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

<u>**Instructions to Candidates:**</u>
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.

   (i) $\vec{PQ}$

   (ii) $\vec{PR}$

   (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
$$1 - \tanh^2 x = \sec h^2 x$$
                                                    (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

    (ii) Sketch the graph for $y = \cosh^{-1} x$ **(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 ½, 1/3 and ¼ 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) $\vec{p} \bullet \vec{q}$

(ii)
$$\vec{p} + \vec{q}$$

(iii)
$$\left|\vec{p}\right| + \left|\vec{q}\right|$$

(6 marks)

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

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

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

(10 marks)