

TECHNICAL UNIVERSITY OF MOMBASA Faculty of Applied & Health

Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE/ARC 14J)

AMA 2150: ENGINEERING MATHEMATICS I

END OF SEMESTER EXAMINATION SERIES: APRIL 2014 TIME ALLOWED: 2 HOURS

Instructions to Candidates: You should have the following for this examination - Answer Booklet - Calculator This paper consist of **FIVE** questions

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

Question One (Compulsory)

- **a)** Define the following terms as used in Mathematics:
 - An equation (1 mark) (i) (1 mark)
 - (ii) A sequence

common difference.

b) Simplify the following equation giving the result without functional indices.

$$F = \sqrt[3]{a^6b^3} \div \sqrt{\frac{1}{9}a^4b^6} \times \left(4\sqrt{a^6b^2}\right)^{\frac{-1}{2}}$$

$$Sn = \frac{n}{2}(2a + (n-1)d)$$

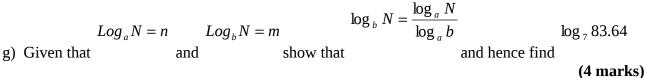
where a is the first term, n is the number of terms and d is the (5 marks)

- d) Insert three geometric means A, B and C between 56 and 896 (3 marks)
- e) Simplify the following:



f) Express the following in Cartesian Form:

 $e^{1-j\pi/4}$



 $7(14.3^{x+5}) \times 6.24^{2x} = 294$

- h) Solve for x in the following equation:
- i) Rewrite the following without logarithms:
 - $\log W = 2(\log A + \log W) (\log 32 + 2\log \pi + 2\log r + \log c)$ (i) (1 mark) $\log S = \log K - \log 2 + 2\log \pi + 2\log n + \log Y + \log r + 2\log L - 2\log h - \log q$ (ii) (1 mark) $\ln I = \ln(2\nu) - \ln(kR + r) - \ln K + KL$ (iii) (1 mark)

Question Two

(4 marks)

(3 marks)

(3 marks)

a) Derive the quadratic equation formular and hence solve the following equation below: $2x^2 - 3x - 4 = 0$

(6 marks)

b) State whether or not the following can each be expressed as product of linear factors. $2v^2 = 0v + 10 = 0$

(1 mark	$2x^2 - 9x + 18 = 0$	(i)
	$x^2 - 11x + 28 = 0$	(1)
(1 mark		(ii)
(1 mar	$x^2 + 5x - 24 = 0$	(iii)
(1 mark	$x^2 - 4x - 21 = 0$	(111)
(1 mark		(iv)

- (iv)
- c) Solve for the unknowns in the following set of equations:

$$5(x+2y) - 4(3x+4z) - 2(x+3y-5z) = 16$$

$$2(3x-y) + 3(x-2z) + 4(2x-3y+z) = -16$$

$$4(y-2z) + 2(2x-4y-3) - 3(x+4y-2z) = -62$$

(7 marks)

d) The 6th term of an AP is -23 and the 10th term is -35. Find the first term, the common difference and the sum of the first 15 terms of the series. (3 marks)

Question Three

$$(a+b) + j(a-b) = 7 + j2$$
a) Given that . Find the values of a and b (3 marks)

b) Transpose the formular below to make f the subject:

$$\frac{R}{r}\sqrt{\frac{f+p}{f-p}}$$
(4 marks)

$$\log_a b = \frac{1}{\log_b a}$$

c) Show that

d) Solve for the unknowns in the following set of equations below:

$$\frac{2x-1}{5} + \frac{x-2y}{10} = \frac{x+1}{4}$$
$$\frac{3y+2}{3} + \frac{4x-3y}{2} = \frac{5x+4}{4}$$

(6 marks)

(2 marks)

(3 marks)

(6 marks)

e) Differentiate between an infinite and a finite sequence.

f) Given the following:

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$$\sum_{n=1}^{n} (2n+3)$$
Find (i)
$$\sum_{n=3}^{n} U_n$$
(ii)
(1 mark)
Question Four
a) Show that:
$$\log_2 x + \log_3 x + \log_4 x = 7.079 \log_{10} x$$
(3 marks)
b) Show that
$$\sin^2 x + \cos^2 x = 1$$
and hence derive the subsequent trigonometric identities
(7 marks)
c) Solve for x in the equation below:
$$2\log_{10} x = 4$$
(3 marks)
$$U_n = n^2 + 3n + 1$$
(3 marks)
$$U_n = n^2 + 3n + 1$$
(3 marks)
(1 mark)
Question Five
a) Given that
$$pq^2 + rq + z = 0$$
(2 marks)
b) Show that
(6 marks)
c) Express the following in polar form:
$$z = 4 + j3$$
(2 marks)
(3 Solve the following set of simultaneous equations:
$$3x + 2y - z = 19$$

$$4x - y + 2z = 4$$

(4 marks)

e) Determine the antilogs to the given base of the following:

2x + 4y - 5z = 32

a)

b)

c)

d)

e)

a)

b)

c)

d)

3.1267		
(i) Antilog te	o base 10	(1 marks)
1.263		
(ii) Antilog to	base 5	(1 mark)
4.6234		
(iii) Antilog t	o base e	(1 mark)
f) Draw an Argand diag	ram to represent the vectors:	

$$z_{1} = 2 + j3$$
(i)
(1 mark)
(i)
(1 mark)
(i)
(1 mark)
(2 - 4 - j5
(iii)
(1 mark)
(1 mark)
(1 mark)