THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS - 2022

FOOD TECHNOLOGY - THIRD YEAR DEGREE

FT 312 FOOD QUALITY ASSURANCE

TUESDAY 07 TH JUNE, 2022– 12:50 P.M.

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES:

1. You have 10 minutes to read the paper. You must not begin writing in the answer book during this time.

2. **ANSWER ALL QUESTIONS**

3. All answers must be written in the answer books provided.

4. Write your name and number clearly on the front page. Do it now.

5. Calculators are permitted in the examination room. Notes and textbooks are not allowed.

6. Show all workings and calculations in the answer book.

MARKING SCHEME

QUESTION 1	[16 MARKS]
QUESTION 2	[14 MARKS]
QUESTION 3	[20 MARKS]
QUESTION 4	[12½ MARKS]
QUESTION 5	[14½ MARKS]
QUESTION 6	[23 MARKS]

ANSWER ALL QUESTIONS

1. (a) Define 'sensory evaluation'. Why is it used in the analysis of food products? [5 marks]

   (b) Differentiate between the terms orthonasal and retronasal. [2 marks]

   (c) List any THREE common characteristics of compounds contributing to sense of taste or sense of smell. [3 marks]

   (d) What are the two classes of sense? Discuss. [3 marks]

   (e) A triangle test was carried out to determine if there was a perceptible difference in the bitterness of a new soft-drink spiked with increased amount of quinine. A total of 15 trained judges were engaged in the experiment. A critical value of 9 judges was required to ascertain a significant difference in the sample. About 11 judges correctly identified the sample.

   Comment if there was any significant difference in the new product due to high amount of quinine and whether or not the NULL Hypothesis should be accepted. [3 marks]

   (Total = 16 marks)

2. You have developed a new fruit juice product and you wish to know if the ascorbic acid added as a dietary supplement, suppresses the pineapple flavour of the new product.

   (a) Discuss the suitable sensory class of method you would use and why. [2 marks]

   (b) Explain the type of panellists and the total number required for the class of method in question 2(a). [5 marks]

   (c) Discuss how you would set-up the experiment to minimise biasing and any distraction, and to achieve as accurate result as possible. [7 marks]

   (Total = 14 marks)

3. (a) You are presented with a number of unknown samples and are asked to identify the aromatic compounds in each sample by sniffing. Outline the sequence of perception process through your nose. [5 marks]

   (b) Describe 'taste bud' with the aid of a diagram. [5 marks]

(c) Describe ANY TWO of the following: [10 marks]

(i) Sourness.
(ii) Saltiness.
(iii) Umami Taste.
(iv) How the sweetness of natural sweetener is conferred as the food material comes into contact with the tongue.

(Total = 20 marks)

4. (a) Define the following:

(i) Quality. [½ mark]
(ii) Food quality. [½ mark]
(iii) Defects. [½ mark]

(b) Explain the term 'process'. [2 marks]

(c) Differentiate between the following:

(i) Quality control and Quality assurance. [1 mark]
(ii) Quality of design and Quality of conformance. [1 mark]
(iii) Common causes of variation and Special causes of variation using two features only. [2 marks]

(d) Musmus Tuna Cannery was taken to court by disgruntle customers after they fell ill from consuming its products produced on the 28.10.20. Internal investigation revealed that two retorts were faulty in the morning shift of that day so did not heat-sterilize the can products thoroughly. The investigation further revealed that the retorts have not been maintained for a while because there was no trained operator on the ground and also there was no funds to hire a consultant to perform periodic maintenance and verification tests on the retorts. The company decided it was too expensive to budget for such costs.

(i) Correctly categorise each issue under correct 'cost of quality' which the Musmus Tuna Company failed to budget for. [4 marks]
(ii) Comment on the type of the 'cause of variation' in question 4(d). [1 mark]

(Total = 12½ marks)

5. (a) (i) Discuss the evolution of quality management from middle ages to 1950s. [5 marks]
(ii) What were Walter Shewhart's and Kaoru Ishikawa's most significant contributions to quality? [3 marks]

(b) Following are important concepts and methods of quality. Select ANY ONE and write notes on: [5 marks]

(i) Taguchi's Loss Function.
(ii) Six-Sigma.
(iii) Design of Experiments.

(c) Define the following terms:

(i) Control chart. [½ mark]
(ii) Action limits. [½ mark]
(iii) Warning limits'. [½ mark]

(Total = 14½ marks)

6. The following table gives the average net weight in grams for each of the15 samples of 5 *maggie* noodles. The range of each sample is also given.

Sample Number	**Mean ($\bar{X}$)**	**Range (R)**
1	87	2
2	89	2
3	86	3
4	88	3
5	85	3
6	85	0
7	84	1
8	83	1
9	82	1
10	84	2
11	83	1
12	87	4
13	85	2
14	82	3
15	85	3
Total	**1,275**	**31**
Mean	**85.0**	**2.07**

(a) Calculate the control limits for mean chart. Limit your calculations to one decimal place. [4 marks]

(b) Plot the mean chart using data from the table. [3 marks]

(c) Comment on any significant changes or patterns on the chart. [9 marks]

(d) Given a specification of 85 $\pm$2 gram, calculate the C_p and C_{pk} and comment on the capability of the process. [5 marks]

(e) Assuming the weights of *maggie* noodles were normally distributed, what

percentage of the noodles would have their weights outside the specification limits when the process was under control at the levels indicated by the data given? Take the z-value to be 2.25 and its corresponding p-value to be 0.987776 at upper specification limit, and assuming the p-value at lower specification limit to be negligible. [2 marks]

(Total = 23 marks)

Useful Data

(1) $C_p = \frac{USL - LSL}{6\sigma}$ (USL = Upper specification limit, LSL = Lower specification limit)

(2) C_{pk} = the smaller of $\frac{USL - \mu}{3\sigma}$ or $\frac{\mu - LSL}{3\sigma}$

(3) *Grand Mean,* $\bar{\bar{X}} = \frac{\sum \bar{X}_i}{k}$ $\bar{X}i$ = mean of i^{th} subgroup

k = No. of samples

(4) *Mean Range,* $\bar{R} = \frac{\sum R_i}{k}$: Ri = range of i^{th} subgroup

(5) $\sigma = \frac{\bar{R}}{d_n}$ or $\frac{\bar{R}}{d_2}$ Where $d_2 = 2.326$

(6) **Mean Charts**

(i) Action Lines at $\bar{\bar{X}} \pm \frac{3\sigma}{\sqrt{n}}$

(ii) Warning Lines at $\bar{\bar{X}} \pm \frac{2\sigma}{\sqrt{n}}$

(7) **Range Charts**

(i) Action Lines at Upper = $D'_{0.001}\bar{R}$ or $D_{0.001}\sigma$ Where $D'_{0.001} = 2.34$, $D_{0.001} = 5.45$
Lower = $D'_{0.999}\bar{R}$ or $D_{0.999}\sigma$ Where $D'_{0.999} = 0.16$, $D_{0.999} = 0.37$

(ii) Warning Lines at Upper = $D'_{0.025}\bar{R}$ or $D_{0.025}\sigma$ Where $D'_{0.025} = 1.81$, $D_{0.025} = 4.20$
Lower = $D'_{0.975}\bar{R}$ or $D_{0.975}\sigma$ Where $D'_{0.975} = 0.37$, $D_{0.975} = 0.85$

(8) $z = \frac{X - \mu}{\sigma}$ Where X = USL or LSL, z = gives indication of proportion