

CHG 2314 HEAT TRANSFER

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Assignment No. 5

1. Electronic devices in form of very thin disks are mounted flush on a square (10 cm x 10 cm) metal plate of thickness 2 mm and thermal conductivity 12 W/m K. Both sides of the plate are exposed to an environment at 25°C with the combined heat transfer coefficient, $h_o = 8 \text{ W/m}^2 \text{ K}$. Neglecting the contact resistance between the devices and the plate, determine the steady state temperature of the devices when they generate 40 W.

To decrease the steady state temperature of the devices during their operation, it is proposed to attach 20 aluminum straight rectangular fins (thickness = 1 mm, width = 10 cm, height = L) to the backface of the plate. The fins are to be attached using an epoxy, and as a result a contact resistance, $R_{t,c}'' = 5 \times 10^{-4} \text{ m}^2 \text{ K/W}$, between the fins and the plate is expected. If the combined heat transfer coefficient for both the finned backface and unfinned face of the plate with the electronic devices is $8 \text{ W/m}^2 \text{ K}$, determine the required length of the fins for the devices not to exceed 75°C, while dissipating 40 W. For aluminum fins use the thermal conductivity of 160 W/m K.

2. Problem 3.140
3. Problem 4.24. In this problem you will need to evaluate the shape factor graphically.

Due Date: Feb. 18, 2005 at 4:00 p.m. in the assignment box.