



**UNIVERSITI KUALA LUMPUR**  
**Malaysia France Institute**

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**FINAL EXAMINATION**  
**JANUARY 2011 SESSION**

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**SUBJECT CODE** : FCB 21002  
**SUBJECT TITLE** : DUCTING AND PIPING NETWORK  
**LEVEL** : BACHELOR DEGREE  
**TIME / DURATION** : 3.30pm - 6.00pm  
( 2 ½ HOURS )  
**DATE** : 12 MAY 2011

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**INSTRUCTIONS TO CANDIDATES**

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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 FIVE (5) questions. Answer ALL questions.
  5. Answer all questions in English.
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**THERE ARE 6 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.**

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**INSTRUCTION: Answer ALL questions.**  
**Please use the answer booklet provided.**

**Question 1**

Figure Q1 shows a Chinese Restaurant floor layout. There is an air handling unit (AHU) room next to Pantry 2 in the building. The air conditioning system installed for the building shall be the water-cooled package (WCP) system.

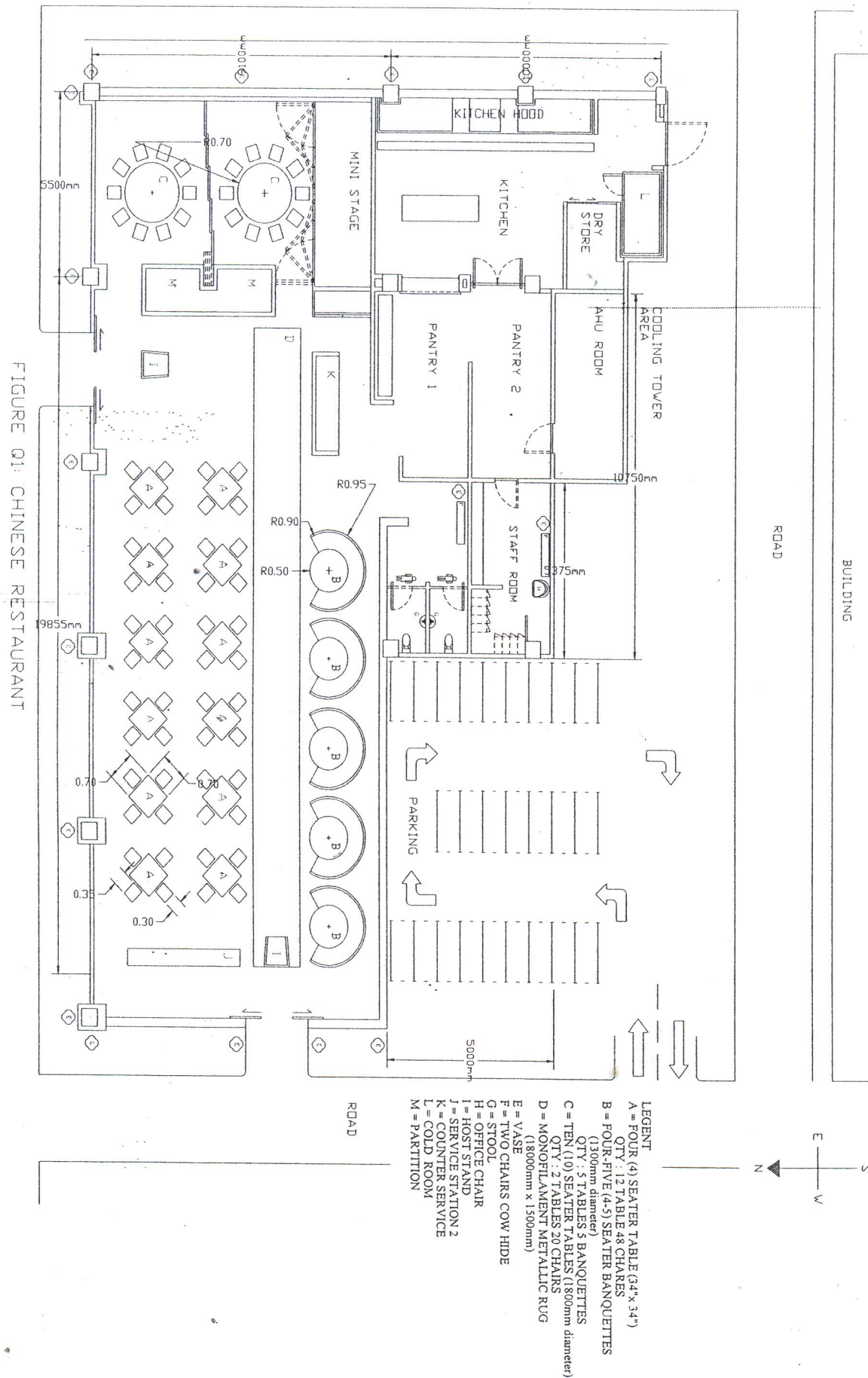
(a) Referring to attachment 1, estimate

- i. the total supply air and return air for each area for the whole floor.

(10 Marks)

- ii. the cooling capacity for each area for the whole floor.

(10 Marks)



**Question 2**

Based on your calculation in Question 1, sketch your proposed ducting layout in a single line diagram complete with duct dimensions and air diffusers location for the whole floor for its

(a) air conditioning system

(10 Marks)

(b) kitchen ventilation system.

(5 Marks)

(c) What type of fan that you would propose for the kitchen ventilation system? Justify your selection in terms of the features and advantages of the selected fan type.

(5 Marks)

**Question 3**

- (a) Based on your calculation in Question 1, sketch your proposed piping layout complete with pipe dimension in a single line diagram for the condenser water system.

(10 Marks)

- (b) Show typical connection for  
i. Water-cooled package unit

