THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

FIRST SEMESTER EXAMINATIONS - 2021

FOOD TECHNOLOGY - THIRD YEAR DEGREE

FT 312 QUALITY ASSURANCE

TUESDAY 15TH JUNE, 2021– 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 [22 MARKS]
QUESTION 2 [20 MARKS]
QUESTION 3 [8 MARKS]
QUESTION 4 [15 MARKS]
QUESTION 5 [22 MARKS]
QUESTION 6 [13 MARKS]

ANSWER ALL QUESTIONS

1. (a) Write Short notes on ANY TWO of the following: [8 marks]

(i) Sour taste.
(ii) Sweet taste.
(iii) Umami taste.

(b) There are three important requirements for sensory testing as listed. Write notes on ANY ONE. [4 marks]

(i) Assessors.
(ii) Samples.
(iii) Test environment.

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

(d) Define the term 'sensory evaluation' and its importance. [3 marks]

(e) Because human senses are used as instruments for measuring, they are subjected to both psychological and physiological factors. Describe ANY ONE physcological factor or physiological factor. [2 marks]

(Total = 22 marks)

2. (a) The aromatic compounds are formed by a number of methods. Discuss ANY TWO. [4marks]

(b) Discuss how 'bitter taste' is conferred. [5 marks]

(c) With the aid of a diagram, indicate the different types of: [6 marks]

(i) Taste which can be detected by taste buds on tongue.
(ii) Nerve cells involve in perception on tongue.

(d) Differentiate between orthonasal and retronasal. [1 mark]

(e) Discuss the term 'Chemisthesis' with at least TWO examples. [4 marks]

(Total = 20 marks)

3. (a) When planning for a sensory project an assessor will need to consider a number of factors. Name and describe at least TWO of these factors. [6 marks]

(b) Name all the papillae. [2 marks]

(Total marks = 8 marks)

4. (a) Define the following terms: [4 marks]

(i) Process.
(ii) Food Quality.
(iii) Quality Control.
(iv) Quality Assurance.

(b) Discuss the evolution of 'Quality Management' from 1940s to 1950s. [2 marks]

(c) Write short notes on ANY TWO of the following: [8 marks]

(i) Taguchi's loss function.
(ii) Six-sigma.
(iii) Quality Circle.

(d) State the significance of ANY ONE the following: [1 mark]

(i) 'Design of experiments' (DOE).
(ii) Central Limit theorem.

(Total marks= 15 marks)

5. The table below gives the average packet weight of biscuits in grams (g). For each of the 10 sample, 5 biscuits were used. The range is also given. Give all answers to 2 d.p.

Sample number	Mean (X)	Range (R)
1	149.5	13.0
2	146.5	14.0
3	148.0	3.0
4	152.3	12.0
5	153.5	10.0
6	144.3	6.0
7	145.3	20.0
8	148.3	11.0
9	149.3	7.0
10	150.0	10.0
Total	**1487**	**106**
Mean	**148.7**	**10.6**

(a) Calculate the control limits for mean and range charts. [8 marks]

(b) Plot the mean and range charts using data from the table. [4 marks]

(c) Comment on any significant changes or trend on the charts. [4 marks]

(d) Given a specification of 150 ± 3 grams, calculate the C_p and the C_{pk} and comment on the capability of the process. [4 marks]

(e) Assuming the packet weights are normally distributed, what percentage of the biscuit would have their weights outside the specification limits when the process is under control at the levels indicated by the data given. Take the z-value to be 0.94 and its corresponding p-value to be 0.81854 at upper specification limit, and assuming the p-value at lower specification limit to be negligible. [2 marks]

(Total marks = 22 marks)

6. (a) Under the cost of quality discuss the possible costs under ANY TWO of the following: [4 marks]

(i) Prevention Cost.
(ii) Appraisal Cost.
(iii) Internal Failure Cost

(b) Write short notes on ANY ONE of the following: [5 marks]

(i) Pareto Chart.
(ii) Ishikawa Fishbone.

(c) With the aid of a diagram explain the relationship between 'precision' and 'accuracy' if the performance of the process is 'accurate but not precise.' [4 marks]

(Total marks= 13 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. o 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 = $D'_{0.001}$ R or $D_{0.001}\sigma$ Where $D'_{0.001} = 2.34$, $D_{0.001} = 5.45$

Lower = $D'_{0.999}$ R or $D_{0.999}\sigma$ Where $D'_{0.999} = 0.16$, $D_{0.999} = 0.37$

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

Lower = $D'_{0.975}$ 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