The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc Degree Programme

Department	: Chemistry
Level	: 5
Name of the Examination	: Final Examination
Course Title and - Code	: **CYU5307 (Chemical Aspects of Food Industry)**
Academic Year	: 2020/2021
Date	: 02/04/2022
Time	: 1.30 p.m to 3.30 p.m
Duration	: 2 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Four (4)** questions in **six (6)** pages.
3. Answer **all four (4)** questions. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary
6. Involvement in any activity that is considered as an exam offense will lead to punishment
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script
9. Use of non-programmable calculators will be allowed.
10. Mobile phones and other electronic equipment are not allowed. Switch off and leave them outside.

(1) Answer **either** (I) **or** (II) from PART A and answer **both** (III) **and** (IV) from PART B.

PART A (Answer either I OR II)

(I) (i) The phenomenon of crystallization of sugar (sucrose) is desirable in certain food industries and undesirable in some other food industries.

(a) Name two monosaccharides formed by hydrolysis of sucrose.

(04 Marks)

(b) Give an example of one (01) food industry where crystallization of sucrose is desirable.

(08 Marks)

(c) Give an example of one (01) food industry where crystallization of sucrose is undesirable.

(08 Marks)

(d) A method to avoid the crystallization of sugar is by preparing invert sugar in the above industries you mentioned in Q (I)(c) above. Explain this statement.

(10 Marks)

(ii) "The moisture content of a food is a function of keeping quality of food" Explain this statement.

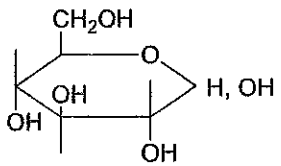
(10 Marks)

(II) (i) Cellulose is a homopolysaccharide and is found as fibers in fruits and vegetables.

(a) What are homopolysaccharides?

(05 Marks)

(b) Draw the chemical structure of cellulose showing their glycosidic linkages, given the structure (Haworth projection formulae) of D-glucose as shown below.



D-glucose

(12 Marks)

(c) Name the principal chemical component present in pectin. (05 Marks)

(d) In the commercial applications of pectin, in the food industry, fruits rich in pectic substances form a gel when boiled in water. Explain how the rate of setting of the gel directly depends on the degree of methylation of pectin?

(08 Marks)

(ii) Sorbitol can be used commonly as a humectant to improve the shelf life of food. What are humectants? What is the role of humectants in improving the shelf life of food? (10 Marks)

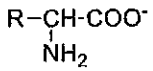
PART B (Answer Both III AND IV)

(III) Milk is an excellent source of proteins and carbohydrates.

(a) Name the main carbohydrate and the main protein present in milk? (05 Marks)

(b) Isoelectric precipitation of milk protein during Yoghurt manufacturing is one of its uses in the food industry.

Assuming that the structure of milk protein is based on,

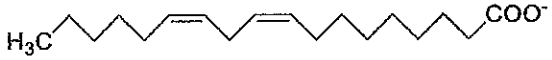


and that milk has a pH of about 6.6 and isoelectric point of milk protein is approximately 4.6, explain with the aid of relevant structures corresponding to changes in the pH values, the isoelectric precipitation process of milk protein in the yoghurt industry. (10 Marks)

Hydrogenation is frequently used in the chemical modification process of oils and fats.

(c) What is meant by hydrogenation of oil? (05 Marks)

(d) Partial hydrogenation of Linoleic acid (C18:2) gives trans-C18:1 (n-8) as the most abundant product. Sketch its structure and explain its health effects, given that the structure of Linoleic acid is.



(10 Marks)

(IV) Enzyme activity varies with different factors, and they play an important role in the food industry.

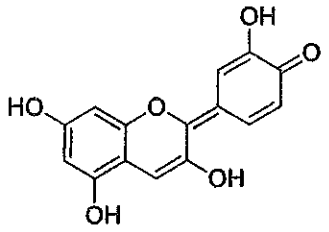
(a) Name four (04) factors affecting the enzymatic activity. (04 Marks)

(b) "Enzymes play an important role in the bread making industry" Explain this statement. (06 Marks)

Different colors of fruits and vegetables are due to the natural pigments present in them.

(c) Name three (03) major groups of natural pigments in food. Give one (01) example for each type. (06 Marks)

(d) Anthocyanins are purple in color in the neutral medium. However, they turn red in acidic medium and blue in alkaline medium.
Give possible structures of anthocyanins in acidic and alkaline media. Given that the structure of anthocyanins in neutral medium is,



(08 Marks)

(e) Briefly explain the conditions that the food industry should satisfy when using polyvinyl chloride (PVC) as a food packaging material.

(06 Marks)

(2)

(I)

(a) The colour of fresh raw meat is bright red and the colour of cooked meat appears brown in colour. Explain the reason for this colour change.

(10 marks)

(b) What is the reason for the characteristic light pink colour of bacon, which remains even after cooking?

