Technical environmental system – Weekly submission II
Nicholas Beloso – 10673057

1 write a summary about the convective heat transfer (half a page) and explain why increasing the thickness of a single pane glass does not increase the total resistance

2 write an explanation about what mistakes you made in the class that resulted in wrong answers.

3 solve the same problem as that of double pane window with with the air-gap thickness of 13 mm and glass thickness of 6 mm, comment on your results and explain why we have an optimal range for the air-gap's distance.

1) Conductive heat transfer:

There are different ways in which heat can be transferred: irradiation, conduction and convection. Convection is the form of heat transmission that occurs mainly in fluids (liquids and gases), but can be also occurs between solids and fluids. Unlike conduction where heat is transmitted from atom to atom, in convection the propagation of heat occurs through the movement of the fluid involving the transport of matter. An example of convection that occurs in our every day life is the air conditioner, a boiling pan of water or the heat transfer between a glass panel and air. Convection process can be divided into two main types: natural convection and forced convection. In few words we can say that the convection process happens when a fluid is heated and its molecules move faster, moving away from each other. As the volume occupied by the fluid increases, it becomes less dense. The tendency of this less dense mass within the fluid as a whole is to undergo an upward movement taking the place of the fluid masses which are at a lower temperature. The cooler fluid portion moves downwards to the place previously occupied by the previously heated fluid portion. This process repeats itself over and over as long as heating is maintained giving rise to so-called convection currents.

2) My mistakes:

I did two main mistakes. The first one is related with the units, meaning I forgot to change from mm to m. The second one is related with the formula. I made minor mistakes applying the formula, but I notice by myself and corrected it before finishing the exercise.

3) Double panel window:

Considering:

High(H): 0,8m

Wide(W):1,5m

k_{glass}: 0,78W/mC

h_1: 10W/m^{2}C

h_2: 40W/m^{2}C

k_{air}: 0,026 W/mC

- For thickness of 6mm:

  $$R_{total}= R_{conv1} + R_{conv2} + 2R_{glass} + R_{airgap}$$

  $$R_{airgap}= L_{air}/K_{air\ x}\ A$$

  $$R_{airgap}= 0,006/0,026x1,2= 0,19230$$

  $$R_{glass}=L_{glass}/k_{glass\ x}\ A$$

  $$R_{glass=}\ 0,004/0,78x1,2= 0,0043C/W$$

  $$R_{conv1=}\ 1/\ h_{1\ x}\ A$$

  $$R_{conv1\ =}\ 1/\ 10\ _x\ 12 = 0,0833\ C/W$$

  $$R_{conv2=}\ 1/\ h_{2\ x}\ A$$

  $$R_{conv2\ =}\ 1/\ 40\ _x\ 12 = 0,0208\ C/W$$

  $$R_{total} = 0,0833 + 0,0208 + 2x0,0043 + 0,19230$$

  $$\boxed{R_{total}= 0,305C/W}$$

- For thickness of 13mm:

  $$R_{total}= R_{conv1} + R_{conv2} + 2R_{glass} + R_{airgap}$$

  $$R_{airgap}= L_{air}/K_{air\ x}\ A$$

  $$R_{airgap}= 0,013/0,026x1,2= 0,4166$$

  $$R_{glass}=L_{glass}/k_{glass\ x}\ A$$

  $$R_{glass=}\ 0,004/0,78x1,2= 0,0043C/W$$

  $$R_{conv1=}\ 1/\ h_{1\ x}\ A$$

  $$R_{conv1\ =}\ 1/\ 10\ _x\ 12 = 0,0833\ C/W$$

  $$R_{conv2=}\ 1/\ h_{2\ x}\ A$$

  $$R_{conv2\ =}\ 1/\ 40\ _x\ 12 = 0,0208\ C/W$$

$R_{total} = 0,4166 + 0,0208 + 2 \times 0,0043 + 0,19230$

R_{total}= 0,637C/W