



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE IN RENEWABLE
ENERGY AND BIOFUELS TECHNOLOGY

COURSE CODE: IPT 422

COURSE TITLE: QUALITY RELIABILITY ENGINEERING

DURATION: 2 HOURS

DATE: 10/02/2021

TIME: 8:00 - 10:00 AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 3 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

QUESTION 1 (30 marks)

- a. Define the following terms:
- i. Process (1 mark)
 - ii. Process capability (1 mark)
 - iii. Specification (1 mark)
 - iv. Process variability (1 mark)
 - v. Process capability analysis (1 mark)
- b. State any five (5) reasons why the control charts are popular. (5 marks)
- c. State any three (3) quality characteristics, giving two (2) examples of each (5 marks).
- d. State any five (5) expectations of Maintainability requirements. (5 marks)
- e. Fifty (50) components are tested for two weeks. Twenty (20) of them fail in this time, with an average failure time of 1.2 weeks. What is the mean time till failure assuming a constant failure rate? (5 marks)
- f. Describe how a control chart is used. (5 marks)

QUESTION 2 (20 marks)

- a. State any five (5) reasons with examples for Reliability engineering. (5 marks)
- b. Define any three (3) different forms of the steady state availability. (6 marks)
- c. Mention any five (3) process capability indices stating the index, its estimation equation and its use. (9 marks)

QUESTION 3 (20 marks)

- a. State any five (5) dimensions of quality. (5 marks)
- b. The percent defective of the incoming lots is 3%. An OC curve showed the probability of acceptance to be 0.515. Given a lot size of 2,000 and a sample of 120, what is the average outgoing quality in percent defective? (5 marks)
- c. A power generating company has decided to purchase solar panels from a solar panel manufacturing company. Both companies have decided that the solar panels are to be supplied in lots of 2,000 panels each. The lot will be accepted up to quality level $p = 0.05$ and rejected at more than quality level $p = 0.20$. Acceptance sampling plan is based on a sample of size 50 drawn from each lot and the lot is accepted if inspected sample contains at most one defective panels. Otherwise, the lot is rejected. Identify which company is the producer and which one is the consumer in the plan. Calculate the producer's risk and the consumer's risk. (10 marks)

QUESTION 4 (20 marks)

- a. 100 cars have accumulated 15000 hours, 10 failures are observed.
- What is the MTBF? (2 marks)
 - What is the failure rate? (2 marks)
- b. Six oil pumps were tested with failure hours of 45, 33, 62, 94, 77 and 105.
- What is the MTTF? (2 marks)
 - Failure rate? (2 marks)
- c. 10 components were tested. The components (not repairable) failed as follows: Component 1, 2, 3, 4, 5 failed after 75, 125, 130, 325, 525 hours. Find the failure rate and mean time till failure. (6 marks)
- d. Explain any three (3) lot-by-lot acceptance sampling plans for attributes. (6 marks)

QUESTION 5 (20 marks)

- a. State any ten (10) Deming points of management as it pertains quality philosophy and management. (10 marks)
- b. Explain the Bathtub curve in terms of Phase, Failure Rate, Possible causes and possible improvement actions. (10 marks)