بسم الله الرحمن الرحيم

Mansoura University
Faculty of Engineering
Mechanical Eng. Dept.

1st Year Electrical Engg.
Final Exam, *June, 2012*
Time: **1.5** *hrs*

Fluid Mechanics and Thermal Engineering
Part II

*Assume Any Reasonable Missing Data*

Answer the following questions:

1.a) Define: the energy, the power, the system, the process and the cycle.

 b) Air is to be heated steadily by an 8 kW electric resistance heater as it flows through an insulated duct. If the air enters at 50°C at a rate of 2 kg/s, determine the exit temperature of air.

2.a) An air-conditioning system operating on the reversed Carnot cycle is required to transfer heat from a house at a rate of 750 kJ/min to maintain its temperature at 24°C. If the outdoor air temperature is 35°C, determine the power required to operate this air-conditioning system.

 b) An air-standard Diesel cycle has a compression ratio of 18.2. Air is at 27°C and 1 bar at the beginning of the compression process. If the air temperature at the end of the heat addition process is 1400°C, determine (*a*) the cutoff ratio, (*b*) the heat rejection per unit mass, and (*c*) the thermal efficiency.

3.a) Hot air at 80°C is blown over a 2m x 4m flat surface at 30°C. If the convection heat transfer coefficient is 55 W/m^2·°C, determine the rate of heat transfer from the air to the plate, in kW.

 b) A heat exchanger is to heat water (*cp* = 4.18 kJ/kg·°C) from 25 to 60°C at a rate of 0.2 kg/s. The heating is to be accomplished by geothermal water (*cp* = 4.31 kJ/kg·°C) available at 140°C at a mass flow rate of 0.3 kg/s. Determine the rate of heat transfer in the heat exchanger and the exit temperature of geothermal water.

GOOD LUCK
Dr. Mostafa Awad

Prob.1   (15 points)

Calculate the gauge pressure of air in the tank shown in Figure.
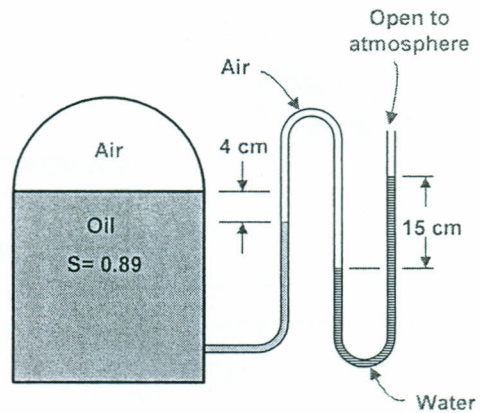
Prob.2   (20 points)

A hinged gate is used as a retainer for castor oil (S=0.96) as shown in Fig. The liquid depth to the horizontal portion of the gate is 0.6 m, and the gate itself is to be designed so that the oil depth does not exceed 1.5 m. When the depth is greater than 1.5 m, the fluid forces act to open the gate, and some oil escapes through it. The gate width is 0.6 m. Determine the length L required for the gate to open when necessary.
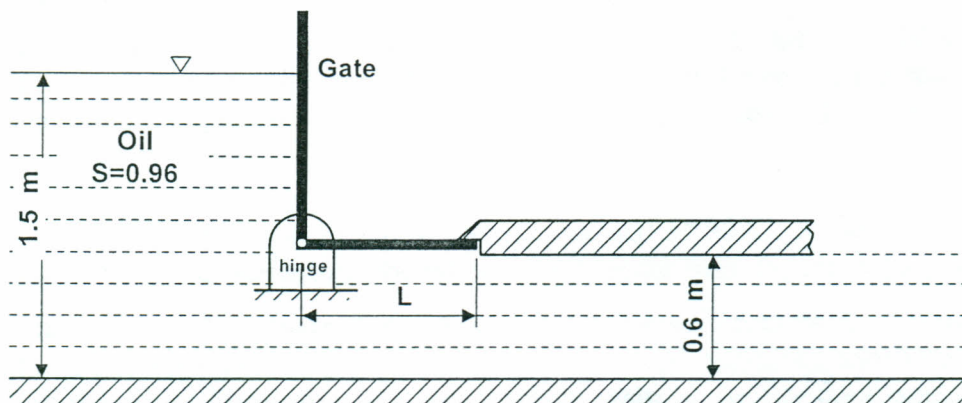
Prob.3   (20 points)

Consider the flow of water through a venture meter, as shown in Fig. A manometer is placed in the line to measure the pressure difference from the inlet to the throat. For the dimensions given, determine the volume flow rate of water through the meter.

Good luck