



TECHNICAL UNIVERSITY OF MOMBASA

**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

EBE 3202: MATHEMATICS IV

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (Compulsory)** any other **TWO** questions
 Maximum marks for each part of a question are as shown
 Use neat, large and well labeled diagrams where required
 This paper consists of **THREE** printed pages

Question One (Compulsory)

a) A matrix m is given as:

$$m = \begin{pmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{pmatrix}$$

show that the matrix is orthogonal if $m^{-1} = m^t$ **(4 marks)**

$$P = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad Q = \begin{pmatrix} 5 & 0 & 5 \\ 10 & 2 & 10 \\ 0 & -2 & 1 \end{pmatrix}$$

b) Given

If (i) matrix m
 (ii) M^{-1} and P^{-1} and hence Q^{-1} **(16 marks)**

Question Two

a) A bag contains 13 marbles of same size 8 are black, 3 white and 2 are red. Two marbles are drawn without replacement. Find probability that both are white **(5 marks)**

b) 95% of bolts produced by a machine are non-defective, 200 bolts are produced per hour. Find probability that if a random sample is drawn then:
 (i) At least 2 will be defective
 (ii) At most 2 will be defective **(7 marks)**

c) The mean mass of 1000 blocks is 3.5kg and have a standard deviation of 0.25kg. Find the probability that a sample of 50 blocks chosen at random without replacement will have a combined mass:
 (i) Between 250kg and 265.5kg
 (ii) Exceed 260kg **(8 marks)**

Question Three

$$A = \begin{pmatrix} 1 & 4 \\ 1 & 6 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$$

a) Given and determine A^{-1} and B^{-1} **(5 marks)**

$$P = \begin{pmatrix} 3 & 1 & -1 \\ 1 & 2 & -1 \\ 1 & 1 & 1 \end{pmatrix}$$

b) Find P^{-1} given and hence solve the following simultaneous equations:

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

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

$$x + y + z = 6$$

(15 marks)

Question Four

a) Form a random sample of size 2 given the data:

3, 5, 4, 2, 1

(i) Find the mean for the samples

(ii) Find sampling distribution of means for the sample means

(iii) Determine standard error

marks)

(10

b) Results for a tensile strength were as follows:

Force applied (KN)	4.5	8.7	12	15	22	26
Extension (mm)	3.2	8.6	10	14	18	21

(i) Determine the equation for regression line of force on extension

(ii) Comment on the results obtained

(iii) Determine the expected extension at a force of 10KN

marks)

(10

Question Five

A tie has a mean breaking strength of 100.25KN. Test results carried out on similar ties are:

Mean breaking strength (KN)	99.4	100	100.1	100.2	100.5	100.7	100.8
Frequency	2	2	4	5	3	2	2

Test at 5% significance level that the mean is greater than 100.25KN

(20 marks)