MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE, APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

THIRD YEAR **SECOND** SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONIC ENGINEERING)

AMS335: PROBABILITY AND STATISTICS

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer Question one and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) Define the following terms: (5marks)
   i. Statistics
   ii. Sampling
   iii. Probability
   iv. Population
   v. Parameter

b) Giving examples, distinguish between discrete and continuous variables. (4marks)

c) Given the data below:
   X = 11,13,17,14,16,10,11,17
   Estimate:

   i) Harmonic mean (3marks)
   ii) Geometric mean (3marks)
   iii) Mean absolute deviation (3marks)

d) Out of 6 engineers and 4 doctors, how may groups of 4 professionals can be formed such that at least one engineer is always there? (4marks)

e) Given a probability distribution of x below

X	0	1	2	3
P(x)	$1/8$	$1/4$	$3/8$	$1/4$

   Find:
   i. Mean of x (3marks)
   ii. Standard deviation of x (5marks)

SECTION TWO: ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) Describe three probability sampling techniques (6marks)

b) Given the frequency distribution table below:

Class	5-9	10-14	15-19	20-24	25-29	30-34	35-39
Frequency	4	7	9	13	8	6	3

   Estimate:
   i) Mode (3marks)
   ii) 87^{th} Percentile (4marks)
   iii) Find the coefficient of skewness α_3 (7marks)

QUESTION THREE (20 MARKS)

a) Discuss three sources of Primary data collection (6marks)

b) At a certain factory, three machines make 30%, 45% and 25% respectively of the products from past experience, it is known that 2%, 3% and 2% of the products made by each machine respectively are defective if the end product is randomly selected,
   i. What is the probability it is defective? (3marks)
   ii. If a product selected randomly was found to be defective, what is the probability it was made by machine 3? (4marks)

c) Unreliable car battery company produces car batteries whose life time can be modelled in the probability density function.

$f(t) = 3e^{-3t}$ for $t > 0$, where t is time in hours. Calculate to 2.d.p. the probability that the car battery will;

i. Have failed by end of one year (3marks)
ii. Still be functional after 2 years (4marks)

QUESTION FOUR (20 MARKS)

a) These data represent the record high temperature in degrees Fahrenheit (F) for 50 towns. Construct a grouped frequency distribution for the data. (5marks)

112	100	127	120	134	118	105	110	109	112
110	118	117	116	118	122	114	114	105	109
107	112	114	115	118	117	118	122	106	110
110	116	108	110	121	113	120	119	111	104
111	120	113	120	117	105	118	112	114	114

b) Define the following terms

i. Hypothesis (1mark)
ii. Null hypothesis (1mark)
iii. Test statistics (1mark)

c) Given the following information, which bulb would you buy if you are willing to take 5% risk?

	Company A	Company B
Mean life time (hrs)	1300	1248
Standard Deviation	82	93
Sample size	120	100

(5marks)

d) As part of a waste removal project, a new compression machine for processing sewage sludge is being studied.

Engineers are interested in moisture control of compressed pellets and the machine filtration rate.

Filtration(x)	78	60	75	48	55	82	80	70	58	65
Moisture (y)	125	115	100	108	113	120	130	114	98	110

i. Fit a regression equation for this data (5marks)
ii. Estimate y when x = 120 (2marks)