Week4_suluderya

Task 1: you should complete the modified example of simplified wall calculations that you went through in the assignment of week 3 and find the total heat transfer through wall

Task 2: In 2 pages you should write a summary (in your own word!) of what you have learnt in this session about radiation and radiative heat transfer.

→ Determine the overall unit thermal resistance (the R-value) and the overall heat transfer coefficient (the U-factor) of a wood frame wall that is built around 38-mm 90-mm wood studs with a center-to-center distance of 400 mm. The 90-mm-wide cavity between the studs is filled with Urithane rigid insulation. The inside is finished with 13-mm gypsum wallboard and the outside with 13 mm plywood and 13-mm 200-mm wood bevel lapped siding. The insulated cavity constitutes 75 percent of the heat transmission area while the studs, plates, and sills constitute 21 percent. The headers constitute 4 percent of the area, and they can be treated as studs.

→ Also, determine the rate of heat loss through the walls of a house whose perimeter is 50 m and wall height is 2.5 m in Las Vegas, Nevada, whose winter design temperature is -2 C. Take the indoor design temperature to be 22 C and assume 20 percent of the wall area is occupied by glazing. Find the total heat transfer through wall.

	Wood Section	Insulation Section	
Outside Air	0.03	0.03	
Wood Bevel (13mm*200mm)	0.14	0.14	
Plywood (13mm)	0.11	0.11	
Urethane Rigid Foam Insulation (90mm)	X	(90*0.98) / 25 = 3.528	
Wood Studs (90mm)	0.63	X	
Gypsum Board (13mm) Inside surface	0.079	0.079	
Inside surface	0.12	0.12	

$R_{\text{with wood}}$ = $(0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12)m^2$

= $1.109 m^2 °C/w$

R_{within} = $(0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12)$

= $4.007 m^2 °C/w$

$U_{wood} = 1/R'_{withwood}$

$= 0{,}9017\ W/m^2 * °C$

$U_{ins} = 1/R'_{withins}$

$= 0{,}2496\ W/m^2 * °C$

$1/R_{total} = 1/R_{wood} + 1/R_{ins}$

$A_{total}/R'_{total} = A_{wood}/R'_{wood} + A_{ins}/R'_{ins}$

$U_{total} = U_{wood} * A_{wood}/A_{total} + U_{insulation} * A_{insulation}/A_{total}$

$= 0.25 * U_{wood} + 0.75 * U_{ins}$

$= 0{,}4126\ W/m^2 * °C$

$R_{value} = 1/U_{tot} = 1/0{,}4126$

$= 2.4237\ m^2 * °C/W$

$Q_{tot} = A_{tot} * U_{tot} * \Delta T$

$= 0{,}4126 * 50 * 2{,}5 * 0{,}8 * 2(2-(-2))$

$= 990{,}2\ W$

TO SUM UP ..

Heat transfer can be categorized into 3 categories: conduction , convection and radiation. If we mention about radiation; it means that the spread of energy from matter as electromagnetic waves as a result of changes in atomic and molecular components.

Radiation occurs through a vacuum or any transparent medium. Radiation is a volumetric happening; All solids, liquids and gases, radiation they emit, absorb, and transmit at varying levels. Radiation for such solids is often considered a surface occurance.

Radiation is not heat and when absorbed into heat it is no longer radiation. The reflected or passing ray is often converted to heat by being held by other absorber units.

Radiative heat transfer is a non-contact heat transfer method between the heat source and the heated object. So no-need mediative tool/ambient to create radiative heat transfer by means of electromagnetic waves.

All materials emit thermal energy according to their temperature. The warmer the material, the more thermal energy it emits. The sun is an elementary example for explanation of heat radiation that dissipates heat through the solar system. Also other examples; communication satellites that receive energy from the sun, and microwave heaters and infrared heaters emit heat.

Radiative wavelengths The known electromagnetic radiation covers a wide range of wavelengths. Radiation at a single wavelength is called "monochromatic". A true radiation bunch contains many monochromatic rays. Any of the wavelengths from zero to infinite can be converted to heat when absorbed by the substance; however, the electromagnetic spectrum that is important in heat flow covers wavelengths in the range of 0.5-50 microns. Visible light is in the range of 0.38 - 0.78 microns!

Thermal radiation at temperatures often applied in the industry is at the wavelengths of the infrared spectrum; they are longer than the longest waves of visible light.

Black Body The highest absorbency value is 1. this value is achieved when an object absorbs all of the incoming radiation (without reflect and transmission). Such an object is called as "black body". A black body has the highest radiation power that can be reached at any temperature according to the Kirchoff laws.