Exam.Code:1014
Sub. Code: 7434

2023

M.E. (Mechanical Engineering)

First Semester

MME-105 (f): Advanced Heat Transfer

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, selecting atleast two questions from each Part. Assume any missing data suitably. Supplement your answer with neat and labeled sketched wherever required. All questions carry equal marks.

x-x-x

Part-A

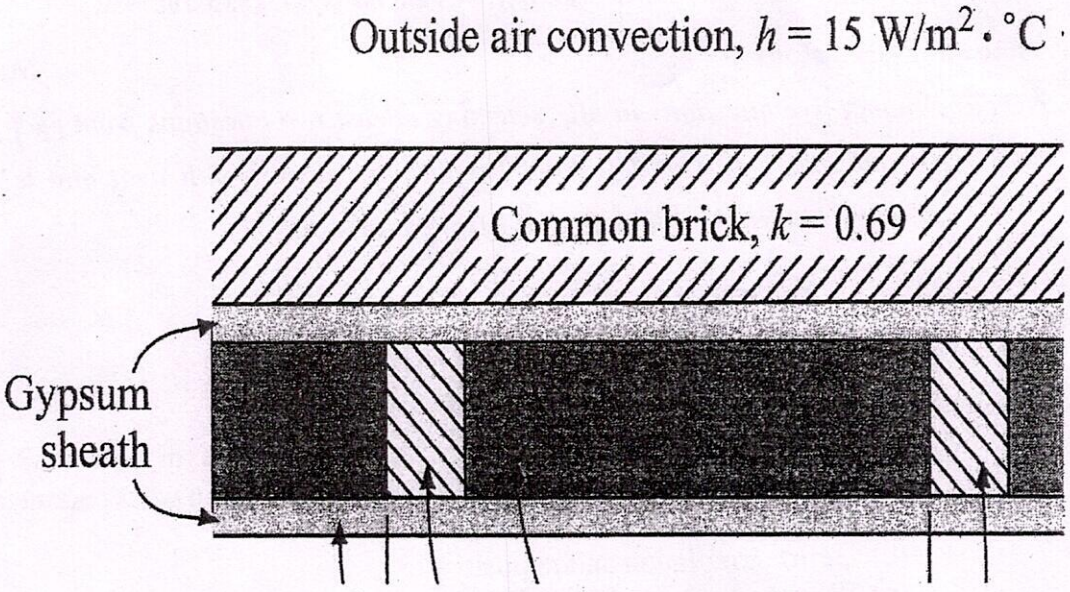
1 (a) Why is the insulated-tip solution important for the fin problems?
(b) What is meant by thermal contact resistance? Upon what parameters does this resistance depend?
(c) Define irradiation and radiosity.
(d) Why do surfaces absorb differently for solar or earthbound radiation?
(e) Can heat be transferred from low temperature to high temperature? Explain.

2 A tube assembly is constructed of copper with an inside diameter of 1.25 cm, wall thickness of 0.8 mm, and circumferential fins around the periphery. The fins have a thickness of 0.3 mm and length of 3 mm, and are spaced 6 mm apart. If the convection heat transfer coefficient from the tube and fins to the surrounding air is 50 $W/m^2°C$, calculate the thermal resistance for a 30-cm length of the tube fin combination. What is the fin efficiency for this arrangement? If the inside tube temperature is 100°C and the surrounding air temperature is 20°C, what is the heat loss per meter of tube length? What fraction of the loss is by the fins?

3 How do you calculate the cooling cost savings while designing an insulation? Explain the step-by-step procedure by giving an example.

4 "Two-by-four" wood studs have actual dimensions of 4.13×9.21 cm and a thermal conductivity of $0.1 W/m^2°C$. A typical wall for a house is constructed as shown in next Figure. Calculate the overall heat-transfer coefficient and *R* value of the wall.

Contd.....P/2



Part-B

5 Explain Reynold's analogy between skin friction and heat transfer.

6 A long pipe 5 cm in diameter passes through a room and is exposed to air at atmospheric pressure and temperature of 20°C. The pipe surface temperature is 93°C. Assuming that the emissivity of the pipe is 0.6, calculate the radiation heat loss per foot of length of pipe.

7 Discuss the concept of equimolar counter-diffusion in gases and its application.

8 Dry air at atmospheric pressure blows over an insulated flat plate covered with a thin wicking material that has been soaked in ethyl alcohol. The temperature of the plate is 25°C. Calculate the temperature of the air stream assuming that the concentration of alcohol is negligible in the free stream. Also calculate the mass-transfer rate of alcohol for a 30-cm-square plate if the free-stream velocity is 7 m/s.

x-x-x