

## TES WEEK 4 ASSIGNMENT

**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

	Wood	Insulation
Outside air	0,03	0,03
Wood bevel 13mm-20mm	0,14	0,14
Plywood 13 mm	0,11	0,11
Urethane rigid foam insulation 90 mm		3,52
Wood studs 90mm	0,63	
Gypsum 13 mm	0,07	0,07
Inside surface	0,12	0,12

$$R_{\text{wood}} = 0,03 + 0,14 + 0,11 + 0,63 + 0,07 + 0,12 = 1,10 \text{ m}^2\text{°C/W}$$

$$R_{\text{ins}} = 0,03 + 0,14 + 0,11 + 3,52 + 0,07 + 0,12 = 3,99 \text{ m}^2\text{°C/W}$$

$$U_{\text{wood}} = 1/R_{\text{wood}} = 1/1,10 = 0,90 \text{ m}^2\text{°C/W}$$

$$U_{\text{ins}} = 1/R_{\text{ins}} = 1/3,99 = 0,25 \text{ m}^2\text{°C/W}$$

$$U_{\text{total}} = 25\% U_{\text{wood}} + 75\% U_{\text{ins}} = 0,9 \times 0,25 + 0,25 \times 0,75$$

$$= 0,225 + 0,1875 = 0,4125 \text{ W/m}^2\text{°C} \quad Q = U_{\text{total}} \times A_s \times \Delta T = 0,4125 \times$$

$$125 \times 0,8 \times 24 = 990,24 \text{ W}$$

**TASK 2:** SUMMARY ABOUT RADIATION AND RADIATIVE HEAT TRANSFER

The thermal radiation is the emission of electromagnetic waves or electromagnetic radiation and they are generated by every type of objects

that have a temperature higher than 0°C or – 273,15 °C. So the thermal radiation is related on the temperature and so the heat of the object and everything around us constantly emits thermal radiation. Radiation transfer occurs in solids, in liquids and gases and differs from conduction and convection because it doesn't require the presence of a material to take place. In fact to have a heat transfer in the case of the conduction and convection there will be the presence of two objects, instead in the radiation it's not necessary to have two object to have the phenomenon but the radiation transfer works when there is a hot object, so thermal radiation can occur in vacuum.

The type of electromagnetic radiation that is pertinent to heat transfer is the thermal radiation emitted as a result of energy transitions of molecules, atoms, and electrons of a substance. Temperature is a measure of the strength of these activities at the microscopic level, and the rate of thermal radiation emission increases with increasing temperature.

Thermal radiation is an electromagnetic wave that are rapidly moving fields of accelerated charges or charging electric currents give rise to electric and magnetic field. These waves transport energy and they are characterized by their wavelength (  $\lambda$  ) and frequency (  $f$  ). These two properties are related by a law:  $c = \lambda f$

C is the speed of propagation of a wave in that medium. The speed of light in a vacuum is equal to  $2,9979 \cdot 10^8$  m/s. The frequency and the wavelength are inverse proportional so if lower is the value of frequency, higher is the value of wavelength and vice versa.

An easy example of an object that emits a lot quantity of radiation is the sun that its temperature is very high and its radiation reaches the earth and heat it. But also a light bulb that has a very less temperature than the sun emits radiation and we can see this radiation by light. By this example we can see that higher is temperature, higher is the emission of radiation

There are different types of radiation like ultraviolet, microwaves, X rays, Cosmic rays, ... in base of their wavelength and the wavelength is measured in m. By the use of the electromagnetic wave spectrum we can understand which types of radiation are. The radiation usually isn't visible, only the Light is the visible portion of the electromagnetic spectrum that lies between 0,40 m and 0,76 m.

The ultraviolet radiation has a wavelength between 0,01 m and 0,40 m and they are very dangerous because they can kill microorganism and cause serious damage to humans and other living beings. These rays are absorbed by the atmosphere and the ozone layer acts as a protective layer. The infrared is the type of radiation that causes heat and almost of the bodies at room temperature emit infrared. Their wavelength extends from 0,76 m and 100 m.

Different bodies emit different amount of radiation per unit surface area and the ideal type of body that emits the maximum amount of radiation by surface at a given temperature is called black body. Also a black body is able to absorb all incident radiation, regardless of wavelength and direction so it's the perfect emitter and absorber of radiation. The propagation of the radiation is also uniform. It differs from the typical behavior of an object because in a real object the propagation isn't uniform, and it's not able to absorb all the incident radiation and it's not able to emit the maximum amount of radiation. The black body is used to serve as standard against which the radiative properties of real surfaces may be compared.

The radiation energy emitted by a blackbody is calculated by:

$$E(T) = \sigma T^4 \text{ (W/m}^2\text{)}$$

is the Stefan-Boltzmann constant, while T is temperature in K. We can see how the amount of energy is related mostly to the temperature that the body has. In the equation the temperature has the power so it's weight is very important to the calculation of the energy.