(10 marks)

(c) Write down 4 changes that take place during ageing of meat.

(08 marks)

(II)

(a) Briefly explain the foam formation property of eggs.

(10 marks)

(b) Write down 5 changes that could occur on heating of milk?

(10 marks)

(c) Briefly explain how smoking is important for the preservation and quality of fish.

(21marks)

(III)

(a) What is meant by parboiling rice? Write down 3 advantages of parboiled rice than raw rice.

(09 marks)

(b) Explain the role of flour and water in the bread making process.

(10 marks)

(c) Write down 3 changes that take place during the fermentation step in the yogurt manufacturing process.

(12 marks)

(3) (I) Food Act No. 26 of 1980 was published in the Government gazette on 25th July 1980.

(i) Briefly explain what the main provisions of the Part II of the Food Act deals with. (10 Marks)

(ii) Define the functions of Food Advisory committee (FAC). (10 Marks)

(iii) Explain briefly the necessary actions that have to be taken by the relevant authorities in the case of any violation of Food Regulation with respect to low quality products, starting from the collection of formal samples from the vendor to the taking of legal action. (20 Marks)

(II) (i) Define the term Good Hygienic Practices (GHP). (10 Marks)

(ii) Food safety is assured by GHP and normally the food produced under GHP is safe. Give three (03) ways of preventing food borne diseases due to consumption of food. (15 Marks)

(III) (i) What is Hazard Analysis Critical Control Points (HACCP)? Why should every food processing company use the HACCP system? (15 Marks)

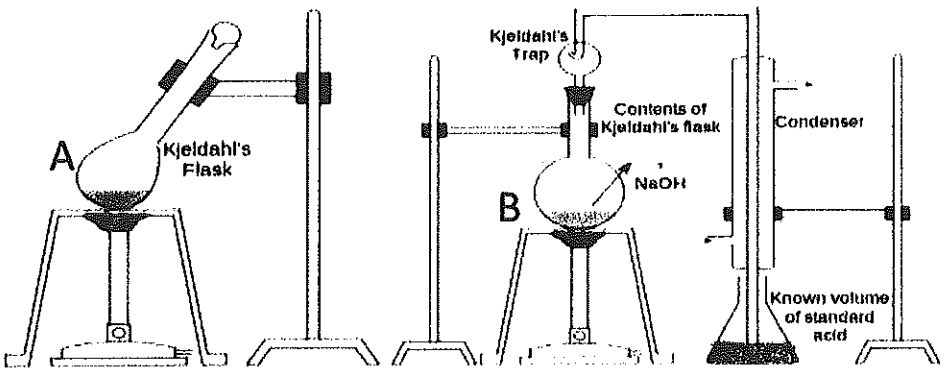
(ii) Give four (04) possible requirements that a food processing company must take to satisfy HACCP. (20 Marks)

(4)

A student in your laboratory analyzed a cheese sample for proximate analysis with different techniques, and the data he obtained were gathered as given below.

	Initial weight of the cheese sample/g		Weight after drying or evaporation of solvent/g		Volume of 0.1 M HCl used for the titration/mL		
	Replicate 1	Replicate 2	Replicate 1	Replicate 2	Blank	Replicate 1	Replicate 2
Moisture analysis (Oven drying method)	2.005	2.015	1.078	1.092			
Fat analysis (Rose-Gottlieb method)	2.005	2.015	0.49	0.54			
Protein analysis (Kjeldahl method)	2.132	1.986			0.08	16.20	15.80

(i) Kjeldahl method is the widely used method for the determination of protein content in a food sample. The technician used the following apparatus for the determination of protein in cheese.



(a) Name the three major steps involved in the Kjeldahl method.

(15 marks)

(b) What are the contents added to flask A?

(10 marks)

(c) Briefly explain what happens to carbon, hydrogen, and protein nitrogen in the contents of flask A during analysis.

(15 marks)

(d) What is the disadvantage of using the Kjeldahl method in protein analysis for a given sample.

(05 marks)

(e) Calculate % of protein of the cheese sample on a wet basis (The conversion factor is 6.25).

(15 marks)

(ii) The Rose-Gottlieb method is used to analyze fat in the cheese sample. The extraction of fat was carried out with a mixture of ethyl ether and petroleum ether in the presence of a concentrated solution of ammonia and ethyl alcohol.

(a) Explain the use of ethyl alcohol and petroleum ether in the Rose-Gottlieb method

(10 marks)

(b) Calculate % of the fat of the cheese sample on a dry and wet basis.

(10 marks)

(c) Which instrumental method could be employed to identify and quantify the different types of fatty acids in a given sample of oil?

(05 marks)

(iii) Another student in your laboratory wants to use the Dean & Stark distillation method to determine moisture in the Cheese sample. He will use ethanol (boiling point = 78° C) as the solvent in the Dean & Stark distillation method. Comment whether his choice of solvent is suitable for the analysis giving reasons.

(15 marks)