TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBC)
DIPLOMA IN ARCHITECTURE (DA)

AMA 2112: ENGINEERING MATHEMATICS II

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

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

This paper consists of **FIVE** questions.
Answer any **THREE** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) Express $2\cos\theta + \sin\theta$ form $R\sin(\theta + \alpha)$ and hence solve $2\cos\theta + \sin\theta = 1$ for $O^o \le \theta \le 360^o$ **(8 marks)**

b) (i) Solve the equation $z^2 + j - 1 = 0$ in the form $r = (\cos\theta + \sin\theta)$
(ii) Represent the solution obtained in b(i) on an Argand diagram. **(12 marks)**

Question Two

a) Solve the following:

$2x^{0.5} = 0.45$

(i) using logarithms show all your working.

$\log(x-1) + \log(x+1) = \log(x+5) + 2$

(ii) **(10 marks)**

b) An experiment was performed and the following results obtained:

$y = kx^n$

where *k* and *n* are constant.

x	3.5	4.4	6.6
y	183	226	310

i) Determine the law graphically
ii) Find the value of y when x = 6 **(10 marks)**

Question Three

a) Prove that $\cos^2\theta + \sin^2\theta = 1$

b) Prove the equation $3\cos^2 x - \sin x = 1$ for $0 \le x \le 360^o$ **(7 marks)**

c) Construction blocks are supplied weekly as 4 thousand tones, 1.2 thousand tones, 0.36 thousand tones and so on.

(i) Find the supply during the 10^{th} week
(ii) The week when only 0.05 thousand tones will be supplied. **(7 marks**)

Question Four

$Z_1 = 4 + 2j \;\; Z_2 = j \;\; Z_3 = 4 - j$

a) Given

$$Z4 = \frac{Z_2 \times Z_3}{Z_1}$$

(i) Find Z_4 in the form $r\angle\theta$ where

(ii) Represent Z_4 on an Argand diagram. **(10 marks)**

b) A surveyor is 100m downslope from the foot of a tower on a sloping ground of slope angle 10^{o}. He measures the angle of elevation from the ground to the top of the tower as 15^{o}, find the height of the tower. **(10 marks)**

Question Five

a) Solve the equation:

$$\log 2x = \log(4x - 1) - \log 3x$$

(6 marks)

b) A polygonal model has 18 sides forming an arithmetic progression of perimeter 117.75mm. The 9^{th} side is 3 times the shortest side. Find the dimension of the longest side. **(7 marks)**

c) A surveyor travels 30m 540^{o}E to station A, 100m to station B N50^{o}W and finally 150m to station C N20^{o}E.

Find:

(i) The distance of the surveyor from the starting point

(ii) The bearing of the surveyor from the North. **(7 marks)**