



UNIVERSITY OF GHANA

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**BSC. ENGINEERING FIRST SEMESTER EXAMINATIONS: 2018/2019**

**DEPARTMENT OF FOOD PROCESS ENGINEERING**

**FPEN 407: STATISTICAL QUALITY CONTROL IN FOOD PROCESSING  
(2 Credits)**

**INSTRUCTIONS:**

**ANSWER QUESTION ONE AND ANY OTHER THREE QUESTIONS.**

**GRAPH SHEETS AND STATISTICAL TABLES ARE AVAILABLE AS NEEDED.**

**TIME ALLOWED: *TWO (2) HOURS***

1. ESCA Biscuits Co. Ltd has been struggling with multiple quality issues on its chocolate wafer line including inconsistent net weight, uneven enrobing of chocolate on wafer and missing wafers. As the in-house Quality Engineer, you have been tasked with implementing a process improvement using the varied tools and techniques available under Statistical Process Control. Explain in detail how you will achieve this task (include specifics on any tool or technique that you might consider using).
2. The Milk-20 Company purchases 1,000 packaging pouches every month from local vendors to be used in its packaging process. The QA Department is responsible for inspecting the incoming pouches and accepting or rejecting the lot. The QA Dept. needs advice on selecting the most ideal sampling plan for the inspection process from the following options:
  - (i) Inspect 15 randomly selected pouches, accept if max 2 pouches are defective.
  - (ii) Inspect 15 randomly selected pouches, accept if max 3 pouches are defective.
  - (iii) Inspect 15 randomly selected pouches, accept if max 4 pouches are defective.
  - a. Determine the probability of accepting lots with 1%, 5%, 10%, 15%, 20%, 25%, 30% and 40% defects under each sampling plan.
  - b. Draw Operating Characteristics (OC) curves for each of the three (3) sampling plans in (a) above.
  - c. Explain the effect of varying the acceptance number on the probability of acceptance of a lot. Advise the QA Dept. on the best option for sampling.
3.
  - a. Explain the different categories of the cost of quality.
  - b. Differentiate between the following (use examples where relevant)

- i. Specification limits and control limits
- ii.  $\alpha$  and  $\beta$  risk
- iii. Causes of variation
- iv. Non-conforming units and non-conformities
- v. Quality Assurance and Quality Control

4. The Fraiche Juice Company is evaluating the process capability of their filling processes for pineapple juice. The process is designed to fill 300ml of pineapple juice with an upper specification limit of 325 ml and a lower specification limit of 275ml. The following table provides the details for three (3) filling lines; AA245, BB318 and CC816, for a random sample of 30 bottles.

Filling Line	Average Net Volume (ml)	Standard Deviation
AA245	293	6.4
BB318	316	9.0
CC816	300	4.8

- a. Calculate the process capability indices,  $C_p$  and  $C_{pk}$  for each line.
  - b. Which of the filling lines is capable of meeting design specifications? Explain your answer.
5. The following data on net content were collected for the 300g can Gold Blend Coffee production process. Use the data to:
- a. Develop a mean control chart for the data.
  - b. Develop a range control chart for the data.
  - c. What conclusions can be made about the quality of the production process? Comment briefly on the two charts.

Sample	Net content (g)				
	1	2	3	4	5
1	305	308	307	311	311
2	313	307	303	310	310
3	306	304	312	311	310
4	309	308	309	309	307
5	310	306	306	307	308
6	308	310	315	303	306
7	306	306	308	310	308
8	311	308	307	307	307
9	309	309	308	307	309
10	306	311	307	309	307