

TECHNICAL UNIVERSITY OF MOMBASA
UNIVERSITY EXAMINATION FOR THE DEGREE OF SCIENCE IN ELECTRICAL &
ELECTRONIC ENGINEERING

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING (DEEE)
DIPLOMA IN MECHANICAL ENGINEERING (DMEN)
STAGE III SEMESTER I
AMA2350: ENGINEERING MATHEMATICS V
TIME: 2 HOURS

Question One (Compulsory)

- a) State THREE advantages of a telephone interview (3 Marks)
- b) State THREE properties of a good measure of dispersion (3 Marks)
- c) Determine using the binomial series the expansion of

$$\left(d - \frac{1}{d}\right)^5 \quad (4 \text{ Marks})$$

- d) The following distribution shows the length of laurel leaves recorded to the nearest millimetre.

<u>Length (mm)</u>	<u>Frequency</u>
118 — 126	3
127 — 135	5
136 — 144	9
145 — 153	12
154 — 162	5
163 — 171	4
172 — 180	2

From the above table calculate the following measures:

- i) Mode (2 Marks)
- ii) 3rd quartile (Q_3) (3 marks)
- iii) 60th percentile (P_{60}) (3 Marks)
- iv) Range (2 marks)
- e) Using examples explain the following estimates
- (i) Point estimation
- (ii) Interval estimation (4 Marks)
- (iii) A random sample of 36 employees of a local mining company showed a mean age of 40 years and standard deviation of 4.5 years. Construct a 95% confidence interval for the mean age of the mining company. (3 Marks)

- f) Explain the following terms related to probability events:
- i) Mutually exclusive events
- ii) Equally likely events
- iii) Independent events (3 Marks)

Question Two (20 marks)

In a survey of 64 middle income apartments in the country it was found that each experienced the following number of electrical faults in a year

19	16	22	9	22	12	39	19	14	23
6	24	16	18	7	17	20	25	28	18
10	24	20	21	10	7	18	28	24	20
14	23	25	34	22	5	33	23	26	29
13	36	11	26	11	37	30	13	8	15
22	21	32	21	31	17	16	23	12	9
15	27	17	21						

From the given data above do the following:

- i) Form a frequency distribution of exclusive class intervals the first class being 5-10. *(4 Marks)*
- ii) Draw a frequency polygon *(5 Marks)*
- iii) Calculate the mean electrical faults per year *(3 Marks)*
- iv) Calculate the median electrical faults *(3 Marks)*
- v) Calculate the standard deviation of the electrical faults in a year *(3 Marks)*
- vi) Calculate the coefficient of skewness of the distribution *(2 Marks)*

Question Three (20 marks)

- a) Determine the following
 - i) Define a random experiment *(1 Marks)*
 - ii) In how many ways can the letters of the word COMMUNICATION be arranged *(2 Marks)*
- b) In how many ways a 9 member committee be seated at a round table if
 - i) Anyone can sit anywhere *(1 Mark)*
 - ii) The president and the secretary must not sit next to each other *(3 Marks)*
- c) In a random selection of 64 house blocks of the 2400 house blocks of a small town, the mean number of electrical-caused accidents per year was 3.2 and sample standard deviation was 0.8.
 - i) Make an estimate of the standard deviation of the population from the sample standard deviation *(1 mark)*
 - ii) Work out the standard error of mean for this finite population *(3 Marks)*
 - iii) If the desired confidence level is 90%, calculate the upper and lower limits of the confidence interval for the mean number of electrical accidents per household per year *(4 Marks)*

- d) A sample of 400 boxes containing a type of an electronic component was found to have a mean weight of 67.47 Kg. Test whether this can be reasonably regarded as a sample from a large population with mean weight of 67.39 Kg and standard deviation 1.30 Kg at 5% level of significance.

(5 Marks)

Question Four (20 Marks)

a)

- i) Define a random variable (1 Marks)
- ii) Four defective capacitors are accidentally mixed with 20 good capacitors. Obtain the probability distribution of the number of defective capacitors in a draw of 2 capacitors at random

(9 Marks)

- b) In a blade manufacturing factory $\frac{1}{5}$ % of the blades produced turns out to be defective. The blades are supplied in packets of 10. Use Poisson distribution to calculate in a consignment of 100,000 packets, the approximate number of packets containing:

- i) No defective blade
- ii) One defective blade (6 Marks)

- c) A variable has been established to follow the standard normal distribution. Determine the probability that a value for this variable will lie

- i) Between 1.3 and 2.4
- ii) Below -1.5

(4 Marks)

Question Five (20 Marks)

- a) Calculate the Geometric mean for the following distribution

Components size	0-10	10-20	20-30	30-40	40-50
Number of components	5	7	15	25	8

(6 Marks)

- b) Evaluate $(1.002)^8$ using binomial expansion correct to 7 significance figures.

(4 Marks)

- c) If 10% of bolts produced by a machine are defective. Determine the probability that out of 10 bolts chosen at random,

- i) One is defective (3 marks)
- ii) None is defective (3 Marks)
- iii) At most 2 bolts will be defective (4 Marks)