WEEK 3 SUBMISSION

QUESTION 1:

In this week's assignment you should first finalize the composite wall question by finding the heat transfer rate, and then solve the same question while the thickness of the brick is increased to 32 cm and comment on the results

ANSWER 1:

k_{brick} = 0.72W/m℃

$k_{plaster}$ = 0.22W/m℃

k_{foam} = 0.026W/m℃

T_1 = 20℃

T_2 = 10℃

h_1 = 10W/㎡℃

h_2 = 25W/㎡℃

$R_{conv1} = 1/ h_1A = 1/10*(0.015+0.22+0.015)*1 = 0.4℃/W$

$R_{foam} = L_{foam}/ k_{foam}A = 0.03/0.026*(0.015+0.22+0.015)*1 \approx 4.6154℃/W$

$R_{plaster\ left} = R_{plaster\ right} = L_{plaster\ left}/k_{plaster}A_{plaster\ left} = 0.02/0.22*(0.015+0.22+0.015)*1 = 3.6364℃/W$

$R_{plaster\ up} = R_{plaster\ down} = L_{plaster\ up}/ k_{plaster}A_{plaster\ up} = 0.16/0.22*0.015*1 \approx 48.4849℃/W$

$R_{brick} = L_{brick}/ k_{brick}A_{brick} = 0.16/0.72*0.22*1 \approx 1.101℃/W$

$\because 1/R_{total\ parellel} = 1/R_{plaster\ up} + 1/R_{brick} + 1/R_{plaster\ down} = 1/48.4849 + 1/1.101 + 1/48.4849 \approx 0.9495℃/W$

$\therefore R_{total\ parallel} = 1/0.9495 \approx 1.0532℃/W$

$R_{conv2} = 1/ h_2A = 1/40*(0.015+0.22+0.015)*1 = 0.1℃/W$

$R_{total} = R_{conv1} + R_{foam} + R_{plaster\ left} + R_{total\ parallel} + R_{plaster\ right} + R_{conv2} = 0.4+4.6154+3.6364+1.0532+3.6364+0.1 = 13.4414℃/W$

$.Q = T_1 – T_2/ R_{total} = 20-10/13.4414 \approx 0.744W$

If we increase the thickness of the brick to 32cm, then following the same procedures we had above, the result will be:

R_{total} = 14.4946℃/W

$.Q = T_1 – T_2/ R_{total} = 20-10/14.4946 \approx 0.69W$

So, from the result we could see that by just increase the thickness of the brick will not significantly increase the thermal resistance of the wall.

QUESTION 2:

You should solve again the simplified wall calculation procedure replacing the glass fiber one with urethane rigid foam and while replacing the fiberboard with plywood and find

the two R_unit values

ANSWER 2:

We could found the R values by checking table:

Outside Air	0.03
Wood Bevel(13mm*200mm)	0.14
Glass fiber	0.7*90/25=2.52
Urethane Rigid Foam Ins.(90mm)	0.98*90/25=3.528
Mineral fiber batt(90mm)	0.66*90/25=2.376
Wood Stud(90mm)	0.63
Plywood(13mm)	0.11
Gypsum Board(13mm)	0.079
Inside Surface	0.12

When replacing the glass fiber with Urethane rigid foam,

R_{foam} = 0.03+0.14+3.528+2.376+0.63+0.079+0.12 = 6.903℃/W

When replacing the fiberboard with plywood,

$R_{plywood}$ = 0.03+0.14+2.52+2.376+0.63+0.11+0.12 = 5.926℃/W