



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

**Faculty of Engineering &
Technology in Conjunction with
Kenya Institute of Highways and
Building & Technology (KIHBT)**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING
(BUILDING SERVICES OPTION)**

EBE 3101: MATHEMATICS I

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 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 (20 marks)

$$y = x \cos 2x$$

- a) Find the first derivative from first principles for the function **(8 marks)**
b) Differentiate the following:

$$z = \cos(x^2 + 4y) - ye^x$$

(i)

$$y = \arctan(x^2 + 5)$$

(ii)

(12 marks)

Question Two (20 marks)

$$z^4 + x - 5j = 0$$

- a) (i) Solve the equation giving the answer in the form (1, 0)
(ii) Represent the roots obtained in a (i) on an Argand diagram. **(8 marks)**
- b) A surveyor covers 100km from station P at N40°W then 50km to station Q that is N60°E. Lastly the surveyor covers S40°E to station R and covers 80km. Find;
(i) The distance between R and P
(ii) The direction of Q **(12 marks)**

Question Three (20 marks)

$$z_1 = -2 - 4j, z_2 = -j, z_3 = 4$$

- a) Given

$$|Z_1 + Z_2 + Z_3|$$

Find (i)

$$z_4 = \frac{z_1}{z_2 - z_3}$$

(ii)

- (iii) Represent z_4 on an Argand diagram. **(12 marks)**

$$\frac{d^2y}{dx^2} \quad y = \frac{e^2 x \sin 4x}{x \log_e 10x}$$

- b) Find for the function **(8 marks)**

Question Four (20 marks)

$$f(x, y) = \frac{e^x}{y^3} + x^4 \cos\left(\frac{x^3}{y}\right)$$

a) Given find

(i) $\frac{\partial f}{\partial x}$

(ii) $\frac{\partial f}{\partial y}$

(8 marks)

b) (i) Solve the equation $z^2 - 16 = 0$ giving the answer in the form $x + yj$
 (ii) Represent the solution obtained in b(i) on a suitable diagram.

(12 marks)

Question Five (20 marks)

a) The surface area A, of a container is related to its dimensions by an expression of the form:

$$y = 2\pi rh + \pi r^2$$

A

r is measured to high by 1%
 h is measured too low by 1.5%

Find the error generated for the surface area.

(8 marks)

b) Find $\frac{dy}{dx}$ for the function $\partial xy + x \sin x - 8y^2$
 $z_1 = -4 + 6j$ $z_2 = -8j + 4$

(5 marks)

c) Given

Find: (i) $(z_1 + z_2)^7$

(ii) $\left| \frac{z_3}{z_4} \right|$

(iii) Express solution for (c) in the form re^Q

(7 marks)