Name: _____ Student Number: _____

AME230 Exam #2 McGrath
One hour Closed Book, Open notes (One page, both sides) Spring 2006

You are expected to solve all the problems using the standard methodology as defined in the text. Please write your answers neatly.

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1. (5 Points) A steam turbine receives steam at 22,700 kg/hr while the power output is 500 kW. The inlet and outlet velocities of the steam are 75 m/s and 300 m/s respectively. The inlet pipe is 3 m above the exhaust. Neglecting the heat loss from the turbine, find the change in enthalpy per kg of steam.

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2. (5 Points) A reversible power cycle R and an irreversible power cycle I operate between the same two reservoirs. (a) If each cycle receives the same amount of energy from the hot reservoir, show that the cycle I necessarily discharges more heat energy to the cold reservoir than cycle R. (b) If each cycle develops the same net work, show that cycle I necessarily receives more heat energy than cycle R.

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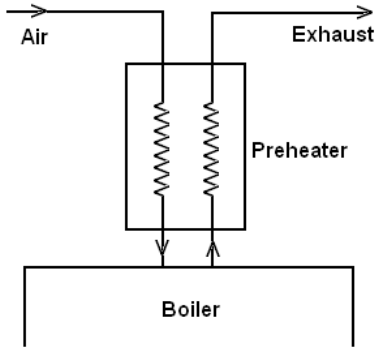
3. (10 Points) The exhaust gases from the boiler in a power plant are used to preheat the air before it enters the boiler. Exhaust gases leave the boiler and enter an air preheater at 100 kPa and 500°C, with a mass flow rate of 75 kg/min. Outside air enters the heat exchanger with a flow rate of 70 kg/min at 101 kPa and 15°C. The exhaust gases leave the preheater at 250°C. Assuming the properties of the exhaust gases can be approximated by those of air, calculate the outside-air temperature as it leaves the preheater and the heat transfer rate between the two gas streams.



(*NOTE: You do not need to use interpolated property data obtained from the table. You can use the nearest value to get the answer, which would be an approximation*.)

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4. (5 Points) A reversible heat pump is used for heating a building in the winter. The heat is absorbed from the earth by a fluid circulating in buried pipes and delivered to the building to maintain the temperature at 23^{o}C. Determine the amount of heat supplied to the building in kW if 1 kW-hr of electrical energy is needed to operate the heat pump. The soil temperature is 0^{o}C.