Week9 Zhou Yuhan

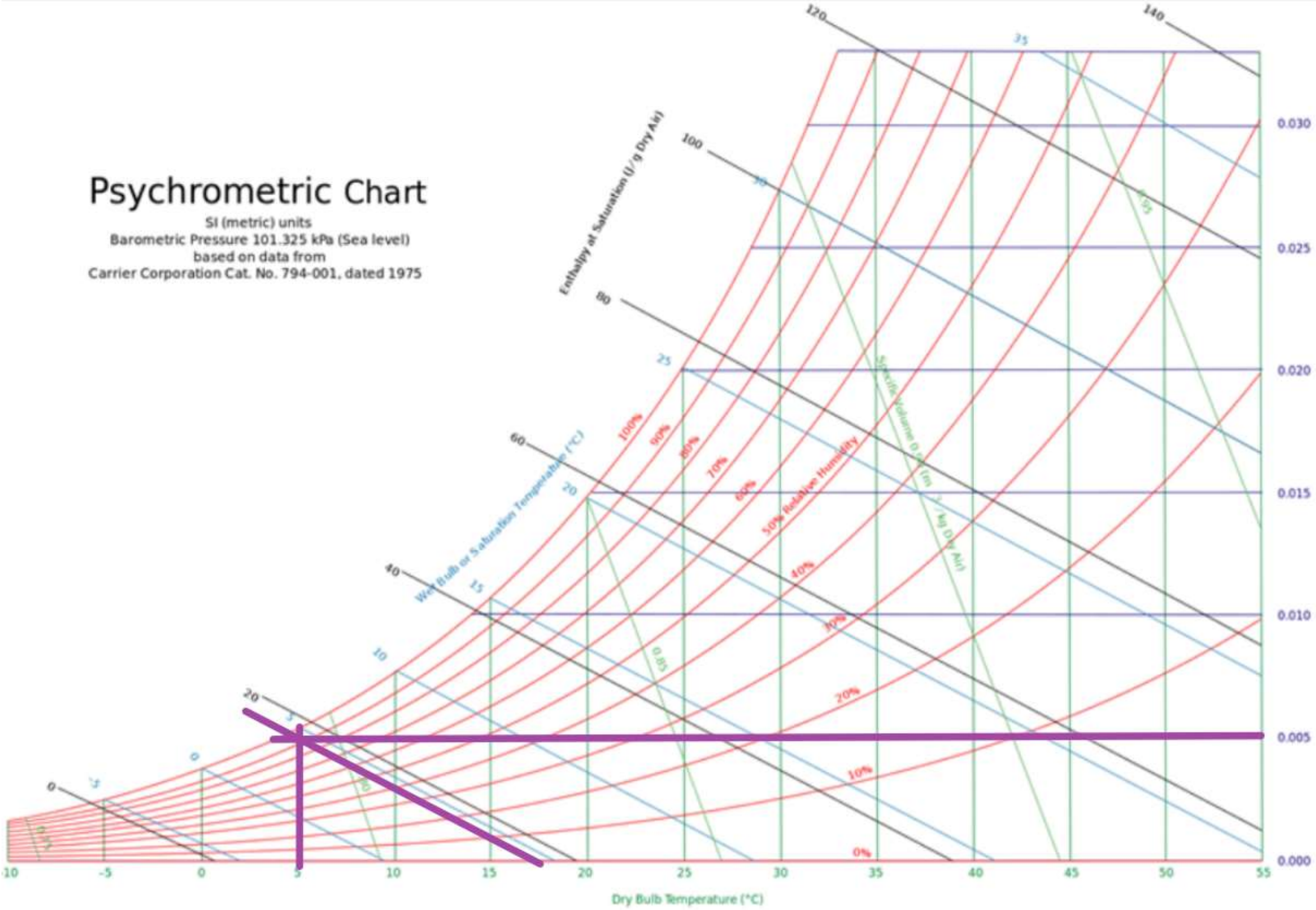
2019年12月5日　　21:46

Task1 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)

