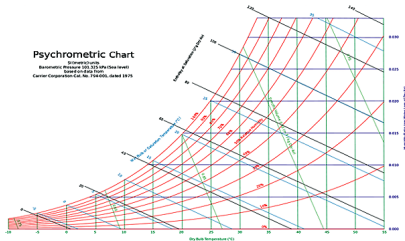Week 9
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Task 1

Psychrometric Chart

Relative humidity = 86%
Atmospheric pressure= 1028hPa
Total air pressure = 102.8kPa
Temperature effettiva= 4 C
T = 277.15K
Absolute humidity (ω) = 0.0045
Wet bulb temperature = 30C
$\omega = 0.622 P_v /(P - P_v)$ (kg of water vapor/ kg of dry air)
$0.0045 = 0.622 P_v /(102.8 - Pv)$
$0.0045 (102.8 - P_v) = 0.622 P_v$
$P_v = 0.738kPa$
For air; $m_a = P_a V_a / R_a T *(Rsp* T)$
$m_v = 0.738 * (16*8*4) / 0.4615 * (277.15 + 4) = 2.912kg$
m_g =mass of water at sat condition = 2.912 / 86% = 5.02kg

Task 2

Height of building - 2.5m2
Floor area – 200m2
Wall area - 144 m2

Internal Gains

$Q_{ig.\ sensible}$ = 136 + 2.2 Acf + 22 Noc

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

$Q_{ig.\ latent}$ = 20 + 0.22 Acf + 12 Noc

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

Infiltration

From the table Good quality - Aul =1.4 cm^2 / m^2
A_L = Aes * A ul = (200 +144) * 1.4 = 481.6 cm3
Q_L = AL *IDF
From the tables; IDF $_{heating}$ = 0.073L/5cm^2
IDF $_{cooling}$ = 0.03L/5cm^2
$V_{infiltration\ heating(QL)}$ = AL * IDF = 481.6 * 0.073 = 35.16L/s
$V_{infiltration\ cooling\ (QL)}$ = AL * IDF = 481.6 * 0.033 = 15.89L/s

Ventilation

Q_v ($V_{ventilation}$) = 0.05*Acf + 3.5(Nbr + 1)
= 0.05 * 200 + 3.5*2 = 17L/s
Q_v ($V_{inf-ventilation\ heating}$) = 35.16 + 17= 52.16L/s
Q_v ($V_{inf-ventilation\ cooling}$) = 15.89 + 17= 32.89L/s

Minimum ventilation:

$\Delta T_{cooling}$ = 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

$Q_{inf-ventilationcoolingsensible}$ = $C_{sensible}$ * V$\Delta T_{Cooling}$ = 1.23 * 32.89 * 7.1
= 287.25 W

$Q_{inf-ventilationcoolinglatent}$ = C_{latent} V$\Delta\omega_{Cooling}$ = 3010 * 32.89 * 0.0039
= 386.13 W

$Q_{inf-ventilationcoolingsensible}$ = $C_{sensible}$ * V$\Delta T_{Heating}$ = 1.23 * 52.16 * 25.1
= 1610.34 W