Week 9- MONDRAGON, ALEJANDRA

domingo, 1 de diciembre de 2019 11:15 p. m.

TASK 1-

Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absolute 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)

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

Il tempo oggi in Piacenza
Lunedi, 02 Dicembre 2019

	05:00	07:00	10:00	14:00	18:00	19:00	21:00
	LightRain	LightRain	PartlyCloud	Sun	LightCloud	PartlyCloud	Cloud
Temperatura effettiva	7°C	7°C	8°C	11°C	6°C	7°C	7°C
Temperatura percepita	5°C	5°C	6°C	11°C	5°C	7°C	7°C
Precipitazioni	1 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	93 %	93 %	88 %	74 %	90 %	90 %	88 %
Pressione atmosferica	1015 hPa	1015 hPa	1016 hPa	1015 hPa	1016 hPa	1017 hPa	1019 hPa
Intensità del vento	11 km/h	10 km/h	12 km/h	8 km/h	6 km/h	4 km/h	4 km/h
Direzione del vento	O	O	NO	NO	SW	SW	SE
Probabilità di nebbia	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	6°C	6°C	6°C	6°C	5°C	5°C	5°C
Nuvole	100 %	100 %	59 %	10 %	34 %	70 %	88 %
Nuvole basse	57 %	45 %	27 %	10 %	27 %	16 %	87 %
Nuvole medie	100 %	98 %	22 %	0 %	25 %	70 %	68 %
Nuvole alte	95 %	95 %	48 %	0 %	0 %	0 %	0 %

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ABSOLUTE HUMIDITY

$$\phi = \frac{m_v}{m_g}$$

7 C = 1.0729 kPa

$$\phi = \frac{m_v}{m_g} = \frac{P_v}{P_g} \dashrightarrow P_g = P_{sat} 7\ °C = 1.0729\ kPa$$

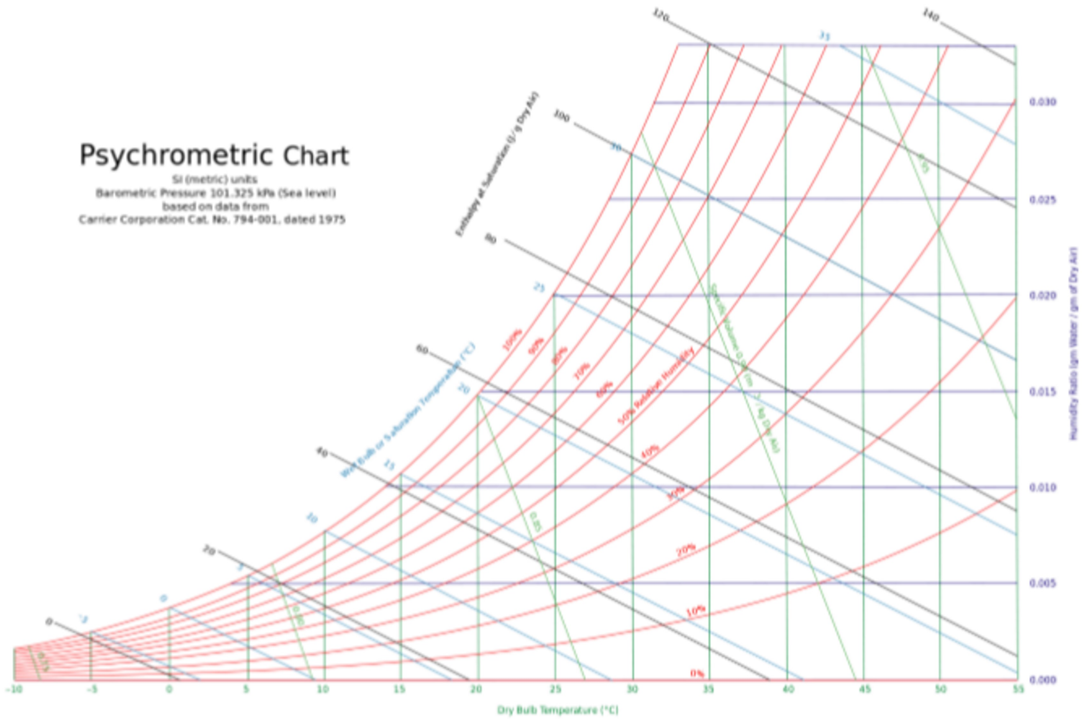
$$\phi = \frac{P_v}{P_g} \rightarrow P_V = \phi \times P_g = 0.93 * 1.0729 = 0.997\ kPa$$

