

# Week Assignment 6

## Question 1

Considering the same example you solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with epsilon = 0.1 should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

### Solution

Case 1 : Without shields

$$\epsilon_1 = 0.1, \epsilon_2 = 0.1$$

$$T_1 = 800\text{K}$$

$$T_2 = 500\text{K}$$

$$\sigma = 5.67 \times 10^{-8} \frac{W}{m^2 K^4}$$

Net heat transfer without shields

$$\frac{\dot{Q}_{\text{net}}}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = \frac{5.67 \times 10^{-8} (800^4 - 500^4)}{\frac{1}{0.1} + \frac{1}{0.1} - 1}$$

$$= 1035.82 \frac{W}{m^2}$$

Case 2 : With shields to reduce the heat transfer by 1%

$$\epsilon_1 = 0.1, \epsilon_2 = 0.1$$

$$T_1 = 800\text{K}$$

$$T_2 = 500\text{K}$$

$$\sigma = 5.67 \times 10^{-8} \frac{W}{m^2 K^4}$$

$$\epsilon_n = 0.1$$

Heat transfer with n shields

$$\text{in between} = 1\% \text{ of } \frac{\dot{Q}_{\text{net}}}{A}$$

$$\frac{\dot{Q}_n}{A} = \frac{1}{100} \left( \frac{\dot{Q}_{\text{net}}}{A} \right) 10.358 \frac{W}{m^2}$$

Heat transfer with n shields

$$\text{in between} \frac{\dot{Q}_n}{A} = \frac{\sigma(T_1^4 - T_2^4)}{\left( \frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1 \right) (N+1)}$$

$$\frac{\dot{Q}_n}{A} = \frac{1}{(N+1)} \left( \frac{\dot{Q}_{\text{net}}}{A} \right) \frac{1}{100} \left( \frac{\dot{Q}_{\text{net}}}{A} \right)$$

$$10.358 = \frac{1}{(N+1)} 1035.82$$

$$N = 99$$

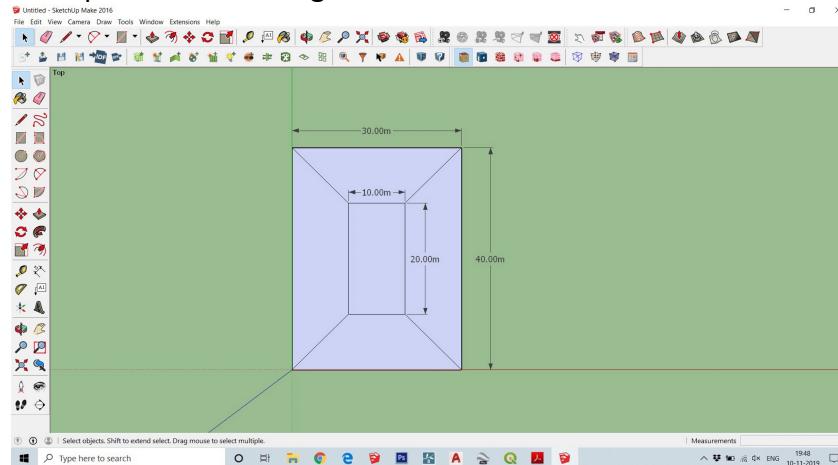
99 shields are required in between to reduce the heat transfer to 1 % in between the parallel sheets.

## Question 2

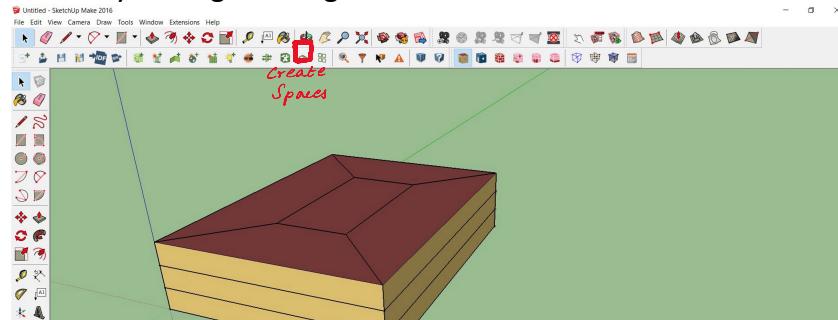
You should create a pdf file with screenshots of all of the steps we went through (clearly from your own file) and explain briefly the reason behind the use of each step (in your own words!)

