WEEK 4 ASSIGNMENT

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QUESTION 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.

ANS.

According to the table we know

Outside air	=0.03
Wood Bevel (13mmx200mm)	=0.14
Plywood (13mm)	= 0.11
Urethane Rigid Foam Ins.	= 3.528 [0.98x90/25]
Wood Stud (90mm)	= 0.63
Gypsum Board (13mm)	= 0.079
Inside Surface	= 0.12

R_{wood} = 0.03+0.14+0.11+0.63+0.079+0.12 = **1.109 m^2°C/W**
$R_{insulation}$ = 0.03+0.14+0.11+3.528+0.079+0.12 = **4.007 m^2°C/W**

$U_{wood} = 1/R_{wood} = 1/1.109$ = **0.902 W/m^2°C**
$U_{insulation} = 1/R_{insulation} = 1/4.007$ = **0.25 W/m^2°C**

$U_{total} = (U \times f_{area})_{wood} + (U \times f_{area})_{insulation}$ = 0.902 x 0.25 + 0.25 x 0.75 = **0.413 W/m^2°C**

ΔT = 22-(-2) = 24°C

$Q = U_{total} A_s \Delta T$ = 0.413 x 125 x 0.8 x 24 = **991.2 W**

QUESTION 2

In your own words, write a summary about radiation and radiative heat transfer.

ANS.

Thermal radiation is a process by which energy, in the form of electromagnetic radiation, is emitted by a heated surface in all direction and travels directly to its point of absorption at the speed of light. Thermal radiation does not require an intervening medium to carry it. Thermal radiation ranges in wavelength from the longest infrared rays through the visible light spectrum to the shortest ultraviolet rays. The intensity and distribution of the radiant energy from within this range is governed by the temperature of the mitting surface.

The rate at which a body radiates (or absorbs) thermal radiation depends upon the nature of the surface as well. A blackbody is one that absorbs all the radiant energy that falls on it. Such perfect absorber would be a perfect emitter. The heating of the earth by the sun is an example of transfer of energy by radiation.

All bodies radiate energy in the form of photons moving in a random direction, with random phase and frequency. When radiated photons reach another surface, they may either be absorbed, reflected or transmitted.

Thermal radiation is an electromagnetic wave that is characterized by its frequency *v* and the wavelength λ. Wavelength and frequency are inversely proportional.

$c = \lambda\nu$ (where, $c = 3.00 \times 10^8$ i.e. the speed of light)

Hence, shorter the wavelength, the higher the frequency and vice versa. All electromagnetic waves, including the thermal radiation travel at the speed of light, regardless of wavelength or frequency.