Lebanese American University
School of Engineering and Architecture
Department of Mechanical Engineering

MEE 304 HEAT TRANSFER
Midterm I, Duration 1.5 hrs

Name: **May 10, 2007** **ID:**

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1) (25 pts) Find the heat transfer rate per unit length if T_2=100^{o}C. The fluid's inside has a Temperature of T_1=50^{o}C and h= 60W/m^{2}K. Take k=0.75W/m ^{o}C for the block.

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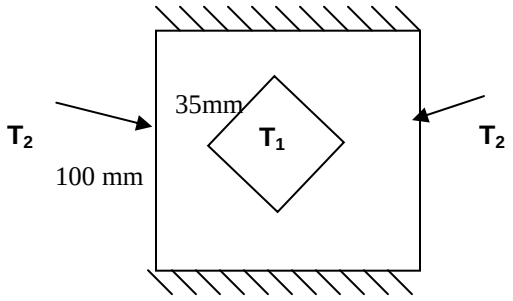
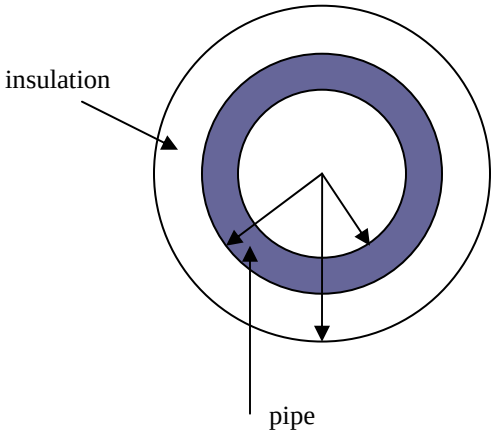
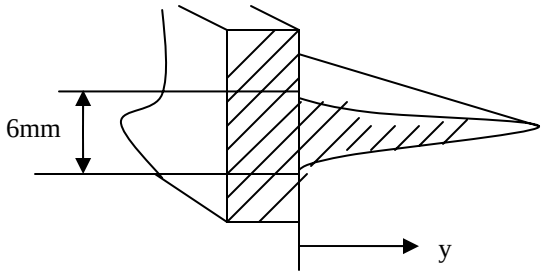


2) (25 pts) A mild steel steam pipe has an outside diameter of 15 cm and a wall thickness of 0.7cm. it is insulated with a 5.3 cm-thick layer of magnesia insulation K_m=0.073W/mK. Superheated steam at 500K flows through the pipe, and the inside heat transfer coefficient is 35 W/m2 K. Heat is lost by convection and radiation to surroundings at 300K, and the sum of outside convection and radiation coefficients is estimated to be 8 W/m2K. fing the rate of heat loss for a 20 m length of pipe



3) (25pts) A pure Aluminum fin has a parabolic profile $y=t(1-x/L)^2$, with t=3mm and L=20mm. Determine the heat dissipation by the fin when its base temperature is 500K and it is exposed to fluid at 300K with a heat transfer coefficient of 2800W/m^{2}K. Also calculate the fin mass.



4) (30 pts.) A wafer of silicon 3 mm thick and 2 cm square is used in an electronic device, One side of the device is held at 85^{o}C and the other is held at 25^{o}C. The thermal conductivity of the silicon varies with temperature as $k=k_o(1+BT)$, where k_o=175 W/mK, B=0.00556^{o}C^{-1}, and T is in ^{o}C.

a) **Determine the heat transfer rate (in W) if the thermal conductivity is evaluated at its average temperature. (10 pts)**
b) **Determine the heat transfer rate (in W) if the temperature dependence of thermal conductivity is formally taken into account in the governing differential equation. (20 pts)**