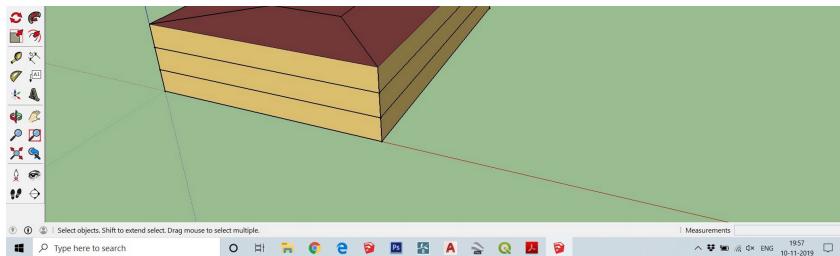
### Solution

Make a plan layout as shown in the image below considering it as and open office building.

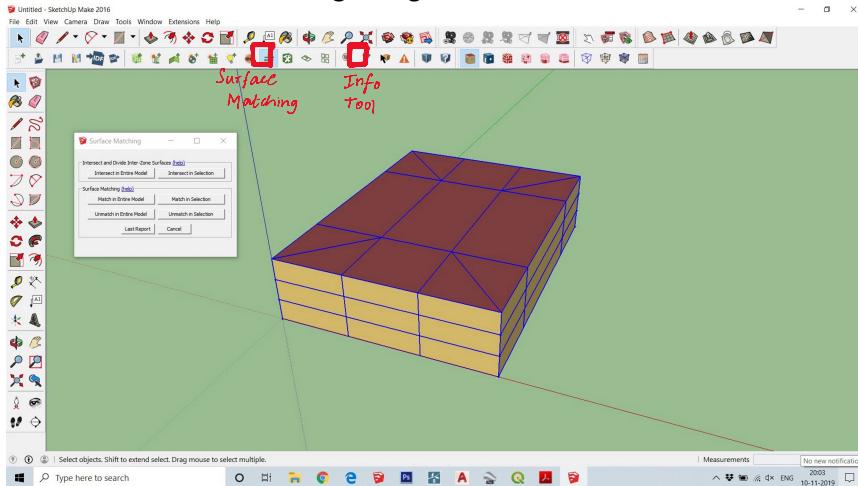


Click create spaces from the diagram as marked in the picture below by setting the height and number of stories.

