CEE526/MAE527 Finite Elements for Engineers
Modeling Project 2-1
Due date: See class website

Write a report (use the style *from FE Modeling Case Studies* document). A sample MS Word document is available on the class web site and can be used as a style guide.

The report should have a cover page, table of contents, list of figures and tables, page numbers, and several sections. As a minimum the following sections are recommended - (a) *Problem Statement* including statements on the response parameters that you are monitoring, (b) *FE Model* where you show via tables and text the material properties, element types used, boundary conditions and loads, (c) *Analysis Results* including details of the FE models used and the response quantities obtained, (d) *Convergence Analysis*, (e) *Concluding Remarks* and (f) *References*. The figures and tables should be labeled and called out in the text. Equations should be properly typed and should have equation numbers. Check your document carefully for spelling and grammatical errors. Write in third person using passive voice.

The report (as a Microsoft Word file) should be turned in electronically (e-mail to s.rajan@asu.edu) by the due date.

Solve either Problem 1 or Problem 2, <u>and</u> Problem 3 or Problem 4.

Problem 1: A long steel tube (Fig. 1) with inner radius r_1 = 3 cm and outer radius r_2 = 5 cm and k = 20 W/(m-^{0}C) has its inner surface heated at a rate of q_0 = -100000 W/m^2 (minus sign indicates that heat flows into the body). Heat is dissipated by convection from the outer surface into a fluid at temperature T_∞ = 120^{0}C and h = 400 W/(m^2-^{0}C). Compute the temperatures on the inner and outer surfaces.

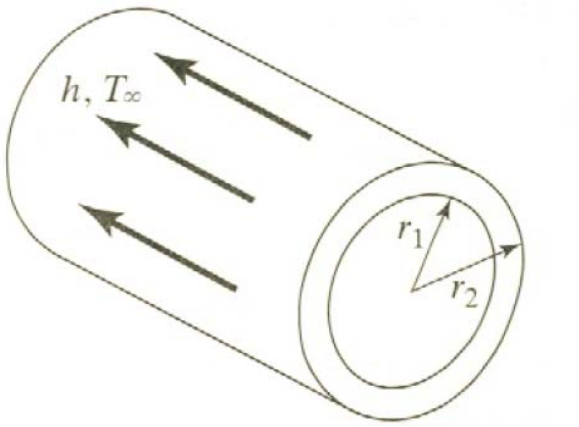

Figure 1

Problem 2: A large industrial furnace is supported on a long column of fireclay brick that is 1 m x 1 m on a side (Fig. 2). During steady-state operation, installation is such that three surfaces of the column are maintained at 600^0K while the remaining surface is exposed to an airstream for which $T_\infty = 300^0$K and h=12 W/(m^2-^{0}K). Determine the temperature distribution in the column and the heat rate to the airstream per unit length of the column. Take k=1 W/(m-^{0}K).

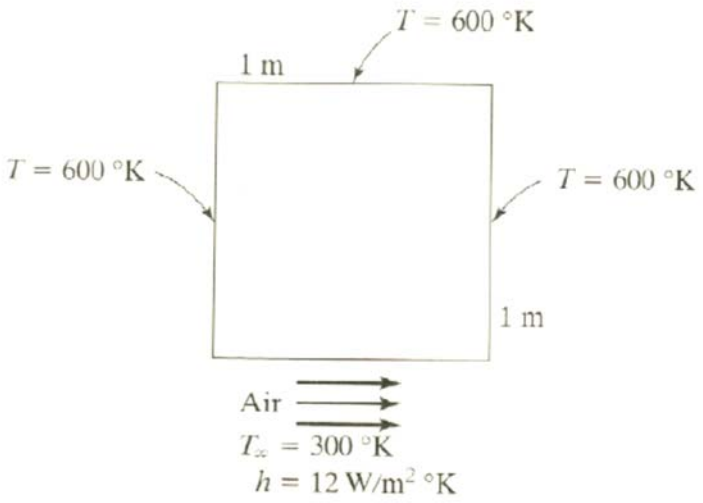

Figure 2

Problem 3: The cross-section of the steel beam in Fig. 3 is subjected to a torque T=500 in-lb. Determine using the program, ASUTruss, the angle of twist and the location and magnitude of the maximum shearing stresses.

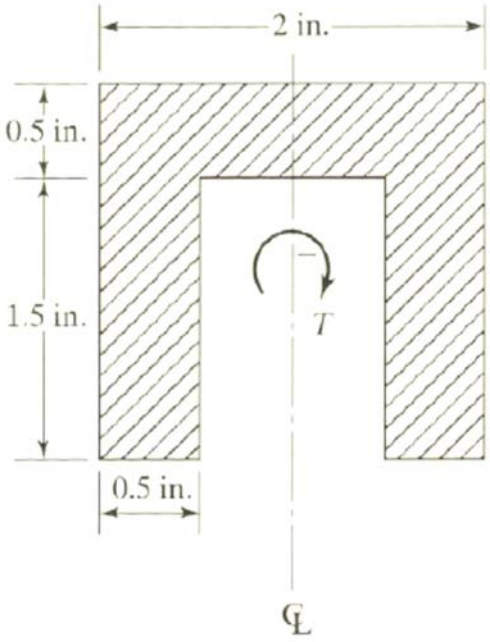

Figure 3

Problem 4: For the dam section shown in Fig. 4, k = 0.003 ft/min. Determine the following:

(a) The line of seepage.
(b) The quantity of seepage per 100 ft length of the dam.
(c) The length ***a*** of the surface of seepage.

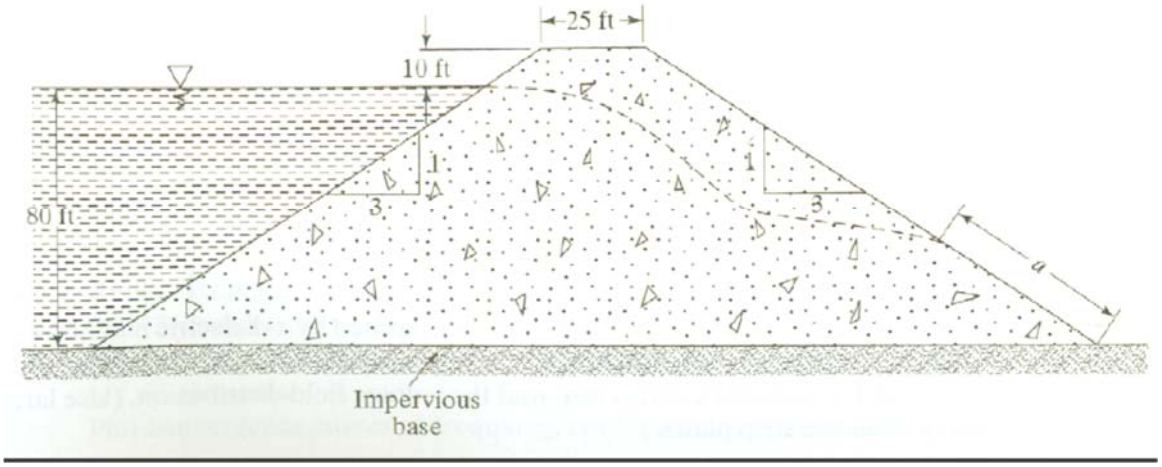

Fig. 4