قائمة الاسئلة

اختبار النهائي للعام الجامعي 2025/2024م-كلية الهندسة :: انظمة تكييف وتبريد الهواء- كلية الهندسة - قسم الميكانيك - المستوى الرابع- 3ساعات

د.عبدالجليل العبيدي

1) The main components of ……… are evaporator, condenser, expansion valve, absorber and generator
   1) - Vapor compression refrigeration system
   2) + Absorption refrigeration system
   3) - Gas Refrigeration System (reverse Bryton cycle)
   4) - Ejector refrigeration system
2) This refrigeration system is comments used worldwide because the coefficient of performance (COP) of the system is high compare to other systems
   1) + Vapor compression refrigeration system
   2) - Absorption refrigeration system
   3) - Adsorption refrigeration system
   4) - Ejector refrigeration system
3) If the suction pressure of a vapor compression refrigeration system is remained constant and the discharge pressure is increased , then
   1) - The work done will decreased
   2) - The cooling effect (cooling load) will increased
   3) - The pressure ratio will decreased
   4) + The coefficient of performance will decreased
4) The HVAC system should be used to control the following conditions of a specific space
   1) - The Temperature of the space
   2) - The humidity of the space
   3) - Air purity and recirculation within the space
   4) + All answer
5) The …….. have the ability to conduct cooling and heating of a specific space at the same time
   1) + VRF Air conditioning system
   2) - VAV Air conditioning system
   3) - Package Air conditioning system
   4) - Heat pump Air conditioning system
6) If the dry temperature is remain constant for a specific process on the psychometrics and the relative humidity is reduced , the dew point will be ……
   1) - Increased
   2) - Remain constant
   3) + Decreased
   4) - No answer
7)

TABLE 9-1 Cooling load temperature differences CLTD, values for flat sunlit roofs, °C.

Roof Number and its Construction	U_m, W/m²·K	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Roofs Without Suspended Ceiling																									
1. Steel sheet with 25.4 mm (or 50.8 mm) insulation	1.209 (0.704)	0	−1	−2	−2	−3	−2	3	11	19	27	34	40	43	44	43	39	33	25	17	10	7	5	3	1
2. 25 mm wood with 25.4 mm insulation	0.963	3	2	0	−1	−2	−2	−1	2	8	15	22	29	35	39	41	41	39	35	29	21	15	11	8	5
3. 101.6 mm L.W. concrete	1.209	5	3	1	0	−1	−2	−2	1	5	11	18	25	31	36	39	40	40	37	32	25	19	14	10	7
4. 50.8 mm H.W. concrete 25.4 mm (or 50.8	1.170 (0.693)	7	5	3	2	0	−1	0	2	6	11	17	23	28	33	36	37	37	34	30	25	20	16	12	10

TABLE 9-2 Latitude-Month correction factor LM, values as applied to flat roofs and walls, north latitudes.

Lat. Angle	Month	N	NNE NNW	NE NW	ENE WNW	E W	ESE WSW	SE SW	SSE SSW	S	Flat Roofs
32	December	−2.7	−3.8	−5.5	−6.1	−4.4	−2.7	1.1	5.0	6.6	−9.4
	Jan./Nov.	−2.7	−3.8	−5.0	−6.1	−4.4	−2.2	1.1	5.0	6.6	−8.3
	Feb./Oct.	−2.2	−3.3	−3.8	−4.4	−2.2	−1.1	2.2	4.4	6.1	−5.5
	Mar/Sept.	−1.6	−2.2	−2.2	−2.2	−1.1	−0.5	1.6	2.7	3.8	−2.7
	Apr./Aug.	−1.1	−1.1	−0.5	−1.1	0.0	−0.5	0.0	5.0	0.5	−0.5
	May/July	0.5	0.5	0.5	0.0	0.0	−0.5	−0.5	−1.6	−1.6	0.5
	June	0.5	1.1	1.1	0.5	0.0	−1.1	−1.1	−2.2	−2.2	1.1

TABLE 9-4 Cooling load temperature differences, CLTD for various construction groups of sunlit walls, °C, north latitude.