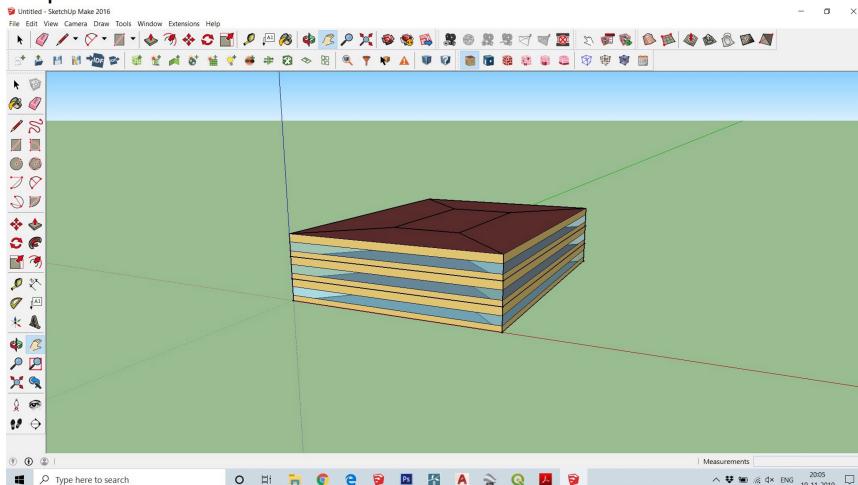




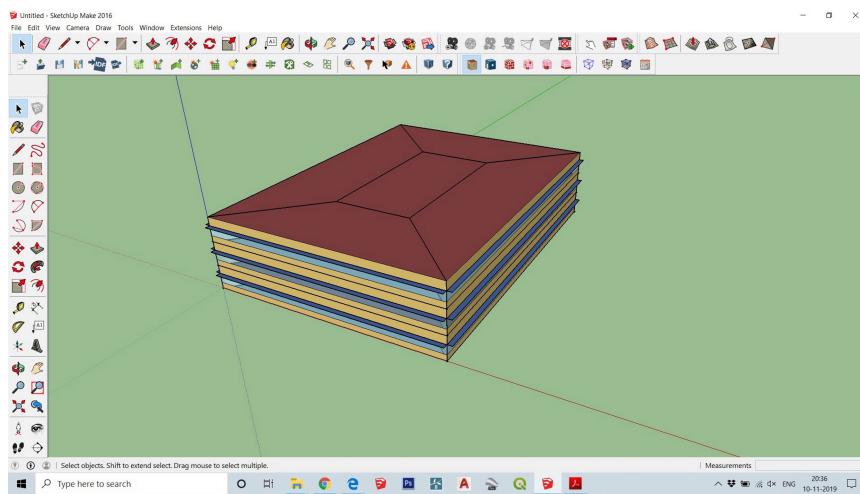
As shown below, do the surface matching and the info tool can be used to check the information regarding the surfaces.



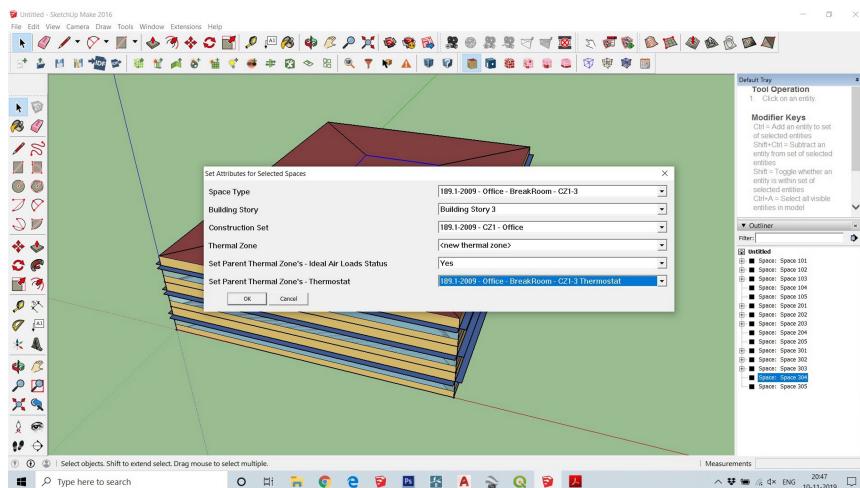
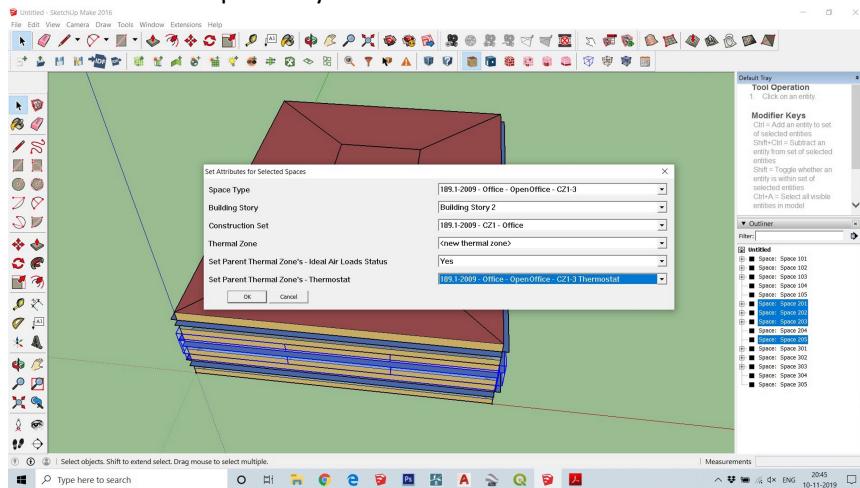
To get the window openings, use Extensions->Open Studio User scripts->Alter or add model elements->Set window to wall ratio.



