# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

## MAIN EXAMINATIONS
## 2021/2022 ACADEMIC YEAR

## FIFTH YEAR FIRST SEMESTER EXAMINATIONS

## FOR THE DEGREE
## OF
## BACHELOR OF SCIENCE IN ELECTRICAL AND COMMUNICATIONS ENGINEERING

**COURSE CODE:** ECE 511

**COURSE TITLE:** ENGINERING PRODUCT DESIGN

**DATE:** THURSDAY, APRIL, 28TH, 2022 **TIME:** 8:00 - 10:00 AM

**INSTRUCTIONS TO CANDIDATES**

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.

QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

## Question One — 30 Marks

a) State and explain the general criteria and guidelines in product design. (10 marks)

b) Documentation is integral to any product. Justify? (2 marks)

c) What is ergonomics? What are the different basic ergonomics requirements for a product design? (10 marks)

d) What is the techno-commercial feasibility of a product? Discuss giving suitable examples of any two metrics from the list give below:

(i) Technical specification and final cost

(ii) Technical specification and enclosure size requirement

(iii) Enclosure size requirements and application requirement (8 marks)

## Question Two — 20 Marks

a) What is the role of documentation in product design and development? (4marks)

b) What are the different types of documentation? Explain each in brief. (10 marks)

c) Explain how visual techniques can be use while preparing the document. (6 marks)

## Question Three — 20 Marks

a) Explain the importance of grounding and shielding. (4 marks)

b) Discuss the noise coupling mechanisms and explain how to minimize these at board level. (10 marks)

c) With reference to PCB design;

i) Define Ground loop.

ii) State and briefly explain problems caused by ground loops.

iii) Draw a well labled circuit diagram of a good & poor ground loop and explain how to minimize the problems identified in (ii) above. (6 marks)

## Question Four — 20 Marks

a) Compare:

i) Quality and Reliability

ii) Repairable and non –repairable systems. (4marks)

b) Justify the following statements

i) Availability and reliability are interrelated by maintainability

ii) Redundancy techniques always result in improved reliability

iii) MTBF is a more useful figure than reliability for maintaining systems

iv) Component or subsystem level redundancy is preferred over total system redundancy method. (8 marks)

c) The failure rate per hour of an electronic product is given by $0.02(1+30e^{-2t}+e^{-t/20})$. Find MTTF at t=104 hours. (8 marks)