Examination Date: 12th August 2013

TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

CERTIFICATE IN ELECTRICAL ENGINERING (CEPE 3)

UKUNDA CAMPUS

AMA 1103: ENGINEERING MATHEMATICS III

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

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 **FOUR** printed pages

SECTION A (COMPULSORY)

Question One

a) (i) If $x = a\sin\theta,\ y = bs\cos\theta$ find the area under the curve between $\theta = 0$ and $\theta = \pi$ **(3 marks)**

(ii) Find the mean value of $y = 3x^2 + 4x + 1$ between $x = 1$ and $x = 2$ **(3 marks)**

b) Determine $\int \frac{x^2}{(x+1)(x-1)^2}$ **(6 marks)**

c) Prove by vectors that the line joining the mid-points of two sides of a triangle is parallel to the third side and half its length. **(4 marks)**

d) (i) In how many different ways can 7 identical bottles of wine be arranged in a wine rack with spaces for 12 bottles. **(3 marks)**

(ii) Evaluate ${}_{89}C_{o}$ **(2 marks)**

(iii) In the binomial expansion of $\left(1 - x/2\right)^9$ written terms of ascending powers of x, find:

(i) The 4th term **(3 marks)**

(ii) The coefficient of x^5 **(6 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) (i) Consider Figure 1 below:

Figure 1

ABCD is a quadrilateral with G and H the midpoint of DA and BC respectively show that $\overline{AB} + \overline{DC} = 2\overline{GH}$

(3 marks)

(ii) If $\overline{OA} = 3i + 5j$ and $\overline{OH} = 5i + 2j$ with help of a diagram find $\overline{AB}$ **(3 marks)**

b) (i) Find the vector product of p and q where $p = 3i - 4j + 2k$ and $q = 2i + 5j - k$ **(3 marks)**

(ii) Find the angle between the vectors $p = 2i + 3j + 4k$ and $q = 4i - 3j + 2k$ **(6 marks)**

(iii) If $a = 2i + 3j + 5k$ y and $b = 4i + 1j + 6k$ find the scalar (dot) product a.b. **(2 marks)**

Question Three

a) (I) Multiply out and simplify

(i) $3(1 + j2)$ (2 marks)

(ii) $(2 + j3)(2 - j5)$ **(2 marks)**

(II) Simplify $3 + j2 + 5 - j^2 10 + j^3 15 - 4$ **(2 marks)**

(III) Rationalize $\dfrac{1 + j2}{1 + j}$ **(3 marks)**

b) (I) If $\dfrac{(2 - j)(3 + j2)}{3 - j4}$ or $r(\cos\theta + j\sin\theta)$ find 'r' **(4 marks)**

(II) Put into polar form:

(i) $j3$ **(1 mark)**

(ii) $-3 + j\sqrt{3}$ **(2 marks)**

(III) Find the modulus of $z = \dfrac{(2 + j3)^2 (3 + j4)^4}{(3 - j4)^3 (2 - j3)^3}$ **(4 marks)**

Question Four

a) (I) Determine the following integrals:

(i) $\int x^6 dx$ **(2 marks)**

$\int 5\sin x dx$

(ii) **(2 marks)**

(II) Determine the following integrals:

$$I = \int \left(2x^3 - 5x2 + 6x - 9\right)\, dx$$

(i) **(2 marks)**

$$I = \int \left(9x^3 + 11x^2 - x - 3\right) dx$$

(ii) given that when x = 1, I = 2 **(4 marks)**

$$\int \frac{5x+2}{3x^2 + x - 4}\, dx$$

b) (I) Integrate by partial fraction **(6 marks)**

$$y = x^2 - 2x + 3$$

(II) Determine the area bounded by the x-axis and ordinates x = -1 and x = 3. **(4 marks)**

Question Five

$$\left(2 - 3/x\right)^8$$

a) (I) In the binomial expansion of written in terms of descending powers of x, find:

(i) The 4th term

(ii) The coefficient of x^{-4} **(4 marks)**

(I) Using Pascals triangle, write down the binomial expansion of $(a + b)^6$ **(3 marks)**

b) (I) Find the value of:

(i) 10!

(ii) 0! **(2 marks)**

(II) (i) How many different arrangement are there of 9 identical umbrellas on a rack of 15 coat hooks? **(3 marks)**

9_{C_4}

(ii) Evaluate **(2 marks)**