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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FCB40102**
SUBJECT TITLE	:	**INDOOR AIR QUALITY**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**9.00 AM – 11.00 AM (2 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. **Drawings need to be returned with the answer booklet.**
5. **This question paper consists of ONE (1) section only. Answer ALL questions.**
6. **Answer all questions in English.**

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE AND APPENDIXES.

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

Appendix 1 shows the floor layout of a radioactive laboratory. The ceiling height is 12 ft. Each door dimension is 4 ft x 7 ft.

(a) Propose the relative room pressure for technologist room, physician room, air lock, post admin waiting area, radioactive lab and autoclave room.

(6 Marks)

(b) Based on your answer above, calculate the required airflow for technologist room, physician room, air lock, post admin waiting area, radioactive lab and autoclave room, including supply air, return air and exhaust air (if any).

(14 Marks)

Question 2

(a) Based on your answer in Question 1, determine whether the cascades pressure is guaranteed to each door opening for radioactive lab and air lock? (Assume room temperature is 15^{o}C)

(10 Marks)

(b) Based on your answer in Question 1, sketch the air distribution system for radioactive lab, autoclave room, technologist room, physician room, air lock and post admin waiting area. Show the amount of air for every supply air diffuser, return air grille and exhaust air grille (if any) in your sketch.

(10 Marks)

Question 3

(a) Based on your answer in Question 1 and 2, explain and sketch your monitoring system or devices for the room pressure in radioactive lab.

(7 Marks)

(b) Based on your answer in Question 1 and 2, estimate the leakage rate from air lock when the door to radioactive lab is opened.

(7 Marks)

(c) What are the conditions or specification that you would propose, in order to maintain the pressure in radioactive lab?

(6 Marks)

Question 4

There is a requirement to maintain the indoor climate, viz indoor dry bulb temperature and relative humidity at 22±1 ^{o}C and 55±5 % respectively, in radioactive lab.

(a) Sketch your control mechanism in order to maintain the indoor climate as mentioned above.

(6 Marks)

(b) Explain the working principle of your control mechanism above.

(6 Marks)

(c) What is your safety measure for your proposed control system? Explain the working principle of your safety measure.

(8 Marks)

Question 5

(a) The physician's office is laid with carpet. The physician usually faces the indoor air quality problem after the room is vacant for a period, especially after his long holiday. Analyze the situation and propose your remedy work (if any) to solve the problem.

(8 Marks)

(b) Sketch your proposed ACMV (Air Conditioning & Mechanical Ventilation) system for the Physician room in order to solve the above mentioned problem.

(12 Marks)

END OF QUESTION

Table 4-3 Engineering Data—High-Performance Dry-Media Filters (Corresponds to Efficiency Data of Figure 4-4)

Standard Size	Meter Inch	0.3 × 0.6 × 0.2 12 × 24 × 8		0.3 × 0.6 × 0.3 12 × 24 × 12		0.6 × 0.6 × 0.2 24 × 24 × 8		0.6 × 0.6 × 0.3 24 × 24 × 12		Pressure Loss	
Rated Capacity[a]		ft^3/min	m^3/s	ft^3/min	m^3/s	ft^3/min	m^3/s	ft^3/min	m^3/s	Inches of Water	Pa
Media Type	M-2A[b]	900	0.42	1025	0.48	1725	0.81	2000	0.94	0.15	37.4
	M-15	900	0.42	1025	0.48	1725	0.81	2000	0.94	0.35	87.2
	M-100	650	0.30	875	0.41	1325	0.62	1700	0.80	0.40	100.0
	M-200	450	0.21	630	0.29	920	0.43	1200	0.56	0.40	100.0
Effective filtering area		ft^2	m^2	ft^2	m^2	ft^2	m^2	ft^2	m^2		
All media types		14.5	1.35	20.8	1.93	29.0	2.69	41.7	3.87		

[a]Filters may be operated from 50 to 120 percent of the rated capacities with corresponding changes in pressure drop.

[b]The M-2A is available in 2-in. thickness and standard sizes with a nominal rating of 0.28 in. wg at 500 fpm face velocity.

APPENDIX 3

PROPERTIES OF AIR

TABLE E.1
Properties of air at standard atmospheric pressure

Temperature T (°C)	Density ρ (kg/m^3)	Specific Weight γ (N/m^3)	Dynamic Viscosity μ (Pa·s)	Kinematic Viscosity ν (m^2/s)
−40	1.514	14.85	1.51×10^{-5}	9.98×10^{-6}
−30	1.452	14.24	1.56×10^{-5}	1.08×10^{-5}
−20	1.394	13.67	1.62×10^{-5}	1.16×10^{-5}
−10	1.341	13.15	1.67×10^{-5}	1.24×10^{-5}
0	1.292	12.67	1.72×10^{-5}	1.33×10^{-5}
10	1.247	12.23	1.77×10^{-5}	1.42×10^{-5}
20	1.204	11.81	1.81×10^{-5}	1.51×10^{-5}
30	1.164	11.42	1.86×10^{-5}	1.60×10^{-5}
40	1.127	11.05	1.91×10^{-5}	1.69×10^{-5}
50	1.092	10.71	1.95×10^{-5}	1.79×10^{-5}
60	1.060	10.39	1.99×10^{-5}	1.89×10^{-5}
70	1.029	10.09	2.04×10^{-5}	1.99×10^{-5}
80	0.9995	9.802	2.09×10^{-5}	2.09×10^{-5}
90	0.9720	9.532	2.13×10^{-5}	2.19×10^{-5}
100	0.9459	9.277	2.17×10^{-5}	2.30×10^{-5}
110	0.9213	9.034	2.22×10^{-5}	2.40×10^{-5}
120	0.8978	8.805	2.26×10^{-5}	2.51×10^{-5}

Note: Properties of air for standard conditions at sea level are

Temperature	15°C
Pressure	101.325 kPa
Density	1.225 kg/m^3
Specific weight	12.01 N/m^3
Dynamic viscosity	1.789×10^{-5} Pa·s
Kinematic viscosity	1.46×10^{-5} m^2/s