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 Y2S2

EHL 2211: ENGINEERING MATHEMATICS IV

SPECIAL/SUPPLEMENTARY EXAMINATIONS

SERIES: JANUARY/FEBRUARY 2012

TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
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

a) Solve the following simultaneous equation using Row reduction method   (10 marks)

$$2x + 3y - 4z = 26$$
$$x - 5y - 3z = -87$$
$$-7x + 2y + 6z = 12$$

b) The experimental values relating centripetal force and radius for a mass travelling at constant velocity in a circle are given below

Force (N)	5	10	15	20	25	30	35	401
Radius cm	55	30	16	12	11	9	7	5

(i) Determine the regression line of force on radius
(ii) Determine the regression line of radius on force
(iii)   Determine the force at a radius of 40 cm and the radius corresponding to a force of 32 newtons   (20 marks)

SECTION B (attempt any TWO questions)

Question 2

An electric circuit contains four resistant and three voltage sources. The arrangement is that E_1, R_1 and R_2 form the first loop. R_2, E_2 and R_3 forms the second loop and finally R_3 E_3 and R_4 forms the last loop. Using an appropriate illustration:

(i) Determine the matrix of the system of simultaneous equations formed by currents I1, I2 and I3 given that $R_1 = R_2 = R_3 = R4 = 1 \, \Omega$, $E_1 = 3V$, $E_2 = 2V$ and $E_1 = 1V$ (8 marks)

(ii) Determine the inverse of the matrix formed in (i) above hence use it or otherwise to solve for current I_1, I_2 and I_3 (12 marks)

Question 3

a) A box containing 74 brass washers, 86 steel washers and 40 aluminium washers. Three washers are drawn at random from the box without replacement. Determine the probability that:

i)   All three are steel washers
ii)   There is no aluminium washers drawn
iii)   There are two brass and either a steel or aluminium washer   (10 marks)

b) An electrical firm manufactures light bulb with a uniform distributed mean of 800 hours and a standard deviation of 40 hours. Determine the probability that a bulb;
   i)   Last between 770 hours and 920 hours
   ii)   Last for more than 880 hours
   iii)   Blows at 680 hours or below   (10 marks)

Question 4

a) Solve the following simultaneous equation using cofactor method
   $$x + y + z = 3$$
   $$x + 2y + 3z = 4$$
   $$x + 4y + 9z = 6$$

                                                                           (10 marks)

b) Given the matrices:
   $$P = \begin{pmatrix} 14 & 9 & 33 \\ 13 & 11 & 36 \\ 17 & 2 & 22 \end{pmatrix} \qquad Q = \begin{pmatrix} 170 & -132 & -39 \\ 326 & -235 & -75 \\ -161 & 125 & 37 \end{pmatrix}$$
   and

   i)   Determine PQ and QP
          $$\left(P^t\right)^{-1} = \left(P^{-1}\right)^t$$
   ii)   Show that   (10 marks)

Question 5

a) Solve the following simultaneous equations using crammers rule
   $$x + y + z = 4$$
   $$2x - 3y + 4z = 33$$
   $$3x - 2y - 2z = 2$$

                                                                           (10 marks)