Sunlit Wall Orientation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Hour of Max. CLTD	Min. Value of CLTD	Max. Value of CLTD
1. Group A Walls (M=630 kg/m²)																											
N	8	8	8	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	8	8	2	6	8
NE	11	11	10	10	10	9	9	9	8	8	8	9	9	9	9	10	10	10	11	11	11	11	11	11	22	8	11
E	14	13	13	13	12	12	11	11	10	10	10	11	11	12	12	13	13	13	14	14	14	14	14	14	22	10	14
SE	13	13	13	12	12	11	11	10	10	10	10	10	10	11	11	12	12	13	13	13	13	13	13	13	22	10	13
S	11	11	11	11	10	10	9	9	9	8	8	8	8	8	8	8	9	9	10	10	11	11	11	11	23	8	11
SW	14	14	14	14	13	13	12	12	11	11	10	10	10	9	9	10	10	10	11	12	13	13	14	14	24	9	14
W	15	15	15	14	14	14	13	13	12	12	11	11	10	10	10	10	10	11	11	12	13	14	14	15	1	10	15
NW	12	12	11	11	11	11	10	10	10	9	9	8	8	8	8	8	8	8	9	9	10	11	11	11	1	8	12

TABLE 9-7 Solar heat gain rate *SHG*, for sunlit glass windows, W/m² for latitude angle of 32°N. [2]

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
N	76	85	101	114	120	139	126	117	104	88	76	69
NNE/NNW	76	85	117	252	350	385	350	249	110	88	76	69
NE/NW	91	205	338	461	536	555	527	445	325	199	91	69
ENE/WNW	331	470	577	631	656	656	643	615	546	451	325	265
E/W	552	647	716	716	694	675	678	691	678	615	546	511
ESE/WSW	722	764	748	691	628	596	612	663	716	738	710	688
SE/SW	786	782	716	590	489	439	473	571	688	754	773	776
SSE/SSW	789	732	615	445	213	262	303	429	596	710	776	795
S	776	697	555	363	233	189	227	350	540	678	767	795
Horizontal	555	685	795	855	874	871	861	836	770	672	552	498

TABLE 9-9 Shading coefficient SC, for glass windows with interior shading. [1]

Type of Glass	Nominal Thickness, mm	Venetian Blinds: Medium	Venetian Blinds: Light	Roller Shade, Opaque: Dark	Roller Shade, Opaque: White	Roller Shade, Translucent: Light
Single Glass						
Clear, regular	2.4	0.74	0.67	0.81	0.39	0.44
Clear pattern	6.0-13.0	0.64	0.55	0.59	0.25	0.39
Heat absorbing plate	5.0-6.0	0.57	0.53	0.40	0.30	0.36
Heat absorbing, plate	10	0.54	0.52	0.40	0.82	0.32
Heat absorbing pattern	—	0.42	0.40	0.36	0.28	0.31
Reflective coated glass	—	0.75	0.23	0.23	—	—

TABLE 9-11 Cooling Load factors CLF, for glass windows with interior shading, North latitude.

Glass Facing	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
N	0.08	0.07	0.06	0.06	0.07	0.73	0.66	0.65	0.73	0.80	0.86	0.89	0.89	0.86	0.82	0.75	0.78	0.91	0.24	0.18
WSW	0.05	0.05	0.04	0.04	0.03	0.07	0.10	0.12	0.14	0.16	0.17	0.23	0.44	0.64	0.78	0.84	0.78	–	–	–
W	0.05	0.05	0.04	0.04	0.03	0.06	0.09	0.11	0.13	0.15	0.16	0.17	0.31	0.53	0.72	0.82	0.81	0.61	0.16	0.12
WNW	0.05	0.05	0.04	0.03	0.03	0.07	0.10	0.12	0.14	0.16	0.17	0.18	0.22	0.43	0.65	0.80	0.84	–	–	–

The total and sensible cooling loads are **9.5 kW** and **7.6 kW**, respectively. If the inside design condition is **24°C** dry bulb and **50% R.H** and the outside design condition is **32°C** dry temperature and **40% R.H**. The ventilation fresh air is **0.130 m³/s**. The supply air relative humidity is **90%** ..

7-1	The Sensible heat ratio	
	a	0.80
	b	0.50
	c	0.70
	d	0.60

1) + a
2) - b
3) - c
4) - d

8)

TABLE 9–12 Cooling load temperature difference CLTD, for convection heat gain rate for glass windows.

