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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FCD20303**
SUBJECT TITLE	:	**DUCTING AND PIPING SYSTEM**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**9.00 AM – 12.00 PM (3 HOURS)**
DATE	:	**31 DECEMBER 2014**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **Please write your answers on the answer booklet provided.**
3. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
4. **This question paper consists of TWO (2) sections. Answer ALL questions in section A, and 2 questions in Section B.**
5. **Duct calculator is allowed to perform duct sizing.**
6. **The drawings need to be returned with the answer booklet.**
7. **Answer all questions in English.**

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIXES.

SECTION A

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

Appendix 1 shows a food court floor layout. There is an open air mechanical plant room to accommodate the water-cooled chiller, cooling towers and pumps for the air conditioning system of the food court. Four (4) air handling unit (AHU) rooms are located at each corner of the building. The food court is designed for a maximum occupancy of 640 pax. There are various type of food provided in the food court as shown in the drawing. The air conditioning system installed for the food court shall be the water-cooled chilled water system. The ceiling height is 12 ft and the space above the plaster ceiling is approximately 30 inches.

(a) Referring Appendixes 1 & 2, estimate

i. the total supply air (cfm) and return air (cfm) for each area for the whole floor.

(10 Marks)

ii. the cooling capacity (Btu/hr) for each area for the whole floor.

(10 Marks)

Question 2

Assuming the cooling capacity for the whole building is 4,600,000 Btu/hr, sketch your proposed ducting layout in a single line diagram complete with duct dimensions and air diffusers/grilles location for the whole floor for its air conditioning system.

(20 Marks)

Question 3

(a) Based on the assumption in Question 2, sketch your proposed piping layout complete with pipe dimension in a single line diagram for the chilled water system.

(10 Marks)

(b) Show typical connection for

i. Water-cooled chiller

(5 Marks)

ii. Chilled water pump

(5 Marks)

SECTION B

INSTRUCTION: Answer TWO (2) questions ONLY.

Question 4

Based on your proposed ducting layout in Question 2,

(a) Calculate the total external static pressure (“ w.g) for the air conditioning ducting system for each AHU.

(15 Marks)

(b) Select the correct AHU model from the catalogue provided based on your calculation above.

(5 Marks)

Question 5

Based on your proposed piping layout in Question 3,

(a) Calculate the total head (ft w.g) for the chilled water pump.

(15 Marks)

(b) Select the correct chilled water pump from the catalogue provided based on your calculation above.

(5 Marks)

Question 6

During testing and commissioning of the AHU installed in the food court, your technicians have collected the following data and submitted to you as the HVAC engineer. Based on the test report,

(a) Fill in the spaces labeled with (a), (b) and (c).

(6 Marks)

(b) Analyse and comment on the system.

(14 Marks)

AIR HANDLING UNIT (AHU) TEST SHEET

	Manufacturer	-		Serial No.	-
	Type	-		Model No.	-
F	Size (MM)	-		Pitch Angle	-
A		Unit	Design	Test	
N	Volume	CFM	38,000	34,900	
	Speed	R.P.M	909	910	
	Manufacturer	TECO		Output HP	15
M	Type	TEFC		Frame No.	(a)
O	Serial No	H112300987		Running Current	20.7
T	Voltage, V	415		Full Load Current	(b)
O		Design		Test	
R	Speed	R.P.M	(c)	1,455	
D	Manufacturer	BANDO		Fan Pulley Dia. (")	8
R	Type	V-BELT		Fan Shaft Dia. (mm)	38
I	Belt Size	C35		Motor Pulley Dia. (")	5
V	No. Of Belt	3		Motor Shaft Dia. (mm)	38
E					
S	Manufacturer	TELEMECANIQUE		O/Load Range	18 - 25
T	Type	AUTO-TRANS		Timer Setting	5S
A	O/Load Setting	23 A		Fuse Rating	100 A
R					
T					
E					
R					

