



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

*Faculty of Engineering and Technology*

**DEPARTMENT OF MEDICAL ENGINEERING**

DIPLOMA IN MEDICAL ENGINEERING  
DME 110/111P Y2 S2

**EHL 2211: ENGINEERING MATHEMATICS IV**

END OF SEMESTER EXAMINATIONS

**SERIES: DECEMBER 2011**

**TIME: 2 HOURS**

## **Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*

Answer question **ONE (COMPULSORY)** from **SECTION A** and any other **TWO** questions from **SECTION B**

Maximum marks for each part of a question are clearly shown

This paper consists of **FOUR** printed pages

## SECTION A (Compulsory)

### Question 1

$$P = \begin{pmatrix} 4 & -3 & 1 \\ -2 & 5 & 1 \\ 3 & -2 & 4 \end{pmatrix} \quad \text{and} \quad Q = \begin{pmatrix} 22 & 10 & -8 \\ 11 & 13 & -6 \\ -11 & -2 & 14 \end{pmatrix}$$

a) If \_\_\_\_\_ and \_\_\_\_\_

- (i) Determine PQ and QP
- (ii) Deduce  $\det P$  and  $P^{-1}$
- (iii) Using the results in (i) above or otherwise, solve the following linear simultaneous equation.

$$4x - 3y + z = 7$$

$$2x - 5y - z = -5$$

$$3x - 2y + 4z = 9$$

(12 marks)

b) The mean height for 106 Medical Engineering Students is 154 cm and the standard deviation is 8cm. Assuming that the heights are normally distributed, determine the number of students likely to have heights

- (i) Between 130cm – 180cm
- (ii) Less than 140cm
- (iii) More than 165cm

(10 marks)

c) Solve the following simultaneous equation using Row reduction method.

$$3x + 5y + 2z = -1$$

$$6x + 2y - 8z = -2$$

$$4x + 5y + 3z = -7$$

(8 marks)

## SECTION B (attempt any TWO questions)

### Question 2

In an experiment to determine the relationship between frequency and the inductive reactance of an electrical circuit, the following data was obtained.

Frequency (Hz)	50	100	150	200	250	300	350
Inductive reactance ( $\Omega$ )	30	65	90	130	150	190	200

- a) Determine the equation of the regression of inductive reactance on frequency  
 b) Determine the equation of the regression line of frequency on inductive reactance assuming a linear relationship.  
 c) Determine the value of:
- (i) Inductive reactance when frequency is 175Hz  
 (ii) Frequency corresponding to 250  $\Omega$  (20 marks)

### Question 3

- a) A d.c circuit comprises of three closed loops. Applying Kirchhoff's laws to the loops give the following equations for current flow in mA.

$$2I_1 + 3I_2 - 4I_3 = 26$$

$$I_1 - 5I_2 - 3I_3 = -87$$

$$-7I_1 + 2I_2 + 6I_3 = 12$$

Use determinants or otherwise to solve for  $I_1, I_2$  and  $I_3$  (10 marks)

- b) A firm manufactures fluorescent tubes with a uniform distributed mean of 600 hours and a standard deviation of 50 hours. Find the probability that a tube
- (i) Blows at 480 hours or below  
 (ii) Last for more than 680 hours  
 (iii) Last between 570 hours and 630 hours  
 (iv) Last between 500 hours and 720 hours (10 marks)

### Question 4

- a) Use Crammers rule to solve the following simultaneous equations

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

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

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

(10 marks)

- b) 1500 gas cylinders have a mean mass of 65kg and a standard deviation of 0.5kg. Find the probability that a sample of 60 cylinders chosen at random from the group without replacement will have a combined mass of
- (i) Between 378 and 396 kg  
 (ii) More than 399 kg (10 marks)

### Question 5

- a) A four terminal network consists of Parallel-series impedance of  $5 \Omega$ ,  $10 \Omega$  and  $8 \Omega$  respectively as shown below.

### FIG 1

Compute the output voltage and current using the resultant impedance transfer matrix (10 marks)

- b) A classroom has 35 desks and the number of breakdown on each desk averages 0.06 per semester. Determine the probability of having number of breakdown in a semester
- (i) Only one
  - (ii) Less than three
- (10 marks)