Solar Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CLTD °C	1	0	−1	−1	−1	−1	−1	0	1	2	4	5	7	7	8	8	7	7	6	4	3	2	2	1

TABLE 4-3 Cooling load factor due to occupants $(CLF)_{occ.}$, for sensible heat gain rate.[2]

Hours After Each Entry into Space	Total Hours in Space								
	2	4	6	8	10	12	14	16	18
1	0.49	0.49	0.50	0.51	0.53	0.55	0.58	0.62	0.66
2	0.58	0.59	0.60	0.61	0.62	0.64	0.66	0.70	0.74
3	0.17	0.66	0.67	0.67	0.69	0.70	0.72	0.75	0.79
4	0.13	0.71	0.72	0.72	0.74	0.75	0.77	0.79	0.82
5	0.10	0.27	0.76	0.76	0.77	0.79	0.80	0.82	0.85
6	0.08	0.21	0.79	0.80	0.80	0.81	0.83	0.85	0.87
7	0.07	0.16	0.34	0.82	0.83	0.84	0.85	0.87	0.89
8	0.06	0.14	0.26	0.84	0.85	0.86	0.87	0.88	0.90
9	0.05	0.11	0.21	0.38	0.87	0.88	0.89	0.90	0.92
10	0.04	0.10	0.18	0.30	0.89	0.89	0.9	0.91	0.93
11	0.04	0.08	0.15	0.25	0.42	0.91	0.91	0.92	0.94
12	0.03	0.07	0.13	0.21	0.34	0.92	0.92	0.93	0.94
13	0.03	0.06	0.11	0.18	0.28	0.45	0.93	0.94	0.95
14	0.02	0.06	0.10	0.15	0.23	0.36	0.94	0.95	0.96
15	0.02	0.05	0.08	0.13	0.20	0.30	0.47	0.95	0.96
16	0.02	0.04	0.07	0.12	0.17	0.25	0.38	0.96	0.97

TABLE 9–15 Cooling load factor $(CLF)_{u}$, for lights [3]

Number of Hours After Lights are Turned ON	Fixture X Hours of Operation		Fixture Y Hours of Operation	
	10	16	10	16
0	0.08	0.19	0.01	0.05
1	0.62	0.72	0.76	0.79
2	0.66	0.75	0.81	0.83
3	0.69	0.77	0.84	0.87
4	0.73	0.80	0.88	0.89
5	0.75	0.82	0.90	0.91
6	0.78	0.84	0.92	0.93
7	0.80	0.85	0.93	0.94
8	0.82	0.87	0.95	0.95
9	0.84	0.88	0.96	0.96
10	0.85	0.89	0.97	0.97
11	0.32	0.90	0.22	0.98
12	0.29	0.91	0.18	0.98
13	0.26	0.92	0.14	0.98
14	0.23	0.93	0.12	0.99
15	0.21	0.94	0.09	0.99
16	0.19	0.94	0.08	0.99

The total and sensible cooling loads are **9.5 kW** and **7.6 kW**, respectively. If the inside design condition is **24°C** dry bulb and **50% R.H** and the outside design condition is **32°C** dry temperature and **40% R.H**. The ventilation fresh air is **0.130 m³/s**. The supply air relative humidity is **90%** ..

7-2	The supply air mass flow rate of ventilation	
	a	3.85 kg/s
	b	5.45 kg/s
	c	1.53 kg/s
	d	0.661 kg/s

1) - a
2) - b
3) - c
4) + d

9) The total and sensible cooling loads are **9.5 kW** and **7.6 kW**, respectively. If the inside design condition is **24°C** dry bulb and **50% R.H** and the outside design condition is **32°C** dry temperature and **40% R.H**. The ventilation fresh air is **0.130 m³/s**. The supply air relative humidity is **90%** ..

7-3	The fresh air mass flow rate of ventilation	
	a	1.435kg/s
	b	2.230 kg/s
	c	0.149 kg/s
	d	0.615 kg/s

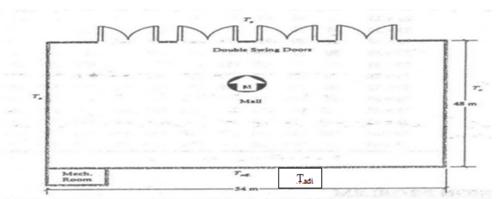
1) - a
2) - b
3) + c
4) - d

10)

	The total and sensible cooling loads are **9.5 kW** and **7.6 kW**, respectively. If the inside design condition is **24°C** dry bulb and **50% R.H** and the outside design condition is **32°C** dry temperature and **40% R.H**. The ventilation fresh air is **0.130 m³/s**. The supply air relative humidity is **90%** ..	
	The coil cooling load capacity	
7-4	a	25.672 kW
	b	12.162 kW
	c	35.820 kW
	d	05.382 kW

