TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

CERTIFICATE IN BUILDING & CIVIL ENGINEERING (CBCE 13S)

AMA 1150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 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) Find the sum of the terms that form the progression:

$$10 + 9\,3/4 + 9\,1/2 + ... 1/4 + 0$$

(6 marks)

b) The third term of an AP is twice the eighth term while sum of first twenty terms is twenty. Find:
   (i) First term
   (ii) Common difference
   (iii) Number of terms after which the values become less than zero **(6 marks)**

c) Building stones are delivered monthly to a construction site in thousand tonnes forming the following series:
   6,520, 3,912, 2,347.2, and so on.

   Find:

   (i) The delivery in the 8th month
   (ii) The time when 5 thousand tonnes will be delivered
   (iii) Amount delivered if the supply continues indefinitely. **(8 marks)**

Question Two

a) Solve the equation:

$$\log_{49}(x+2) + \log_{49} x = \frac{1}{2}$$

(5 marks)

b) An assembly hall is designed to have 25 polygonal sides in an arithmetic progression of perimeter 1100m. The longest side is 10 times shortest side. Find the length for the 5th side. **(5 marks)**

c) Results from a laboratory test suggest a relationship of the form: $y = Kx^a$ where K and a are constants. The data obtained is as follows:

	3.	4.	6.
x	5	4	6
	18	22	31
y	3	6	0

   (i) Use graphical method to determine the relationship
   (ii) Find the value of y when x = 5 **(10 marks)**

Question Three

$$\left(P-\frac{1}{q}\right)^{13}$$

a) Find the 8th term in the binomial expansion of: **(4 marks)**

b) A builder borrows K£ 80,000 and repays in 15 equal monthly installments at an interest of 12% on outstanding balance. Find the total interest paid. **(7 marks)**

c) (i) Expand $\frac{1}{\sqrt[4]{1-x}}$ up to the term containing x^3

(iii) By putting $x=\frac{1}{81}$ in the expansion obtained in c (i) evaluate $\frac{1}{\sqrt[4]{80}}$ correct to 4 decimal places. **(9 marks)**

Question Four

a) Show from first principles that for any triangle ABC:

$$\frac{a}{\sin A}=\frac{b}{\sin B}$$

(4 marks)

b) Solve for equation:

$3\sin\theta-4\cos\theta=1 \quad 0^o\le\theta\le360^o$ for **(7 marks)**

c) (i) Solve the equation:

$z^2-2j-4=0$ giving answer in the form $x+yj$

(ii) Represent the answer in c(i) on a diagram **(9marks)**

Question Five

a) (i) Given $z_1=-j,\ z_2=-3-4j\ \ z_3=6-2j$ find $z4^{10}$ where $z_4=\frac{z_1\times z_2}{z_3}$

(ii) Express z_4 of a (i) in the form (r,θ) and hence represent it on a diagram **(11 marks)**

b) (i) A train travels 200km from station A at N45°W to station B. It then covers 300km to station C at S60°W. Finally it proceeds to station D at S40°E covering 100km. Use complex number method to determine the distance between stations A and D.

(ii) Determine the bearing of station D **(9 marks)**