(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2018/2019 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: ENGINEERING PRODUCT DESIGN

DATE: THURSDAY, 14TH FEBRUARY 2019 **TIME:** 8:00 AM TO 10:00 AM

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Answer Any Other TWO (2) questions

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

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

Question One (30 Marks)

a) Define the following terms as applied to engineering product design.

i. Triboelectric Effect [1 mark]
ii. Electromagnetic Interference [1 mark]
iii. Electromagnetic Compatibility [1 mark]
iv. Net Present Value [1 mark]
v. Robust setpoint [1 mark]

b) A team is contemplating the launch of a product in an entirely new category, which is an inherently risky type of project. It could just launch the project and hope for success, or spend time and money testing the product in the marketplace. Given the team's assessment of the likelihood of success, the present value is Ksh. 2 million for this plan. The team spends an additional Ksh. 1 million for investigation. After investigation there is a 70% chance of launching the product and reaping positive cash flow of Ksh. 5 million. There is a 30% chance of cancelling the project, reaping only Ksh. 0.5 million in salvage value. Calculate the *net present value* of the project and advise the team accordingly. [6 marks]

c) Outline any *six* possible characteristics of dysfunctional product development teams in a manufacturing firm. [6 marks]

d) Name and explain the four types of intellectual property relevant to product design and development [4 marks]

e) Draw the Ingress Protection rating table and show how it is used. [5 marks]

f) List any eight potential sources of noise that may make a logic signal unusable. [4 marks]

Question Two (20 Marks)

a) Give the *three* types of shield against electromagnetic interference. [3 marks]

b) Compare and contrast *static* and *dynamic* power dissipation of CMOS semiconductor devices. [4 marks]

c) Giving relevant examples explain any *five* sources of transients in electrical circuits. [5 marks]

d) Give any *four* devices that can be used to suppress transients, their applications, advantages and disadvantages. [8 marks]

Question Three (20 Marks)

a) Differentiate between utility patents and design patents as intellectual property. [5 marks]

b) Enumerate the steps generally followed in Monte Carlo methods of simulation. [2 marks]

c) Identify and explain any *five* motives for changing the design of a product already on a receptive market. [5 marks]

c) Outline *four* elements that a firm purchase order specifies to the manufacturer. [4 marks]

d) A trigger circuit of single phase SCR consists of following components with failure rates shown in table below. Determine overall failure rate and MTTF of the trigger circuit. [4 marks]

Component	Number used (n_i)	Failure rate for 10^6 hours (λ_i)
Transistors	8	0.61
Diodes	10	0.20
Resistors	21	0.60
Capacitors	4	0.60
Pulse Transformers	1	0.15
Small Transformers	1	0.20

Question Four (20 Marks)

a) Clearly explain the *five* points of that must guide a designer in constructing a list of metrics to satisfy potential customer needs. [5 marks]

b) Product development projects can be classified into *four* types. Identify and explain each. [4 marks]

c) Define the phrase *pipeline management* and hence explain the *four* considerations crucial to managing a new design project. [5 marks]

d) Name and explain any *six* challenges encountered in the development of electronic engineering products for laboratory use. [6 marks]

Question Five (20 Marks)

a) Using the technique of *functional decomposition* develop a Function diagram of a handheld nailer. [3 marks]

b) Name and explain the *two* main prototyping technologies currently available for design of electromechanical engineering products in industry. [4 marks]

c) List any *four* events against which a power supply should be protected in the case of catastrophic failure. [2 marks]

d) Highlight the difference between the terms *grounding* and *shielding* hence explain the *three* common ways of breaking ground loops in electronic circuitry. [5 marks]

e) Identify and explain the *three* main adverse operating conditions that could arise in a utility AC power distribution system. [6 marks]