1) - a
2) + b
3) - c
4) - d

11) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
The overall heat transfer of the mall walls **U_{wall}= 0.635 W/m².k**, **U_{roof} = 0.761 W/m².k**, **$U_{adjacent}$ =2.782 W/m².k**, **U_{glass}=6.7 W/m².k**, Temperature conditions : **T_o= 36.3°C**, **T_i= 26°C**, **Ø=50%** , **T_{adj}= 32.3°C** , **$T_{o.m}$= 27.5°C** Number of person= **250 persons**, **70 W** sensible and **45 W** latent
Light: 30W/m² fluorescent type on for 16 hours, fixture X. Glass door: Four venetian medium type, single glass doors clear pattern **6 mm** thickness, with interior shading, area **1.5 m x 2.4 m** each. Building construction M . working hours: from 8.00 to 24.00 solar time hours. Consider the cooling of the mall occurs at 17.00 hours for July



Layout of the design problem

	The heat transfer to the adjacent area	
8-1	a	2243 W
	b	2524 W
	c	3975W
	d	7010W

1) - a
2) - b
3) + c
4) - d

12) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
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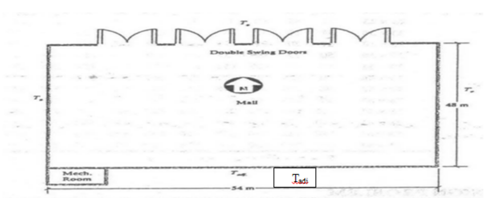

Layout of the design problem

	The heat transfer from the roof	
8-2	a	75152.7 W
	b	21940 W
	c	42030 W
	d	83150 W

1) + a
2) - b
3) - c
4) - d

13)

Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
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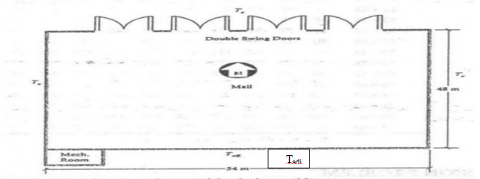

Layout of the design problem

		The heat transfer from the north wall
8-3	a	2153.20 W
	b	1156.70 W
	c	262.20 W
	d	552.98 W

1) - a
2) - b
3) - c
4) + d

14) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
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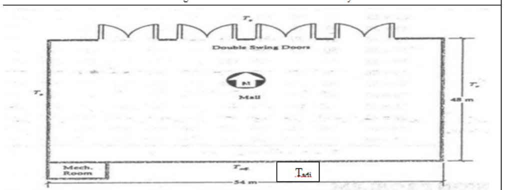

Layout of the design problem

		The heat transfer from the north glass door
8-4	a	1397.79 W
	b	8267.20 W
	c	4123.70 W
	d	862.20 W

1) + a
2) - b
3) - c
4) - d

15) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
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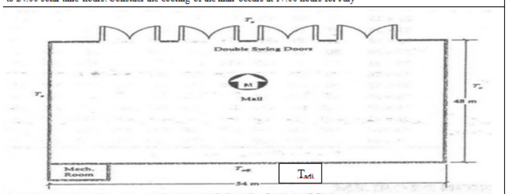
Light: 30W/m² fluorescent type on for 16 hours, fixture X. Glass door: Four venetian medium type, single glass doors clear pattern **6 mm** thickness, with interior shading, area **1.5 m x 2.4 m** each. Building construction M . working hours: from 8.00 to 24.00 solar time hours. Consider the cooling of the mall occurs at 17.00 hours for July



Layout of the design problem

		The heat transfer from the east wall
8-5	a	4267.20 W
	b	3739.68 W
	c	6310.47 W
	d	1367.20 W

1) - a
2) + b
3) - c

4) - d

16) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
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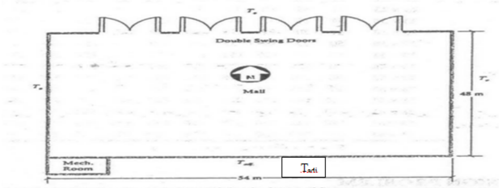
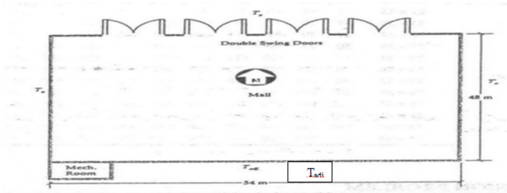


Layout of the design problem

8-6	The heat gain from the occupancy	
	a	45896 W
	b	55896 W
	c	27000 W
	d	35436 W

