بسم الله الرحمن الرحيم

Mansoura University
Faculty of Engineering
Mechanical Eng. Dept.

1st Year Electrical Engg.
Final Exam, *June, 2011*
Time: **1.5** *hrs*

Fluid Mechanics and Thermal Engineering

Part II

Assume Any Reasonable Missing Data

Answer the following questions:

1.a) Define: the isolated system, the closed system, the open system, the entropy and the enthalpy.

b) A large fraction of the thermal energy generated in the engine of a car is rejected to the air by the radiator through the circulating water. Should the radiator be analyzed as a closed system or as an open system? Explain.

c) A 4m x 5m x 6m room is to be heated by a baseboard resistance heater. It is desired that the resistance heater be able to raise the air temperature in the room from 7 to 23°C within 15 min. Assuming no heat losses from the room and an atmospheric pressure of 100 kPa, determine the required power of the resistance heater. Assume constant specific heats at room temperature.

2.a) An air-conditioning system is used to maintain a house at a constant temperature of 20°C. The house is gaining heat from outdoors at a rate of 20,000 kJ/h, and the heat generated in the house from the people, lights, and appliances amounts to 8000 kJ/h. For a COP of 2.5, determine the required power input to this air-conditioning system.

b) The compression ratio of an ideal dual cycle is 14. Air is at 100 kPa and 300 K at the beginning of the compression process and at 2200 K at the end of the heat-addition process. If the heat transfer to air takes place partly at constant volume and partly at constant pressure is 1520.4 kJ/kg, determine (*a*) the fraction of heat transferred at constant volume and (*b*) the thermal efficiency of the cycle.

3.a) How does forced convection differ from natural convection?

b) Two surfaces of a 1 cm thick plate are maintained at 100°C and 60°C, respectively. If it is determined that heat at a rate of 800 W/m^2 is transferred through the plate and lost to the atmospheric air which maintained at 20°C , determine (*a*) the thermal conductivity of the plate material and (*b*) the heat transfer coefficient of the air.

c) An adiabatic heat exchanger is used to heat cold water at 15°C entering at a rate of 4 kg/s by hot air at 90°C entering at a rate of 5 kg/s. If the exit temperature of hot air is 40°C, determine the exit temperature of cold water.

GOOD LUCK
Dr. Mostafa Awad