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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FRD20702**
SUBJECT TITLE	:	**INTRODUCTION TO COLD ROOM**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**2.00 PM – 4.00 PM (2 HOURS)**
DATE	:	**10 JANUARY 2015**

INSTRUCTIONS TO CANDIDATES

1. **Please read the instructions given in the question paper CAREFULLY.**
2. **This question paper is printed on both sides of the paper.**
3. **Please write your answers on the answer booklet provided.**
4. **Answer should be written in blue or black ink except for sketching, graphic and illustration.**
5. **This question paper consists of TWO (2) sections. Section A and B. Answer ALL question in section A. For section B, answer TWO (2) questions only.**
6. **Answer all questions in English.**

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (60 MARKS)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

(a) Specify or write a temperature for common space and product of the following applications:

Applications	Common space or product temperature (^{o}C)
Air Conditioning	
High temperature refrigeration	
Medium temperature refrigeration	
Low temperature refrigeration	
Extra low temperature refrigeration	

(10 marks)

(b) List five (5) places where cold room and freezer room are used.

(5 marks)

Question 2

(a) State four (4) main components in a refrigeration system. (4 marks)

(b) State a function of each component in a refrigeration system.

(4 marks)

(c) Explain in details how the refrigeration system works. State the pressure and temperature changes within the process. Sketches are required.

(7 marks)

Question 3

There are some important features to consider for a cold store. Answer the following:

(a) Explain the following aspects in terms of causes and effects. Show your sketch if necessary.

(i) Air flow problem at evaporator because a fan motor faulty

(ii) Door left slightly open.

(10 marks)

(b) Suggest a correction method to the problems.

(i) Air flow problem at evaporator because a fan motor faulty

(ii) Door left slightly open.

(10 marks)

Question 4

There are many parts, materials and components which are used in cold room installation. Describe the function of the following:

(a) Pressure relief port (3 marks)

(b) Digital thermostat (3 marks)

(c) Heater safety control. (4 marks)

SECTION B (40 MARKS)

INSTRUCTION: Answer only TWO questions
Please use the answer booklet provided.

Question 5

100 kg of lean beef is to be cooled from 18 to 4°C, then frozen and cooled to −18°C. The moisture content is 69.5%, so the latent heat is estimated as 233 kJ/kg. Lean beef initial freezing point is – 2 ^{o}C. Specific heat of beef before freezing is as 3.52 kJ/(kg·K); after freezing, 2.12 kJ/(kg·K). Estimate the cooling load.

(20 marks)

Question 6

(a) Sketch to show the installation of P-trap for refrigeration piping.

(10 marks)

(b) Sketch to show one of the correct installations of multiple evaporators.

(10 marks)

Question 7

- Internal temperature = -18°C
- Ambient temperature = 30°C
- Internal dimension = 5m W x 6m L x 6m H
- Insulation thickness = 150mm
- Material = foam polyurethane
- External dimension = 5.3m W x 6.3m L x 6.3m H
- Product load = 10,000 kg chicken
- Specific Heat Above Freezing, 4.34 kJ/(kg·K)
- Specific Heat Below Freezing, 3.32 kJ/(kg·K)
- Initial Freezing Point, - 2.8 °C
- Latent heat of fusion of product, 220 kJ/kg

Using the information above and table Q7 below in the design of a cold room, calculate the following:

(a) Heat transmission through the walls

(10 marks)

(b) Product refrigeration load

(10 marks)

Table Q7: Insulation details

Typical Values :-
h_1 .....20 W/m²K (for normal wind exposure 3 to 5 m/s)
h_2 .....8 W/m²K
C_1 for brickwork 100 mm thick .....7.20 W/m²K
C_2 for concrete blocks 100 mm thick .....7.95 W/m²K
k for corkboard..... 0.042 W/mK (density 145 kg/m³)
k for expanded polystyrene.... 0.034 W/mK (density 25 kg/m³)
k for foamed polyurethane..... 0.026 W/mK (density 30 kg/m³)

For COLD ROOM calculations it is normal commercial practice to ignore the insulating value of air film coefficients and normal building materials, using only the thermal property of the insulating material.
Thus, in practice :- Q = A x k/x x T.D.

Suggested Relationship Between Thickness of Insulant and T.D.

Thickness of Insulation	Corkboard	Expanded Polystyrene	Foamed Polyurethane
50 mm	11 K TD	13 K TD	17 K TD
75 mm	16 K TD	19 K TD	25 K TD
100 mm	22 K TD	25 K TD	33 K TD
125 mm	27 K TD	32 K TD	42 K TD
150 mm	32 K TD	38 K TD up	50 K TD up
200 mm	43 K TD up	---	---

END OF QUESTION