Tempo domani a Piacenza
Venerdì, 06 Dicembre 2019

	05:00	07:00	10:00	14:00	18:00	19:00	21:00
	PartlyCloud	PartlyCloud	LightCloud	PartlyCloud	LightCloud	PartlyCloud	PartlyCloud
Temperatura effettiva	2°C	2°C	5°C	8°C	5°C	5°C	5°C
Temperatura percepita	2°C	0°C	5°C	8°C	5°C	5°C	4°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	95 %	98 %	89 %	77 %	91 %	92 %	95 %
Pressione atmosferica	1025 hPa	1025 hPa	1025 hPa	1023 hPa	1021 hPa	1022 hPa	1021 hPa
Intensità del vento	3 km/h	6 km/h	4 km/h	3 km/h	4 km/h	4 km/h	5 km/h
Direzione del vento	O	NO	O	NO	SW	SW	SW
Probabilità di nebbia	1 %	8 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	2°C	2°C	3°C	4°C	3°C	3°C	4°C
Nuvole	44 %	46 %	27 %	74 %	35 %	49 %	43 %
Nuvole basse	20 %	44 %	23 %	72 %	34 %	48 %	42 %
Nuvole medie	11 %	1 %	20 %	51 %	13 %	13 %	1 %
Nuvole alte	27 %	4 %	0 %	1 %	0 %	0 %	1 %

Chosen time:10:00
Temperature T=5°C
Relative humidity ϕ =89%
Total air pressure P=1025hPa=102.5kPa



Absolute Humidity=0.005

Wet bulb temperature= 5 ℃

The mass of water vapour (M_v)

$$P_v = \frac{p\omega}{0.622+\omega} = 0.84kg$$

V_{roomA}=20*6*6=720㎡

$$M_v = \frac{P_v V_{roomA}}{R_v T} = 4.7\text{kg}$$

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%	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：

$Q_{insensible}$ $=136+2.2A_{fc}+22N_{oc}=136+2.2*200+22*2=620W$

$Q_{iglatent}$ $=20+0.22A_{fc}+12N_{oc}=20+0.22*200+12*2=88W$

The Infiltration：

$A_{es}=A_{wall}+A_{roof}=200+144=344$ ㎡

$A_L=A_{es}*A_{ul}=344*1.4=481.6$ ㎠

$T_{cooling}=24℃$

$T_{heating}=20℃$

$\Delta T_{cooling}=31.1℃-24℃=7.1℃$

$\Delta T_{heating}=20℃-（-4.1）℃=24.1℃$

DR=7.1℃=7.1K

IDFheating=$0.073\frac{L}{S*cm^2}$

IDFcooling=$0.033\frac{L}{S*cm^2}$

Infiltration airflow rate:

$Q_{i.heating}=A_{L*}$IDFheating$=481.6*0.073=35.15\frac{L}{s}$

$Q_{i.cooling}=A_{L*}$IDFcooling$=481.6*0.033=15.89\frac{L}{s}$

Ventilation:

$Q_v=0.05A_{fc}+3.5(Nbr+1)=0.05\times200+3.5(1+1)=17\frac{L}{s}$

$Q_{i\text{-}v.heating}=Q_{i.heating}+Q_v=35.15+17=52.15\frac{L}{s}$

$Q_{i\text{-}v.cooling}=Q_{i.cooling}+Q_v=15.89+17=32.89\frac{L}{s}$

C_sensible =1.23

C_latent=3010

$\Delta\omega$_cooling=0.0039

$q\_inf\text{-}ventilation\ cooling\ sensible = C\_sensible\ Q\_i\text{-}u.\ cooling\ \Delta T\_cooling = 1.23*32.89*7.1 = 287.25W$ $q\_inf\text{-}ventilation\ cooling\ latent = C\_latent\ Q\_i\text{-}ucooling\ \Delta\omega\_cooling = 3010*32.89*0.0039 = 386.13W$

$q\_inf\text{-}ventilation\ heating\ latent = C\_sensible\ Q\_i\text{-}wheating\ \Delta T\_Theating = 1.23*52.15*24.1 = 1546W$