1) - a
2) - b
3) + c
4) - d

17) Design an air conditioning for summer operation for the show mall in figure for a city location Lat. Angle 32°, Sunlit wall: L.W. Concrete 203.2 mm concrete, 50.8 mm insulation, **group (A)**, dark color
Sunlit roof: L.W. Concrete with suspended of **4.2 height**, **type No. 3**, dark color
The overall heat transfer of the mall walls **U_{wall}= 0.635 W/m².k**, **U_{roof} = 0.761 W/m².k**, **$U_{adjacent}$ =2.782 W/m².k**, **U_{glass}=6.7 W/m².k**, Temperature conditions : **T_o= 36.3°C, T_i= 26°C, Ø=50%** , **T_{adj}= 32.3°C** , **$T_{o.m}$= 27.5°C** Number of person= **250 persons**, **70 W** sensible and **45 W** latent
Light: 30W/m² fluorescent type on for 16 hours, fixture X. Glass door: Four venetian medium type, single glass doors clear pattern **6 mm** thickness, with interior shading, area **1.5 m x 2.4 m** each. Building construction M . working hours: from 8.00 to 24.00 solar time hours. Consider the cooling of the mall occurs at 17.00 hours for July



Layout of the design problem

8-7	The heat gain from the light	
	a	32350 W
	b	54236 W
	c	17056 W
	d	74,649.6 W

1) - a
2) - b
3) - c
4) + d

18) A refrigerator uses **refrigerant-134a** as the working fluid and operates on an ideal vapor compression refrigeration cycle between **0.14 and 0.8 MPa**. If the mass flow rate of the refrigerant is **0.05 kg/s**, determine

9-1	The rate of heat removal from the refrigerated space	
	a	7.131 kW
	b	15.23 kW
	c	3.76 kW
	d	25.19 kW

1) + a
2) - b
3) - c
4) - d

19)

A refrigerator uses **refrigerant-134a** as the working fluid and operates on an ideal vapor compression refrigeration cycle between **0.14 and 0.8 MPa**. If the mass flow rate of the refrigerant is **0.05 kg/s**, determine

9-2	The power input to the compressor	
	a	0.39 kW
	b	1.799 kW
	c	3.34 kW
	d	2.76 kW

1) - a
2) + b
3) - c
4) - d

20) A refrigerator uses **refrigerant-134a** as the working fluid and operates on an ideal vapor compression refrigeration cycle between **0.14 and 0.8 MPa**. If the mass flow rate of the refrigerant is **0.05 kg/s**, determine

9-3	The rate of heat rejection to the environment	
	a	15.71 kW
	b	3.890 kW
	c	8.93 kW
	d	1.547 kW

1) - a
2) - b
3) + c
4) - d

21) A refrigerator uses **refrigerant-134a** as the working fluid and operates on an ideal vapor compression refrigeration cycle between **0.14 and 0.8 MPa**. If the mass flow rate of the refrigerant is **0.05 kg/s**, determine

9-4	The COP of the refrigerator	
	a	4.32
	b	5.89
	c	2.65
	d	3.96

1) - a
2) - b
3) - c
4) + d

22) If the above question used a heat exchanger to subcooled the high pressure liquid refrigerant after the condenser and superheat the low pressure gas refrigerant before inter compressor with 5°C then ,

10-1	The rate of heat removal from the refrigerated space	
	a	7.699 kW
	b	1.72 kW
	c	3.53 kW
	d	15.22 kW

1)	+	a
2)	-	b
3)	-	c
4)	-	d

23) If the above question used a heat exchanger to subcooled the high pressure liquid refrigerant after the condenser and superheat the low pressure gas refrigerant before inter compressor with 5°C then ,

	The power input to the compressor	
	a	4.43 kW
10-2	b	12.42 kW
	c	0.65 kW
	d	1.846 kW

1)	-	a
2)	-	b
3)	-	c
4)	+	d

24) If the above question used a heat exchanger to subcooled the high pressure liquid refrigerant after the condenser and superheat the low pressure gas refrigerant before inter compressor with 5°C then ,

	The rate of heat rejection to the environment	
	a	5.453 kW
10-3	b	3.533 kW
	c	9.545 kW
	d	2.940 kW

1)	-	a
2)	-	b
3)	+	c
4)	-	d

25) If the above question used a heat exchanger to subcooled the high pressure liquid refrigerant after the condenser and superheat the low pressure gas refrigerant before inter compressor with 5°C then ,

	The coefficient of performance	
	a	3.23
10-4	b	4.17
	c	5.56
	d	2.34

1)	-	a
2)	+	b
3)	-	c
4)	-	d