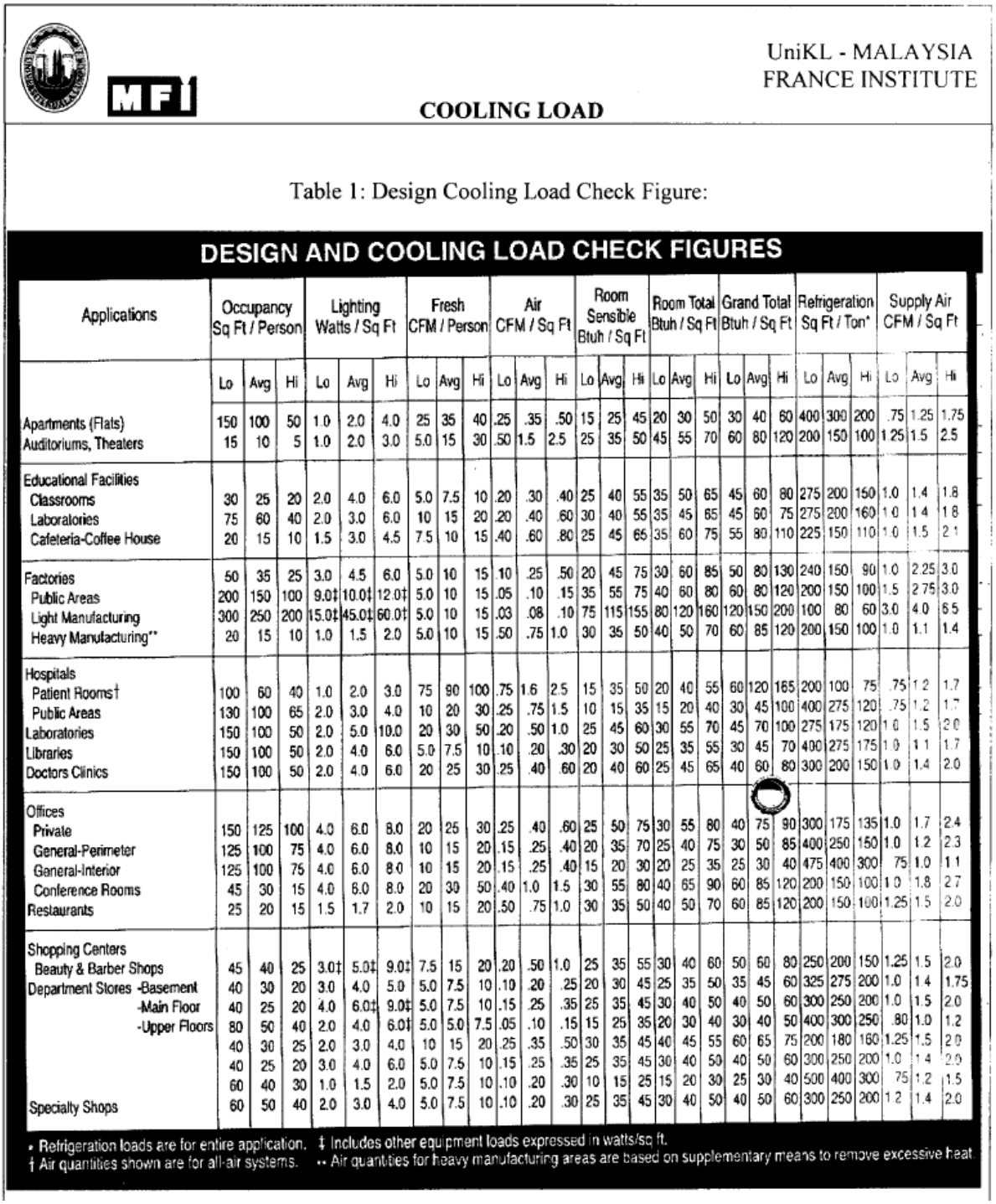
REMARKS:-

INSTRUMENT USED (Ref. No.)

* -Suction Pressure + Discharge Pressure ΔP Differential Pressure Fan No.

END OF QUESTION

Appendix 2



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COOLING LOAD

Table 1: Design Cooling Load Check Figure:

