Submission 4 - Technical Environmental Systems

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**

$$R'_{with\ wood} = 1.109\ m^2 \circ \frac{C}{W}$$
$$R'_{with\ insulation} = 4.007\ m^2 \circ \frac{C}{W}$$

$$U_{total} = U_{wood} * \left(\frac{A_{wood}}{A_{total}}\right) + U_{insulation} * \left(\frac{A_{insulation}}{A_{total}}\right)$$
$$= \frac{1}{R'_{wood}} * 0.25 + \frac{1}{R'_{insulation}} * 0.75$$
$$= 0.2254 + 0.1871$$
$$= 0.4125\ W/(m^2 °C)$$

Therefore, Total heat transfer through the wall, $\dot{Q} = A(T_{i\square} - T_{o\square})/R'_{total}$
$= U_{total} * A * (T_i - T_o)$
$= 0.4125 * (50 * 2.5 * 0.8) * 2(2 - (-2))$
$= 990\ W$

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

Radiation refers to the transfer of energy in the form of electromagnetic waves (moving electromagnetic fields produced by accelerated electric charges). These waves are characterized by their wavelength/frequency. Energy of a photon, e $\infty \frac{1}{wavelength}$
The difference in radiation as compared to conduction & convection is that it does not require a material medium for heat transfer, that is, it can take place in vacuum as well.

Radiative Heat Transfer:
Thermal radiation refers to the electromagnetic radiation emitted by a body as a result of its temperature. The rate of emission of thermal radiation increases with increase in temperature. Thermal radiation is emitted by all matter whose temperature is above absolute zero. It ranges from Infrared rays, Visible rays to the higher wavelengths of Ultraviolet radiations. Objects which emit radiation in the visible range form light sources.

Black Body Radiation refers to the radiation emitted by an ideal body, which is maximum at a given temperature. Black bodies are perfect emitters and absorbers of heat. This emitted energy strongly depends on the temperature of the black body. Energy emitted, $E_B \infty T^4$