



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF APPLIED BIOLOGY AND BIOCHEMISTRY

BACHELOR OF SCIENCE HONOURS DEGREE

THEORY: PRINCIPLES OF QUALITY ASSURANCE SBB 2211

AUGUST 2009

3 HOURS (100 MARKS)

INSTRUCTIONS

Answer Four (4) Questions. Each question carries 25 marks. Where a question contains subdivisions, the mark value for each subdivision is given in brackets. Illustrate your answer where appropriate with large, clearly labeled diagrams. Use attached table of Areas under Normal Curve to solve Question 2c. Graph paper will be provided by the invigilator on request.

1. Explain the concept of HACCP, and demonstrate its application in the production of a named food item.
- 2.(a) A random sample of 100 cans of baked beans taken from a batch had the following weights in grams.

Exceeding	Not exceeding	Frequency in sample
203.4	203.8	2
203.8	204.2	7
204.2	204.6	13
204.6	205.0	18
205.0	205.4	22
205.4	205.8	17
205.8	206.2	14
206.2	206.6	6
206.6	207.0	1

- (i) Plot the frequency distribution curve for this sample. (6 marks)
 - (ii) Deduce the distribution pattern of the weights from the shape of the curve. (2 marks)
- (b) Four readings of the thickness of packaging material are 0.076 mm, 0.082 mm, 0.073 mm and 0.077 mm. Determine the sample standard deviation. (6 marks)
- (c) The population mean of a company's product is 9.07 kg, with a population standard deviation of 0.40 kg. If the distribution is normal, determine,
- (i) The percentage less than 8.30 kg. (5 marks)
 - (ii) The percentage greater than 10 kg. (6 marks)

Note: $Z = \frac{X_i - \mu}{\sigma}$

3.(a) A sampling plan is said to have an AQL of 0.6% at 5% producer's risk, and an LTDP of 4% at 10% consumer risk. Explain the meaning of these terms. (8 marks)

(b) Using this sampling plan, state the probability of accepting a batch containing

(i) 0.6% defectives (3 marks)

(ii) 4% defectives (3 marks)

(c) What are the effects of increased sample size and increased acceptance number on an operating characteristic curve? (5 marks)

(d) Outline the differences between single, double and multiple sampling plans. (6 marks)

4.(a) A project team is studying the downtime cost of a soft drink bottling line. Data analysis in thousands of dollars for a 3 month period are:

Back pressure regulator	30
Adjust feed worm	15
Jam copper head	6
Lost cooling	52
Valve replacement	8
Other	5

Construct a pareto diagram and comment on the action required to reduce downtime in this production line. (9 marks)

(b) Outline briefly, the elements that contribute to quality costs in a production process. (10 marks)

(c) Describe, with examples where necessary, three main categories of defects used within a quality system. (6 marks)

5.(a) Define and differentiate between the terms **variable** and **attribute**. Give two practical examples of each. (10 marks)

(b) A machine is set to produce nails of 12.05 mm diameter. Samples of four pieces were taken from among the last made at intervals of 15 minutes, with the following results.

Sample No.									
1	2	3	4	5	6	7	8	9	10
12.05	12.06	12.05	12.06	12.08	12.08	12.10	12.09	12.10	12.10
12.06	12.06	12.06	12.07	12.07	12.09	12.09	12.08	12.09	12.11
12.05	12.05	12.07	12.08	12.08	12.09	12.07	12.10	12.11	12.12
12.04	12.05	12.07	12.06	12.07	12.07	12.09	12.11	12.11	12.11

Plot the above data on an x bar and standard deviation quality control chart and comment on them with regard to process capability of the machine. Use 12.05 mm as the grand mean.

(15 marks)

SPECIAL CHARTING FACTORS FOR VARIABLE CONTROL CHARTS

Sample size	A ₂	A ₃	B ₃	B ₄	D ₃	D ₄
2	1.880	2.659	0	3.267	0	3.267
3	1.023	1.954	0	2.568	0	2.574
4	0.729	1.628	0	2.266	0	2.282
5	0.577	1.427	0	2.089	0	2.115

6.(a) An employment agency monitoring employee absences on a daily basis, over a two week period, compiled the following percentage figures:

5.1, 6.0, 4.3, 5.2, 5.1, 6.0, 5.4, 4.9, 5.1, 5.6, 5.2, 4.7, 5.1, 6.0

From these figures calculate the:

- (i) Mean (3 marks)
- (ii) Median (2 marks)
- (iii) Mode (2 marks)
- (iii) Range (2 marks)

(b) Sketch the following curves

- (i) Normal (2 marks)
- (ii) Positively skewed (2 marks)
- (iii) Negatively skewed (2 marks)

(c) Distinguish between common and special cause variation in a process giving two examples of probable causes of each.

(10 marks)

END OF EXAMINATION



