**WEEK 4**

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QUESTIONS:

1 . Complete the modified example of simplified wall calculations from the assignment of week 3 and find the total heat transfer through wall.

2. In 2 pages write a summary of what you have learnt about radiation and radiative heat transfer.

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|  |  |  |
| --- | --- | --- |
|  | **Wood** | **Insulation** |
| **Outside air** | 0.03 | 0.03 |
| **Wood bevel** | 0.14 | 0.14 |
| **Urethane rigid foam** | / | (0.98/25)x90 = 3.53 |
| **Plywood** | 0.11 | 0.11 |
| **Gypsum board** | 0.079 | 0.079 |
| **Inside surface** | 0.12 | 0.12 |
| **Wood studs** | 0.63 | / |

*R’wood =0.03+0.14+0.11 + 0.079 + 0.12 + 0.63 =1.11*

*R’insulation = 0.03+0.14+3.53+0.11+0.079+0.12=4.01*

*Ains*

*Utot = Uins ×*

A

*tot*

*+ Uwood ∗*

*Awood Atot*

*Utot = Uins × 0.75 + Uwood 0.25*

*1 1 W*

*Uins = R′*

*ins*

*= 4.01 = 0.2494 m2℃*

*1 1 W*

*Uwood = R′*

*wood*

*= 1.11 = 0.9009 m2℃*

𝑊

*𝑈𝑡𝑜𝑡 = 0.2494 × 0.75 + 0.9009 × 0.25 = 0.18705 + 0.225225 = 0.412275 𝑚2℃*

*𝐴𝑡𝑜𝑡 = 50 × 2.5 × 0.8 = 100𝑚2*

*∆𝑇 = 22 − (−2) = 24℃*

*𝑄𝑡𝑜𝑡 = 𝑈𝑡𝑜𝑡 × 𝐴𝑡𝑜𝑡 × ∆𝑇 = 989.46 𝑊*

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RADIATION HEAT TRANSFER

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Heat transfer through radiation takes place in form of electromagnetic waves mainly in the infrared region. Radiation emitted by a body is a consequence of thermal agitation of its composing molecules. Radiation heat transfer can be described by reference to the **'black body'**.

A black body is a hypothetical body that completely absorbs all wavelengths of thermal radiation incident on it. Such bodies do not reflect light, and therefore appear black if their temperatures are low enough so as not to be self-luminous. All black bodies heated to a given temperature emit thermal radiation.

The radiation energy per unit time from a black body is proportional to the fourth power

of the absolute temperature and can be expressed with Stefan-Boltzmann Law as

q = σ T4 A (1)

where

q = heat transfer per unit time (W)

σ = 5.6703 10-8 (W/m2K4) - The Stefan-Boltzmann Constant

T = absolute temperature in kelvins (K)

A = area of the emitting body (m2)