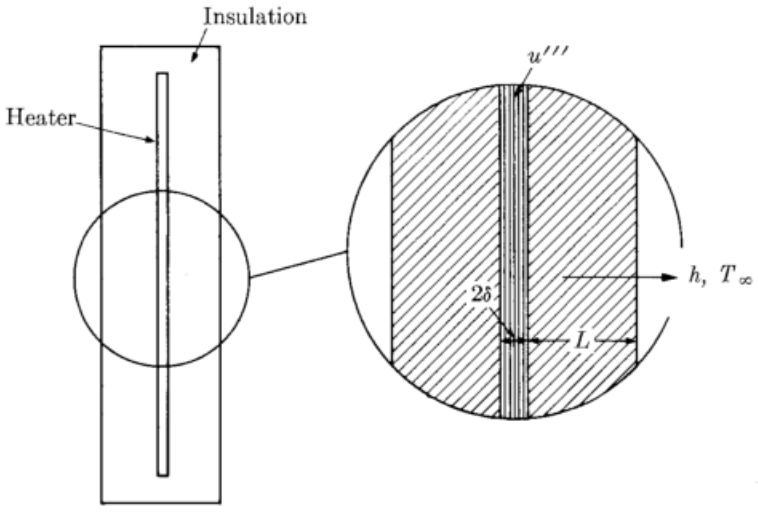
Cankaya University
Faculty of Engineering
Mechanical Engineering Department

HW 3

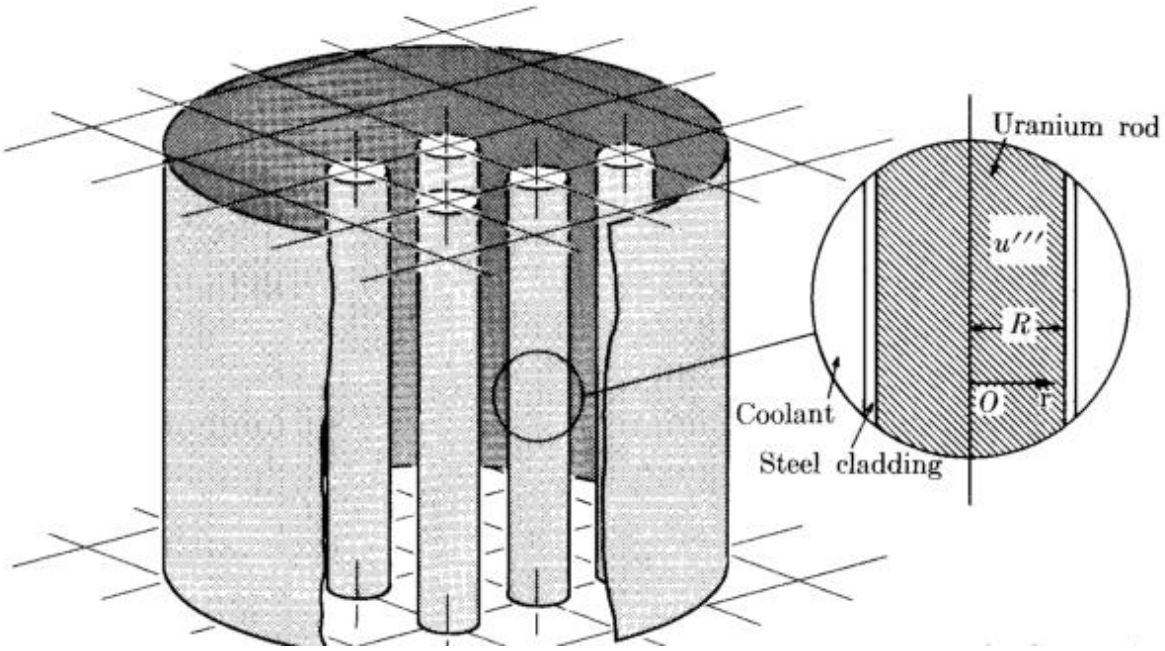
P-1) Internal energy is to be generated electrically in a flat metal plate of thickness 2δ for heating purposes. To obtain low surface temperatures, and for electrical insulation, this plate is covered by an electrical insulator of thickness L which is also a poor thermal conductor (see figure). The heater is at the ambient temperature T_∞ initially; then the internal energy u''' is suddenly generated in the heater. Make a one-dimensional analysis. Do not solve . Just develop differential equation and initial and boundary conditions.



P-2) . The core of a pool reactor is made of cylindrical fuel elements, each composed of a uranium rod of radius R and a stainless steel cladding of negligible thickness (see figure) The reactor has the uniform temperature T_∞ initially; then internal energy is assumed suddenly to be generated in the uranium rods as

$$u'''/u_0''' = 1 - (r/R)^2,$$

where u_0''' is the internal energy generation at the center line. The temperature of the coolant is held constant at T_∞. The heat transfer coefficient is large. Formulate the problem. Just develop the differential equation and state its initial and boundary conditions



P-3) A solid sphere of radius R having the initial temperature T_0 is dropped into boiling water at temperature T_∞. Formulate the problem. Just develop the differential equation,initial condition and boundary conditions.
Hint: Sphere is suddenly drpoed into boiling water.

P-4) Problem 3-29 of Text book, Heat Conduction ,Yener and Kakac, 4 th Edition.