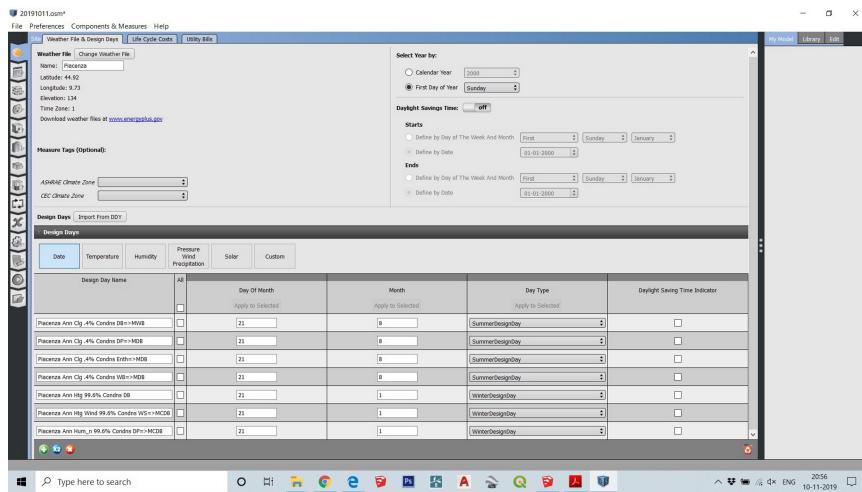
To give overhang to the windows, use Extensions->Open Studio User scripts->Alter or add model elements->Add overhang by projection factor.



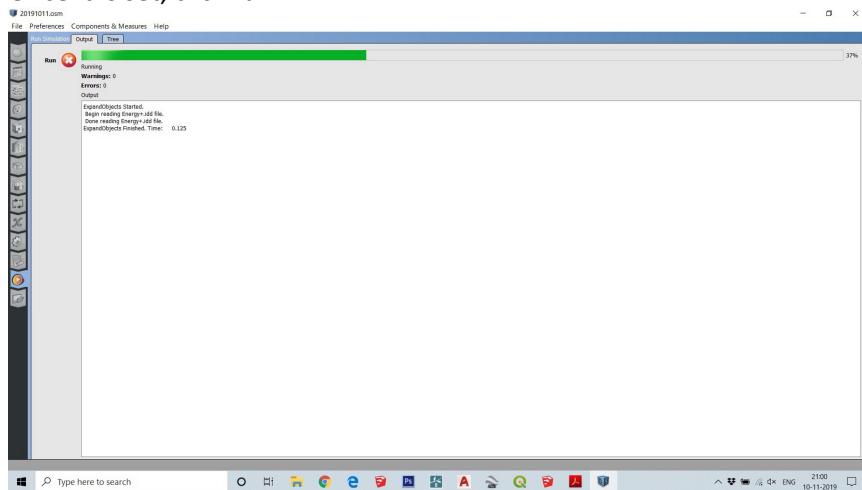
To set the thermal zone for the surfaces, select the respective surfaces as shown below and click set attributes for selected spaces. And set the space typology accordingly, the story, construction set, new thermal zones respectively.



Launch open studio, once the thermal zones are allotted. Load the related weather files and you can see it as below.



Once it is set, click run.



The final results will be displayed as below.

