



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
SEPTEMBER 2014 SESSION**

SUBJECT CODE : FRB40302
SUBJECT TITLE : BIOLOGICAL APPLICATION OF REFRIGERATION
LEVEL : BACHELOR
**TIME / DURATION : 2.00 PM – 4.00 PM
(2 HOURS)**
DATE : 07 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 questions paper consist ONE (1) section. Answer any FOUR (4) questions.**
- 6. Answer all questions in English.**

THERE ARE 3 PRINTED PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ANY FOUR (4) questions only
Please use the answer booklet provided.

Question 1

In a food factory, cleanliness of machines and production area is important. Bacteria contamination on raw material and production equipment should be avoided to reduce food-borne related disease. Bacteria could reproduced and form a biofilm in the area which is not properly cleaned. Answer the following questions:

- a) Discuss SIX (6) methods that could lead to cross contamination. (12 marks)
- b) Discuss FOUR (4) steps that could be taken to reduce the risk of food cross contamination (8 marks)
- c) Define the bacteria biofilm. Give THREE (3) reasons why it is more difficult to eliminate bacteria in biofilm. (5 marks)

Question 2

Onion, banana and beef are to be transported to a city (1000 km away) using a refrigerated container. You are the technical advisor who is responsible on the design of this refrigerated container.

- a) Discuss and justify FIVE (5) aspects that need to be considered in the design process of this refrigerated container. (15 marks)
- b) Sketch and explain the likely design of your refrigerated container. (10 marks)

Question 3

Bacteria are one of the microorganisms that can cause contamination in food industries. Reproduction rate of bacteria can be controlled through some mechanisms including controlling the food temperature. Answer the following questions:

- a) With aid of a sketch, explain the phases of bacteria growth rate against time
(10 marks)
- b) Explains FIVE (5) methods of controlling the bacteria growth rate.
(15 marks)

Question 4

Freezing is a process that is important in food preservation. Answer the following question:

- a) Sketch and explain the typical temperature curves in freezing process. Your sketch should include thermal centre, surface, mean and air temperatures.
(5 marks)
- b) Discuss THREE (3) factors that determine the time required for freezing. You may use a sketch in your explanation.
(15 marks)
- c) Rate of freezing can be calculated using Equation 1.

$$\frac{dr}{dt} = - \frac{T_{cc} - T_m}{\frac{\rho \Delta H}{k} + \frac{1}{h}} \quad \text{Equation 1}$$

Discuss THREE (3) parameters in Equation 1 that may important in freezing process.

(5 marks)

Question 5

Evaporation of water could increase the rate of cooling of food. However, this is not favourable since it may reduce the mass of a product. Answer the following questions:

- a) Explain THREE(3) types of cooling technology that may lead to loss of water through evaporation
(6 marks)
- b) Discuss THREE(3) methods that may avoid an excessive loss of water through evaporation
(6 marks)
- c) Calculate the mass of evaporated water to reduce the temperature of a 20 kg meat by 1 Kelvin if its specific heat is 3.5 kJ/kgK. You may take the latent heat of evaporation of water as 2400 kJ/kg. Comment on the feasibility of this method in meat freezing.
(8 marks)
- d) It is suggested that a thin (~ 5 mm thickness) fish fillet is to be cooled using
- vacuum cooling
 - cryogenic cooling

Evaluate ONE (1) advantage and ONE (1) disadvantage of these technologies in this application

(5 marks)

END OF QUESTION