Technical Environmental Solutions/ Submission no.4/ Leyana Altemawy

Task no.1

Find the total heat transfer through wall, in the previous example of simplified wall calculations of the assignment of week 3.

	Plywood	Urethane
Outside air	0.03	0.03
Wood bevel	0.14	0.14
Plywood (13 mm)	0.11	0.11
Urethane (90 mm)	-	(0.98 x 90 / 25) = 3.528
Wood studs	0.63	-
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

The overall unit thermal resistance:
R with plywood = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109 C/W
R with Urethane = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.007 C/W

The overall heat transfer coefficient:
UPlywood = 1/Rplywood = 1/1.109 = 0.9017 m^2C/W
Uurethane = 1/Rurethane = 1/4.007 = 0.2496 m^2C/W

Utot= Uplywood × Aplywood / Atot + Uurethane× Aurethane /Atot
Utot= 0.9017 x 0.25 + 0.2496 x 0.75 = 0.4126 W/m^2C

The rate of heat loss through the wall:

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

$Q_{tot} =$ 0.4126 x 100 x 24 = 990.24 W

Task no.2
A summary about radiation and radiative heat transfer

Radiation is a method of heat transfer that does not rely upon any contact between the heat source and the heat source and the heated object. Heat can be transmitted through empty space by thermal radiation. Thermal radiation (often called infra-red radiation) is a type electromagnetic radiation or light.
Radiation is a form of energy transport consisting of electromagnetic waves traveling at the speed of light, no medium is required.

According to Maxwell theory, energy transfer takes place via electromagnetic waves in radiation. Electromagnetic waves transport energy like other waves and travel at the speed of light. Electromagnetic waves are characterized by their frequency ν (Hz) and wavelength λ (µm), where: $\lambda = c / \nu$

where c is the speed of light in that medium; in a vacuum c0 = 2.99 x 108 m / s

Radiation heat transfer is very important in buildings, application on that:

- heat exchange between the lighting fixture and interior surfaces.
- solar heat absorption on exterior surfaces
- solar heat absorption and reflection by interior building surface
- heat emission by the exterior surfaces to the sky
- heat exchange among interior surfaces
- heat exchange between interior surfaces and occupants

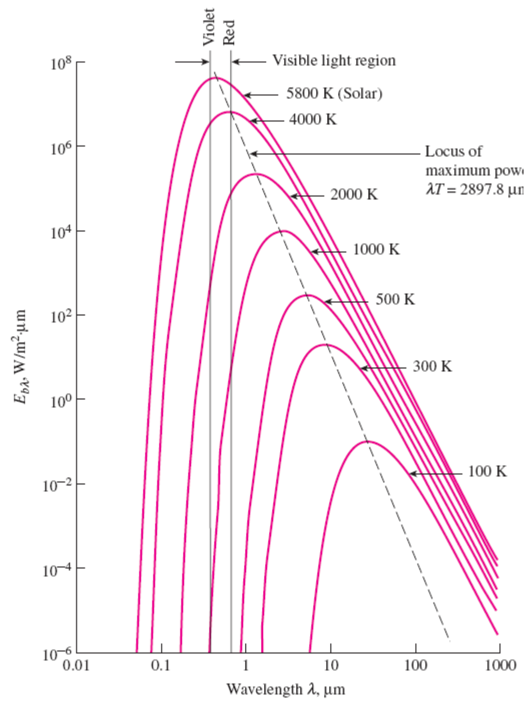
Light is simply the visible portion of the electromagnetic spectrum, lies between 0.40 and 0.76 µm. A light source is when a body, emits some radiation in the visible range.

A blackbody is defined as a perfect emitter and absorber of radiation. At a specified temperature and wavelength, no surface can emit more energy than a blackbody. A blackbody is a diffuse emitter which means it emits radiation uniformly in all direction. Also a blackbody absorbs all incident radiation regardless of wavelength and direction.

The radiation energy emitted by a blackbody per unit time and per unit surface area can be determined from the Stefan-Boltzmann Law: $\sigma = 5.67 \times 10^{-8}$ $w/m^2.k^4$

Spectral blackbody emissive power is the amount of radiation energy emitted by a blackbody at an absolute temperature T per unit time, per unit surface area, and per unit wavelength:
$Eby(\lambda, T) = C1/\lambda^5 [\exp(C_2/\lambda T) - 1]$ (W/M2.µm)

The bellow graph, shows the variation of the blackbody emissive power with wavelength for several temperatures.


Violet
Red
Visible light region
5800 K (Solar)
4000 K
Locus of
maximum pow
λT = 2897.8 μm
2000 K
1000 K
500 K
300 K
100 K
10^8
10^6
10^4
10^2
10^0
10^{-2}
10^{-4}
10^{-6}
$E_{b\lambda}$, W/m²·μm
0.01
0.1
1
10
100
1000
Wavelength λ, μm