Fifth Week

Task 1

Emissivity (ε):

Emissivity is ratio of the thermal radiation of a surface to the radiation of a blackbody at the same temperature. The amount of temperature is between 0 and 1. The emissivity of a surface is based on temperature of surface, wavelength, as well as direction of emitted radiation.

Absorptivity (α):

Absorptivity is measure of material's ability to absorb radiation. Actually, it is the ratio of absorbed radiation to incident radian that hitting surface which is between 0 and 1.

Reflectivity (ρ):

Reflectance is ratio of the surface radiation reflect to the incident radiation In order to calculate the value of absorptivity which is between 0 and 1. The reflectivity of different objects is also different, which mainly depends on the nature of the object itself (surface condition), as well as the wavelength of incident electromagnetic wave and incident Angle.

View factor (F):

View factor is the fraction of radiation leaving the first surface and hit the second surface. The amount of this do not related to surface property. It is more angel factor which means the factor base on angel of leaving first surface and angel of hitting second surface.

Heat exchange between two black surfaces:

The heat exchange between two black surfaces refers to the process in which one black surface emits radiation to another black surface and is completely absorbed, while the other black surface also emits radiation and is also completely absorbed by the first black surface. Furthermore, for each temperature, for each wavelength and for each direction, the black body absorbs all the radiant energy hitting it and emits the maximum amount of energy.

Heat exchange between the two gray surfaces:

Grey bodies absorb a certain amount of radiation while reflecting a portion of the radiation off of the surface back into space. This makes the calculation of black bodies simpler.
Radiation resistance is the force of which prevents the passage of radiation waves.

Radiation resistance:

The radiation resistance is the value to measure the energy defeated by loss resistance which is converted to heat radiation and the energy lost by radiation resistance is converted to electromagnetic waves.

Task 2

ϵ1=ϵ2=0.1;

K, T2=308 k

σ=5.67 × 10 − 8 $w/(m\text{^}2.k\text{^}4\ )$

$\dot{Q}_{1\to2}$ = $\frac{A_1\sigma(T_1^4-T_2^4)}{\frac{1}{\epsilon_1}+\frac{1}{\epsilon_2}-1}$ = $\frac{1.5\times5.67\times10^{-8}\times(308^4-298^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1}$ = 4.98 w

$F_{12}=\ \frac{1}{\frac{1}{\epsilon_1}+\frac{1}{\epsilon_2}-1}$ = $\frac{1}{\frac{1}{0.1}+\frac{1}{0.1}-1}$ = 0.0526

Example:

$F_{12}=0.01$

$\dot{Q}_{1\to2}=\ A_1\ \times\ F_{12}\ \times\ \sigma\ (T_1^4-T_2^4)$ = $1.5\times0.01\ \times5.67\ \times10-8\ \times(2984-3084)=$ $-0.9466\,w$

$\dot{Q}_{2\to1}=\ -\dot{Q}_{1\to2}=0.09466\,w$