



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEP VI)

EEE 0231: MATHEMATICS III

END OF SEMESTER EXAMINATION

SERIES: APRIL 2013

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table*
- *Non-programmable Scientific Calculator*

This paper consist of **FIVE** questions in **TWO** sections **A & B**

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
 Maximum marks for each part of a question are as shown
 This paper consists of **THREE** printed pages
SECTION A (COMPULSORY)

Question One

- a) Define the following terms as relating to data collection:
 (i) Sample
 (ii) Census
 (iii) Respondent (3 marks)
- b) State **THREE** reasons why raw data needs to be classified. (3 marks)
- c) Sketch the graph of $y = \tanh x$ for values of x between -3 and 3 (10 marks)
- d) (i) A lady is asked to rank 6 types of washing detergent according to her preference. Calculate the total number of possible rankings. (3 marks)
 (ii) Four couples occupy eight seats in a row at random. Calculate the probability that all the ladies are sitting next to each other. (5 marks)
- e) Given three points $P = (1, 0, 0)$ $Q = (1, 1, 1)$ and $R = (2, -1, 3)$ determine vectors.
 \vec{PQ}
 (i)
 \vec{PR}
 (ii)
 (iii) Perpendicular vector to \vec{PQ} and \vec{PR} (6 marks)

SECTION B (Answer any TWO questions from this section)

Question Two

- a) State **FOUR** qualities of a good average. (4 marks)
- b) The following distribution shows the lifetime in hours of 40 bulbs of a certain type.

Life (Hours)	Frequency
118 – 126	3
127 – 135	5
136 – 144	9
145 – 153	12
154 – 162	5
163 – 171	4
172 – 180	2

From the distribution:

- (i) Plot a cumulative frequency distribution (5 marks)
- (ii) Calculate:
 - (i) Mean
 - (ii) Median
 - (iii) Range
 - (iv) Standard deviation (11 marks)

Question Three

- a) (i) Using Osborne’s rule prove $1 - \tanh^2 x = \operatorname{sech}^2 x$ (3 marks)
- (ii) Given $Ae^x + Be^{-x} = 4 \cosh x - 5 \sinh x$ determine the value of A and B (5 marks)
- b) Solve the equation $\sinh x = 3$ correct to 4 s.f (7 marks)
- c) (i) Define a “one-to-one” function $y = \cosh^{-1} x$
- (ii) Sketch the graph for (5 marks)

Question Four

- a) (i) Distinguish uncertain events from certain events. (2 marks)
- (ii) Explain the following events giving an example of each case:
 - (i) Favourable events
 - (ii) Mutually exclusive events (4 marks)
- b) Determine the probability that a leap year selected at random will contain 53 Sundays. (5 marks)
- c) A problem in statistics is given to three students A, B and C whose chances of solving it independently are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. Determine the probability that:
 - (i) The problem is solved
 - (ii) At least two of them are able to solve the problem
 - (iii) Exactly two of them are able to solve the problem. (9 marks)

Question Five

- a) Define the following type of vectors:
 - (i) Unit vector
 - (ii) Zero vector
 - (iii) Equal vector
 - (iv) Position vector (4 marks)

- b) Given two vectors $\vec{p} = 2i + j - k$ and $\vec{q} = i - 3j + 2k$ determine:
- (i) $\vec{p} \cdot \vec{q}$

$$\vec{p} + \vec{q}$$

(ii)

$$|\vec{p}| + |\vec{q}|$$

(iii)

(6 marks)

c) If $\vec{a} = 4\hat{i} + \hat{j} - 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{c} = \hat{i} - 2\hat{k}$ determine:

$$(\vec{a} - 2\vec{b}) \times \vec{c}$$

(i)

$$\vec{a} \times (2\vec{c} \times 3\vec{b})$$

(ii)

(10 marks)