Week9-mollaiyan-mohammadjavad

Tuesday, December 3, 2019 8:46 PM

Task 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)

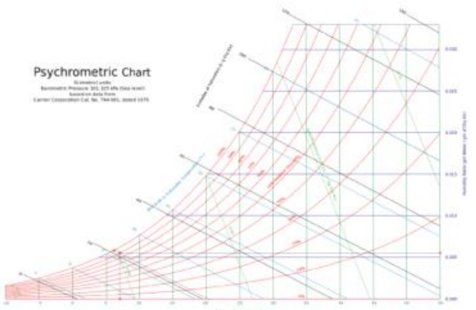
Weather Forecast Website example

Umidità: Relative humidity, Pressione atmosferica: Air total pressure (1 hPa: 0.1 kPa), Temperatura effettiva: temperature to be utilized.

Il tempo oggi in Piacenza
Lunedì, 02 Dicembre 2019

	13:00	14:00	16:00	18:00	20:00	21:00	22:00
	PartlyCloud	PartlyCloud	LightCloud	LightCloud	PartlyCloud	Cloud	PartlyCloud
Temperatura effettiva	10°C	10°C	9°C	6°C	7°C	7°C	8°C
Temperatura percepita	10°C	10°C	8°C	5°C	7°C	6°C	7°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	79 %	77 %	89 %	90 %	90 %	92 %	91 %
Pressione atmosferica	1016 hPa	1016 hPa	1016 hPa	1017 hPa	1019 hPa	1019 hPa	1020 hPa

The time now is 8 pm from the data given in the website :
relative humidity is =90%
Total air presure = 101.9 kPa
Tempurture in kelvin scale T= 230 K



absoulte humidty $\omega = 0{,}0055$

balb temperature $T_{wb} = 6°c$

$$\omega = \frac{0{,}622 P_v}{P_a} = \frac{0{,}622 P_v}{P - P_v} = 0{,}0055$$

intarduce $P = 101{,}9$ Kpa

$P_v \approx 0{,}893$ Kpa

autem $\phi = \frac{m_v}{m_g} = 90\%$

For any Ideal gas => water vapour, $R_{sp} = 0{,}4615$

$P_v = 0{,}893$ Kpa

$$m_v = \frac{0{,}893\, V}{0{,}4615 \times 230} \approx 8{,}41 \times 10^{-3}\, V$$

$$m_g = \frac{m_v}{90\%} \approx 9{,}34 \times 10^{-3}\, V$$

Task 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

BRINDISI, Italy WMO#: 163200

Lat: 40.65N Long: 17.95E Elev: 10 StdP: 101.2 Time Zone: 1.00 (EUW) Period: 86-10 WBAN: 99999

Annual Heating and Humidification Design Conditions

	Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB		
				99.6%			99%			0.4%		1%				
		99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	
(1)	2	2.9	4.1	-5.1	2.5	7.2	-3.0	3.0	7.4	13.4	10.2	12.4	10.6	3.4	250	(1)

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

	Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB		
			0.4%		1%		2%		0.4%		1%		2%				
			DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(2)	8	7.1	32.8	23.6	31.1	24.3	29.9	24.3	27.2	29.7	26.3	29.0	25.6	28.3	4.2	180	(2)

	Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Hours 8 to 4 & 12.8/20.6	
	0.4%			1%			2%			0.4%		1%		2%			
	DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(3)	26.3	21.8	29.2	25.4	20.7	28.5	24.7	19.7	27.9	86.0	30.1	82.2	29.1	78.5	28.3	1236	(3)

Extreme Annual Design Conditions

	Extreme Annual WS			Extreme Max WB	Extreme Annual DB				n-Year Return Period Values of Extreme DB								
					Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
	1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(4)	11.3	9.9	8.7	31.4	0.4	37.3	1.4	3.0	-0.6	39.4	-1.4	41.1	-2.2	42.8	-3.2	44.9	(4)

internal gains :

	Extreme Annual WS			Max	Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
	1%	2.5%	5%	WB	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(4)	11.3	9.9	8.7	31.4	0.4	37.3	1.4	3.0	-0.6	39.4	-1.4	41.1	-2.2	42.8	-3.2	44.9	(4)

internal gains:

calculate the sensibile cooling load from internal gains:

$q_{ig,s} = 136 + 2.2 A_{cf} + 22 N_{oc} = 136 + 2.2 * 22 * 200 + 22 * 2 = 620\,W$

calculate cooling f int gains.

$q_{ig,l} = 20 + 0{,}22 A_{cf} + 12 N_{oc} = 20 + 0{,}22 * 200 + 12 * 2 = 88\,W$

infiltration:

$A_{ul} = 1{,}4\ cm^2/m^2$

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

thus, $A_L = A_{es} \times A_{ul} = 344 \times 1{,}4 = 481{,}6\ cm^2$

$T_{cooling} = 24°C \qquad T_{heating} = 20°C$

$\Delta T_{cooling} = 31{,}1°C - 24°C = 7{,}1°C = 7{,}1\,K$

$\Delta T_{heating} = 20°C - (-4{,}1°C) = 24{,}1°C = 24{,}1\,K$

$DR = 7{,}1°C = 7{,}1\,K$

$IDF_{heating} = 0{,}073 \dfrac{L}{s \times cm^2}$

$IDF_{cooling} = 0{,}033 \dfrac{L}{s \times cm^2}$

airflow rate:

$Q_{i,heating} = A_L + IDF_{heating} = 481{,}6 \times 0{,}073 \approx 35{,}157 \frac{L}{s}$

$Q_{i\,cooling} = A_L \times IDT_{cooling} = 481{,}6 \times 0{,}033 \approx 15{,}893 \frac{L}{s}$

min whole building vetilation:

$Q_v = 0{,}05 A_{cf} + 3{,}5 (N_{br} + 1) = 0{,}05 \times 200 + 3{,}5 \times (1+1) = 17 \frac{L}{s}$

$Q_{i-v\,heating} = Q_{i,\,heating} + Q_v \approx 35{,}157 + 17 = 52{,}157 \frac{L}{s}$

$Q_{i-v\,cooling} = Q_{i\,cooling} + Q_v \approx 15{,}893 + 17 = 32{,}893 \frac{L}{s}$

Given that $C_{sensible} = 1{,}23$, $C_{latent} = 3010$, $\Delta W_{cooling} = 0{,}0039$

$q_{inf-v_{es}} = C_s Q_{ivc} \Delta T_c \approx 1{,}23 \times 32{,}893 \times 7{,}1 = 287{,}25\,W$

$q_{inf-v_{cl}} = C_l Q_{i-vc} \Delta W_c \approx 3010 \times 32{,}893 \times 0{,}0039 = 386{,}13\,W$

$$q_{infl-v_{cl}} = C_L Q_{i\_vc} \Delta W_c \approx 3010 \times 32{,}893 \times 0{,}0039 = 386{,}13 \, W$$

$$q_{infl-v_{hs}} = C_s Q_{i\_vh} \Delta T_{heating} = 1{,}23 \times 52{,}157 \times 24{,}1 = 1546{,}09 \, W$$