DESIGN AND COOLING LOAD CHECK FIGURES

Applications	Occupancy Sq Ft / Person			Lighting Watts / Sq Ft			Fresh CFM / Person			Air CFM / Sq Ft			Room Sensible Btuh / Sq Ft			Room Total Btuh / Sq Ft			Grand Total Btuh / Sq Ft			Refrigeration Sq Ft / Ton*			Supply Air CFM / Sq Ft		
	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi
Apartments (Flats)	150	100	50	1.0	2.0	4.0	25	35	40	.25	.35	.50	15	25	45	20	30	50	30	40	60	400	300	200	.75	1.25	1.75
Auditoriums, Theaters	15	10	5	1.0	2.0	3.0	5.0	15	30	.50	1.5	2.5	25	35	50	45	55	70	60	80	120	200	150	100	1.25	1.5	2.5
Educational Facilities																											
Classrooms	30	25	20	2.0	4.0	6.0	5.0	7.5	10	.20	.30	.40	25	40	55	35	50	65	45	60	80	275	200	150	1.0	1.4	1.8
Laboratories	75	60	40	2.0	3.0	6.0	10	15	20	.20	.40	.60	30	40	55	35	45	65	45	60	75	275	200	160	1.0	1.4	1.8
Cafeteria-Coffee House	20	15	10	1.5	3.0	4.5	7.5	10	15	.40	.60	.80	25	45	65	35	60	75	55	80	110	225	150	110	1.0	1.5	2.1
Factories	50	35	25	3.0	4.5	6.0	5.0	10	15	.10	.25	.50	20	45	75	30	60	85	50	80	130	240	150	90	1.0	2.25	3.0
Public Areas	200	150	100	9.0‡	10.0‡	12.0‡	5.0	10	15	.05	.10	.15	35	55	75	40	60	80	60	80	120	200	150	100	1.5	2.75	3.0
Light Manufacturing	300	250	200	15.0‡	45.0‡	60.0‡	5.0	10	15	.03	.08	.10	75	115	155	80	120	160	120	150	200	100	80	60	3.0	4.0	6.5
Heavy Manufacturing**	20	15	10	1.0	1.5	2.0	5.0	10	15	.50	.75	1.0	30	35	50	40	50	70	60	85	120	200	150	100	1.0	1.1	1.4
Hospitals																											
Patient Rooms†	100	60	40	1.0	2.0	3.0	75	90	100	.75	1.6	2.5	15	35	50	20	40	55	60	120	165	200	100	75	.75	1.2	1.7
Public Areas	130	100	65	2.0	3.0	4.0	10	20	30	.25	.75	1.5	10	15	35	15	20	40	30	45	100	400	275	120	.75	1.2	1.7
Laboratories	150	100	50	2.0	5.0	10.0	20	30	50	.20	.50	1.0	25	45	60	30	55	70	45	70	100	275	175	120	1.0	1.5	2.0
Libraries	150	100	50	2.0	4.0	6.0	5.0	7.5	10	.10	.20	.30	20	30	50	25	35	55	30	45	70	400	275	175	1.0	1.1	1.7
Doctors Clinics	150	100	50	2.0	4.0	6.0	20	25	30	.25	.40	.60	20	40	60	25	45	65	40	60	80	300	200	150	1.0	1.4	2.0
Offices																											
Private	150	125	100	4.0	6.0	8.0	20	25	30	.25	.40	.60	25	50	75	30	55	80	40	75	90	300	175	135	1.0	1.7	2.4
General-Perimeter	125	100	75	4.0	6.0	8.0	10	15	20	.15	.25	.40	20	35	70	25	40	75	30	50	85	400	250	150	1.0	1.2	2.3
General-Interior	125	100	75	4.0	6.0	8.0	10	15	20	.15	.25	.40	15	20	30	20	25	35	25	30	40	475	400	300	75	1.0	1.1
Conference Rooms	45	30	15	4.0	6.0	8.0	20	30	50	.40	1.0	1.5	30	55	80	40	65	90	60	85	120	200	150	100	1.0	1.8	2.7
Restaurants	25	20	15	1.5	1.7	2.0	10	15	20	.50	.75	1.0	30	35	50	40	50	70	60	85	120	200	150	100	1.25	1.5	2.0
Shopping Centers																											
Beauty & Barber Shops	45	40	25	3.0‡	5.0‡	9.0‡	7.5	15	20	.20	.50	1.0	25	35	55	30	40	60	50	60	80	250	200	150	1.25	1.5	2.0
Department Stores -Basement	40	30	20	3.0	4.0	5.0	5.0	7.5	10	.10	.20	.25	20	30	45	25	35	50	35	45	60	325	275	200	1.0	1.4	1.75
-Main Floor	40	25	20	4.0	6.0‡	9.0‡	5.0	7.5	10	.15	.25	.35	25	35	45	30	40	50	40	50	60	300	250	200	1.0	1.5	2.0
-Upper Floors	80	50	40	2.0	4.0	6.0‡	5.0	5.0	7.5	.05	.10	.15	15	25	35	20	30	40	30	40	50	400	300	250	.80	1.0	1.2
	40	30	25	2.0	3.0	4.0	10	15	20	.25	.35	.50	30	35	45	40	45	55	60	65	75	200	180	160	1.25	1.5	2.0
	40	25	20	3.0	4.0	6.0	5.0	7.5	10	.15	.25	.35	25	35	45	30	40	50	40	50	60	300	250	200	1.0	1.4	2.0
	60	40	30	1.0	1.5	2.0	5.0	7.5	10	.10	.20	.30	10	15	25	15	20	30	25	30	40	500	400	300	.75	1.2	1.5
Specialty Shops	60	50	40	2.0	3.0	4.0	5.0	7.5	10	.10	.20	.30	25	35	45	30	40	50	40	50	60	300	250	200	1.2	1.4	2.0

* Refrigeration loads are for entire application. ‡ Includes other equipment loads expressed in watts/sq ft.
† Air quantities shown are for all-air systems. ** Air quantities for heavy manufacturing areas are based on supplementary means to remove excessive heat