(5 Marks)

- ii. Condenser water pump

(5 Marks)

**Question 4**

Based on your proposed ducting and piping layout in Question 2 and 3,

- (a) Calculate the total external static pressure for the air conditioning ducting system in inch WG  
(8 Marks)
- (b) Select the correct water-cooled package unit model from the catalogue provided based on your calculation above.  
(2 Marks)
- (c) Calculate the total head for the condenser water system.  
(8 Marks)
- (d) Select the correct condenser water pump from the catalogue provided based on your calculation above.  
(2 Marks)



## Question 5

During testing and commissioning of the water-cooled package unit, 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) Analyze and comment on the system.

(14 Marks)

TITLE	TESTING AND COMMISSIONING
SYSTEM	RECORDS
Equipment/Ref	WATER-COOLED PACKAGE UNIT
Manufacturer	
Model / Serial	
Location	
Function	
Drawing Ref.	

## WATER-COOLED PACKAGE UNIT TEST SHEET

ITEM	DESCRIPTION	DESIGN	ACTUAL	REMARK
1	Fan Type	Centrifugal	Centrifugal	
2	Air Volume (L/s)	7,550	6,490	
3	Motor HP / RPM	15/1450	15/1452	
4	Motor Type	TEFC	TEFC	
5	Running Amp. / Ampere	18.5	17.5	
6	Full Load Amp. / Ampere	a	a	
7	Frame No.	b	b	
8	Volts / Phase / Hertz	415/3/50	415/3/50	
9	Blower Pulley, Inch	5.5	5.5	
10	Motor Pulley, Inch	4.5	4.5	
11	Belt Size / Qty	30/2	30/2	
12	Blower RPM	c	c	
ITEM	DESCRIPTION	YES	NO	REMARK
11	Check Primary Filter	/		
12	Check No Vibration Noise	/		
13	Check Thermostat	/		
14	Check Cooling Coil & Drainage	/		
15	Check BCMS Interlocking	/		

END OF QUESTION

## Attachment 1



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## COOLING LOAD

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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																											
Public Areas	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
Light Manufacturing	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
Heavy 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	5.5
	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	230	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.

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