Student **Lizet Bonilla Grajales**

1. Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absoloute humidity, the wet-bulb temperature and the mass of water vapour in the air in ClassRoom A (Aula A) of Piacenza campus in the moment that you are solving this exercise (provide the inputs that you utilized.

A 10m x 5m x 4m room contains air at 25C and 101.7kPa at a relative humidity of 95% (Aprox. Size of aula A - 1017hPa x 0.1kPa and 95% of Piacenza's weather cast)

$$\phi = \frac{m_v}{m_g} = \frac{P_v}{P_g} \dashrightarrow P_g = P_{sat} 25\,°C = 3.1698\ kPa$$

$$\phi = \frac{P_v}{P_g} \rightarrow P_V = \phi \times P_g = 0.95 * 3.1698 = 3.01\ kPa$$

$$P_a = P - P_v = 101.7\ kPa - 3.01\ kPa = 98.68\ kPa$$

$$\omega = 0.622 \frac{P_v}{P_a} = 0.622 \frac{3.01}{98.68} = 0.0189 \frac{Kg_{vapour}}{kg_{dryAir}}$$

$$m_a = \frac{P_a V_a}{R_a T} \qquad R_{sp.} = \frac{R_{global}}{M_{gas}} \dashrightarrow R_a = 0.287, R_v = 0.4615$$

$$m_a = \frac{98.68 * (10 * 5 * 4)}{0.287 * (273 + 25)} = 230.76$$

$$m_v = \frac{3.01 * (10 * 5 * 4)}{0.4615 * (273 + 25)} = 47.05\ kg$$

Using the chart with 95% as percentage of relative humidity and 25C as temperature inside Aula A we have:

$$\omega = 0.019 \frac{kg_{vapour}}{kg_{dryair}}$$

$$h = \frac{73.5kJ}{kg_{dryair}}$$

$$T_{wb} = 25\ C$$

2. Utilize the same methodology we went through in the class and determine the sensible and latent load corresponding to internal gains, the ventilation, and the infiltration in a house with a *good* construction quality and with the same geometry as that of the example which is located in Brindisi, Italy

Building height = 2.5m
Floor area = 200 m^2
Number of occupants = 2
Number of bedrooms = 1
Wall area = 144 m^2

Temperature difference calculation

$\Delta T_{cooling} = 31.1 - 24 = 7.1\ ℃$
$\Delta T_{heating} = 20 - 4.1 = 15.9\ ℃$
DR = 7.1 °C

Internal gains

$\dot{Q}_{ig_{sensible}} = 136 + 2.2A_{cf} + 22N_{oc}$
$= 136 + 2.2\ x\ 200 + 22\ x\ 2 = 620\ W$
$\dot{Q}_{ig_{latent}} = 20 + 0.22A_{cf} + 12N_{oc}$
$= 20 + 0.22\ x\ 200 + 12\ x\ 2 = 88\ W$

Infiltration

$$A_{ul} = 1.4 \frac{cm^2}{m^2}$$

$A_{es} = 200 + 144 = 344\, m^2$

$A_L = A_{es}\, x\, A_{ul} = 344\, x\, 1.4 = 481.6\, cm^2$

$IDF_{heating} = 0.063\ \frac{L}{s.cm^2}$

$IDF_{cooling} = 0.053\ \frac{L}{s.cm^2}$

$\dot{Q}_{i_{heating}} = A_L\, x\, IDF = 481.6\, x\, 0.063 = 30.34\ \frac{L}{s}$

$\dot{Q}_{i_{cooling}} = A_L\, x\, IDF = 481.6\, x\, 0.053 = 25.52\ \frac{L}{s}$

Ventilation

$\dot{Q}_v = 0.05 A_{cf} + 3.5(N_{br} + 1) = 0.05\, x\, 200 + 3.5\, x\, 2$
$= 17\ \frac{L}{s}$

$\dot{Q}_{inf-ventilation_{heating}} = 30.34 + 17 = 47.34\ \frac{L}{s}$

$\dot{Q}_{inf-ventilation_{cooling}} = 25.52 + 17 = 42.52\ \frac{L}{s}$