**Thermodynamics I** **MEN 210 A** **December 5, 2005**
**Examination Two** **Dr. Walid C. Assaf**
**Open Book, Closed Notes**

**Problem One:** 20%

Helium gas at atmospheric pressure of 101 kPa and 500K degrees is heated until its pressure reaches 7.5 MPa at 1750 K degrees. Calculate the change in specific internal energy for this process.

**Problem Two:** 30%

Air treated as ideal gas is compressed in a nearly reversible process (polytropic) from 0.2 liters at 90 kPa and 20°C to final pressure of 845.15 kPa and final volume $V_2$. The work of compression is = - 190.17 kJ per kg of air. It is known that the compression ratio is $[V_1/V_2] = 6$. Draw and properly label the p-V diagram for this process. Calculate the value of the polytropic exponent n for the equation $PV^n$ = constant and the heat transfer for the process in kJ per kilograms. Are the specific heats constant in this problem? Yes or No and how can you find out?

**Problem Three:** 30%

Hot water in steady flow having an enthalpy of 763.5 kJ/kg and temperature 453.15 Kelvin degrees enters a flash chamber through a throttling valve. A mixture of liquid and vapor in the flash chamber is formed at 400kPa pressure. The liquid is withdrawn and is discarded while the saturated vapor feeds a turbine. Water exits from the turbine at 10 kPa and an enthalpy of 2345.4 kJ/kg. Work output of the turbine is 1000kW. What is the quality of the exiting steam from the turbine? Find the mass flow rate in kg/sec of the hot water that enters the flash chamber. Draw a schematic diagram for this power plant.

**Problem Four:** 20%

Calculate the thermal efficiency and the net work output of an engine operating in a Carnot Cycle mode. The high and low temperatures are 600 and 300 Kelvin degrees. The heat transferred at the high temperature is 250 kJ/kg.