WEEK ASSIGNMENT - 4

RANJANA SIVA

Question 1

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.

ANSWER

Dimensions: 38mm, 90 mm
Center to center distance = 400mm
Insulation:
Thickness: 90mm
Filled with urethane rigid foam insulation
Inside finish:
13mm thick gypsum
Outside finish:
13mm plywood
13mm 200mm wood bevel lapped siding
T_{out} = -2°c

T_{in} = 22°c

20% wall area is glazing
Insulated cavity constitutes 75% of the heat transmission area
Studs, plates and sills constitute 21%

R_{unit} values

	Wood	Insulation
Outside air	0.03	0.03
Wood bevel (13mm * 200mm)	0.14	0.14
Polywood (13mm)	0.11	0.11
Urethane rigid foam (90mm)	No	$0.98*9025=3.528$
Wood studs (90mm)	0.63	No
Gypsum board (13mm)	0.079	0.079
Inside surface	0.12	0.12

$R_{with\ wood}$

$=0.03+0.14+0.11+0.63+0.079+0.12=1.109\ m^2°cw$

$R_{with\ insulation}$

=0.03+0.14+0.11+3.528+0.079+0.12=4.007 m^2°cw

U_{wood} =
$\frac{1}{R'wood}$
= 11.109=0.902 wm2°c
z

$U_{insulation}$ =
$\frac{1}{R'insulation}$
= 14.007=0.249 wm2°c

$U_{total} = U_{wood} * \frac{Awood}{Atotal} + U_{insulation} * \frac{Ainsulation}{Atotal}$

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

= 0.25 * 0.902 + 0.75 *0.249

= 0.2255 + 0.1867 = 0.4122 wm2°c

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

= 0.4122 * 100 * 24 = 989.28 W

Question 2

Write a summary of what you have learnt in this session about radiation and radiative heat transfer.

ANSWER:

Radiation heat transfer does not require a medium for heat transfer, unlike conduction and convection. There is no heat loss due to in vacuum medium. Radiation is an instant process unlike the other two heat transfers. Radiation occurs in solids liquids and gases. Under the e;ectromagnetic spectrum, there are different types of radiation including Thermal Radiation, Light, Blackbody Radiation, etc. The light is the visible spectrum of the electromagnetic radiation. The electromagnetic radiation is a wave movement and transports energy just like other waves characterized by wavelength and frequency.

$\lambda = \frac{c}{\nu}$ Where c is the speed of propagation of wave in the medium given,

The electromagnetic radiation is a transfer of a packet of energy called photons or quanta. The Energy of the photon in inversely proportional to its wavelength.

$$e = h\nu = \frac{hc}{\lambda}$$

Blackbody is a perfect example of a perfect emitter and absorber. All quantities of emitting and absorption is compared to the blackbody as a reference.

The radiation energy emitted by a blackbody:

$$E_b(T) = \sigma T^4 \qquad (\mathrm{W/m^2})$$

Blackbody emissive power

$$\sigma = 5.670 \times 10^{-8}\ \mathrm{W/m^2 \cdot K^4}$$

Stefan–Boltzmann constant