Week 9_Prize Kabahinda

Task 1

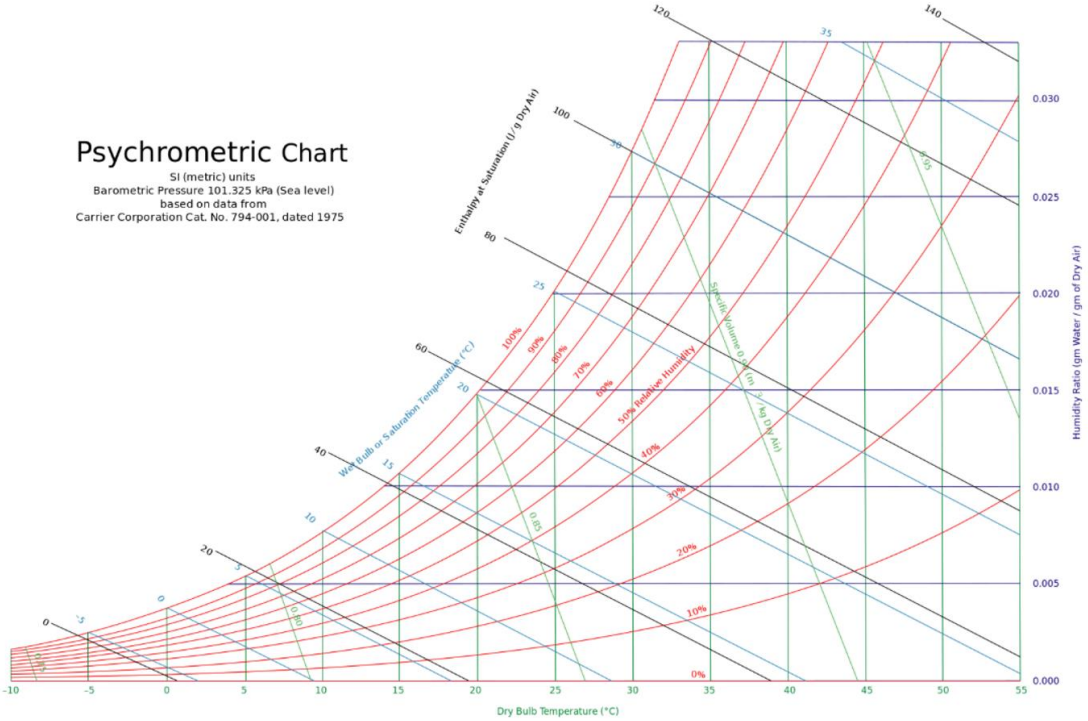
Relative humidity = 86%

Atmospheric pressure= 1028hPa

Total air pressure = 102.8kPa

Temperature effettiva; 4^0C

T = 277.15K



Absolute humidity (ω) = 0.0045

Wet bulb temperature = 3^0C

$\omega = 0.622\ P_v/(P - P_v)$ (kg of water vapor/ kg of dry air)

$0.0045 = 0.622\ P_v/(102.8 - P_v)$

$0.0045\ (102.8 - P_v) = 0.622\ P_v$

$P_v = 0.738 kP_a$

We assume our classroom to be 16m by 8m by 4m

For air; $m_a = P_aV_a / R_aT * (R_{sp} * T)$

$m_v = 0.738 * (16*8*4) / 0.4615 * (277.15 + 4)$

=2.912kg

m_g =mass of water at sat condition

$\phi = \frac{m_v}{m_g}$ = 2.912 / 86% = 5.02kg

Task 2

Height of building - 2.5m^2

Floor area – 200m^2

Wall area - 144 m^2

Internal Gains

$Q_{ig.\ sensible} = 136 + 2.2\ A_{cf} + 22N_{oc}$

$= 136 + 2.2 * 200 + 22* 2 = 620W$

$Q_{ig.\ latent} = 20 + 0.22\ A_{cf} + 12N_{oc}$

$= 20 + 0.22 * 200 + 12* 2 = 88W$

Infiltration

From the table Good quality - A_{ul} =1.4 cm^2/m^2

$A_L = A_{es} * A_{ul}$

$= (200 +144) * 1.4$

$= 481.6\ cm^3$

$Q_L = A_L$ *IDF

From the tables; IDF heating = 0.073L/5cm2

IDF cooling = 0.03L/5cm2

V infiltration $_{heating}(Q_L) = A_L * IDF = 481.6 * 0.073 = 35.16L/s$

V infiltration $_{cooling}(Q_L) = A_L * IDF = 481.6 * 0.033 = 15.89L/s$

Ventilation

$Q_v (V_{ventilation}) = 0.05*A_{cf} + 3.5(N_{br} + 1)$

$= 0.05 * 200 + 3.5*2 = 17L/s$

Q_v (Vinf-ventilation $_{heating}$) = 35.16 + 17= 52.16L/s

Q_v (Vinf-ventilation $_{cooling}$) = 15.89 + 17= 32.89L/s

The required minimum whole building ventilation rate in Brindisi

$\Delta T_{cooling} = 31.1\ °C - 24\ °C = 7.1°C$

$= 7.1\ K$

$\Delta T_{heating} = 21\ °C - (-4.1\ °C) = 25.1°C$

$= 25.1\ K$

$DR = 7.1\ °C = 7.1\ K$

$C_{sensible} = 1.23\ ,\ C_{latent} = 3010$

$\Delta\omega Cooling = 0.0039$

$$\dot{Q}_{inf-ventilation_{cooling_{sensible}}} = C_{sensible} * \dot{V}\Delta T_{Cooling} = 1.23 * 32.89 * 7.1 = 287.25\ W$$

$$\dot{Q}_{\text{inf}-\text{ventilation}_{\text{cooling}_{\text{latent}}}} = C_{\text{latent}} * \dot{V}\Delta\omega_{\text{Cooling}} = 3010 * 32.89 * 0.0039 = 386.13\ \text{W}$$

$$\dot{Q}_{inf-ventilation_{\text{heatingg}_{sensible}}} = C_{sensible}\dot{V}\Delta T_{\text{heating}} = 1.23 * 52.16 * 25.1 = 1610.34\ W$$