JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DIPLOMA IN APPLIED STATISTICS

2ND YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR MAIN CAMPUS

COURSE CODE: WAB 2218

COURSE TITLE: IMPROVEMENT OF PROCESS QUALITY

EXAM VENUE: **STREAM:**

DATE: **EXAM SESSION:**

TIME: 2.00 HOURS

Instructions:

1. **Answer question one (compulsory) and any other two questions.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Question 1 [30 marks]

a) List three major advantages of adopting statistical process control (SPC) in a production environment. (2 Marks)

b) Define the concept of statistical process control (2 Marks)

c) Define the term process quality characteristics and explain the difference between attributes and variables. (3 Marks)

d) Explain the purpose of using checklists in the context of quality management and process improvement. (3 Marks)

e) List and describe two key methods for collecting quality control data in a manufacturing process (4 Marks)

f) When monitoring quality in a manufacturing process, data can be classified as either discrete or continuous. How would you distinguish between these two types of data in terms of their application in quality control? (4 Marks)

g) A factory manufactures gears with a target diameter of 15 mm and a standard deviation of 0.2 mm. A sample of 40 gears yields an average diameter of 15.1 mm. Is the manufacturing process in control based on this sample? Justify your answer. (5 Marks)

h) Define a multiple sampling plan and outline two scenarios where it offers advantages over a single sampling plan. (5 Marks)

i) A bakery must maintain bread at a temperature between 50°C and 65°C during delivery. If the process managing the bread temperature has a mean of 53°C and a standard deviation of 1.5°C, compute the process capability index (Cp) and interpret its meaning. (5 Marks)

j) Explain the difference between Conformance and Durability (2 Marks)

Question 2 [20 marks]

i) Discuss the concept of Serviceability in a university context. How can a university ensure that its services, such as academic advising and IT support, are both accessible and efficient for students? (10 Marks)

ii) You are developing a sampling plan for a manufacturing process producing 1500 units daily. Discuss the key factors to consider when determining an appropriate sampling plan. (10marks)

Question 3 [20 marks]

A factory has recently implemented a Statistical Process Control (SPC) system to monitor its production process. The control chart below shows a set of data for 10 samples collected in a manufacturing process:

Sample	Measurement 1	Measurement 2	Measurement 3	Measurement 4
1	50.1	49.9	50.0	50.2
2	50.3	50.0	49.8	50.1
3	49.9	50.2	50.1	49.9
4	50.0	50.3	50.1	50.0
5	50.2	50.1	49.9	50.0
6	50.1	50.0	50.2	49.9
7	49.9	50.1	50.0	50.1
8	50.0	49.9	50.1	50.2

i) Calculate the mean and range for each sample. (10 Marks)

ii) Create an X-bar chart and an R-chart to monitor the process. (10 Marks)

Question 4 [20 Marks]

You are tasked with improving a food packaging line. The specifications for the weight of each package are 50 ± 2 grams, and you have collected data showing that the process has a mean of 50.5 grams and a standard deviation of 1 gram.

i) Calculate the process capability indices (Cp and Cpk). (10 Marks)

ii) Based on the calculated values, determine whether the process is capable of meeting specifications. (10 Marks)

Question 5 [20 marks]

i) Data collection plays a vital role in quality control. Discuss FIVE data collection methods used in the context of process improvement, highlighting their advantages and disadvantages. (20 Marks)