$$partial\ pressure\ of\ dry\ air{:}\ \ P_a = P - P_v = 0.1\ kPa - 0.997\ kPa = -0.897\ kPa$$

$$\omega = 0.622\frac{P_v}{P_a} = 0.622\frac{0.997}{-0.897} = 0.439\frac{Kg_{vapour}}{kg_{dryAir}}$$

$$m = \frac{PV}{R_{sp.}T}$$

$$m_a = \frac{P_aV_a}{R_aT} \qquad R_{sp.} = \frac{R_{global}}{M_{gas}}$$



Ra= *0.4615*

$$m_v = \frac{0.897 * (5 * 10 * 3)}{0.4615 \ * (273 + 7)} = 0.487 \ \ kg$$

$$m_{wv} = \frac{0.487}{0.93} = 0.523 \ kg$$

$$h_a = \ \ 1.005 * T = 1.005 \ * 7 = 7.035 \frac{kJ}{kg_{dryAir}} \ * \ T \ in \ °C$$

$$h_v = \ \ 2501.3 + 1.82 \ * 7 = 2510.12 \frac{kJ}{kg_{water}}$$

$$h_{\square} = h_a + \omega h_v = \ \ 7.035 + 0.439 \ * 2510.12 = 1108.97 \frac{kJ}{kg_{dryAir}}$$

Task 2 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

$$\dot{Q}_{ig_{sensible}} = 136 + 2.2A_{cf} + 22N_{oc} = 136 + 2.2 \text{ x } 200 + 22 \text{ x } 2 = 620 \ W$$

$$\dot{Q}_{ig_{latent}} = 20 + 0.22A_{cf} + 12N_{oc} = 20 + 0.22 \text{ x } 200 + 12 \text{ x } 2 = 88 \ W$$

Infiltration

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

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

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

Qi=ΔL IDF

$$IDF_{heating} = 0.065 \ \frac{L}{s.\,cm^2}$$

$$IDF_{cooling} = 0.032 \ \frac{L}{s.\,cm^2}$$

$$T_{cooling} = 31.1 \ ℃$$

$$T_{heating} = 4.1 \ ℃$$

$$\dot{V}_{i_{heating}} = A_L \text{ x } IDF = 481.6 \text{ x } 0.065 = 31.30 \ \frac{L}{s}$$

$$\dot{V}_{i_{cooling}} = A_L \text{ x } IDF = 481.6 \text{ x } 0.032 = 15.41 \ \frac{L}{s}$$

Ventilation

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

$$\dot{Q}_{inf-vent\ heat} = 31.30 + 17 = 48.30 \ \frac{L}{s}$$

$$\dot{Q}_{inf-vent\ cool} = 15.41 + 17 = 32.41 \ \frac{L}{s}$$

$$\dot{Q}_{inf-vent\ coool\ senst} = C_{sensible}\dot{V}\Delta T_{cooling} = 1.23 \text{ x } 32.41 \text{ x } 7.1 = 283.04 \ W$$

$$\dot{Q}_{inf-vent\ cool\ lat} = C_{latent}\dot{V}\Delta\omega_{cooling} = 3010 \text{ x } 32.41 \text{ x } 0.0045 = 438.99 \ W$$

$$\dot{Q}_{inf-vent\ heat\ sens} = C_{sensible}\dot{V}\Delta T_{heating} = 1.23 \text{ x } 48.30 \text{ x } 15.9 = 944.60 \ W$$

$$\dot{Q}_{inf-vent\ heat\ lat} = C_{latent}\dot{V}\Delta\omega_{heating} = 3010 \text{ x } 48.30 \text{ x } 0.0046 = 668.76 \ W$$