Mid-Term Examination (7.6.2021)
Subject: Heat Transfer (CHE 204)
B.E. (FT and Chemical with MBA)- 4th Semester

Max. Marks: 25
Time allowed: 1 hr

Note: Attempt all questions. Assume missing data, if any.

1.a) Define overall heat-transfer coefficient.
 b) What is Dittus-Boelter equation? When does it apply?
 c) Define Grashof number. What is its physical significance?
 d) What is meant by a thermal boundary layer?
 e) Define Fin efficiency.

(5*2=10)

2.a) A glass window with an area of 0.557 m^2 is installed in the wooden outside wall of a room. The wall dimensions are 2.44 m X 3.05 m. The wood is 25.4 mm thick and the glass is 3.18 mm thick. The inside room temperature is 299.9K and the outside air temperature is 266.5 K. The convection coefficient, h_i on the inside wall of the glass and the wood is estimated as 8.5 W/m^2.K ; the outside coefficient, h_o is also estimated as 8.5 W/m^2.K for both surfaces. Calculate the heat loss through the wooden wall, through the glass window and the total.
Given, k_{wood} = 0.1505 W/m.K and k_{glass} = 0.692 W/m.K

(6)

3.a) Adding Insulation to large pipes decreases the heat transfer rate, why?
 b) A metal steam pipe having an outside diameter of 30 mm has a surface temperature of 400 K and is to be insulated with an insulation having a thickness of 20 mm and a k of 0.08 W/m.K. The pipe is exposed to air at 300 K and a convective coefficient of 30 W/ m^2.K. Calculate
 i)   Critical radius and the heat loss per m of length for the bare pipe,
 ii)   Heat loss for the insulated pipe assuming that the surface temperature of the pipe remains constant.

(3,6)