilibrium at 2200 K, 100 kPa. This mixture is then cooled to 1000 K very rapidly, so that the composition does not change. **Determine the mole fraction of NO in the products and the heat transfer for the overall process.**

2. A saturated air-water vapor mixture at 20°C, 100 kPa, is contained in 50-m^3 closed tank in equilibrium with 1 kg of liquid water. The tank is heated to 80°C. **Is there any liquid water in the final state? Find the heat transfer for the process.**

3. A small power plant with reheat produces steam at 3 MPa, 600°C in the boiler. It keeps the condenser at 45°C by transfer of 10 MW out as heat transfer. The first turbine section expands to 500 kPa and then flow is reheated followed by the expansion in the low-pressure turbine. **Find the reheat temperature so the turbine output is saturated vapor. For this reheat find the total turbine power output and the boiler heat transfer.**

$5\ 75°C$.

Points: 1 (35%), 2 (30%), and 3 (35%).