TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN MECHANICAL ENGINEERING (DMEN 5)

AMA 2350: ENGINEERIGN MATHEMATICS V

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

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
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) For the function defined by:

$$f(x) = 0 \qquad -\pi \leq x \leq -\pi/2$$

$$f(x) = 4 \qquad -\pi/2 \leq x \leq \pi/2$$

$$f(x) = 0 \qquad \pi/2 \leq x \leq \pi$$

      (i) Sketch the function between -2π to 2π

      (ii) Obtain the Fourier series for the function   **(11 marks)**

b) Solve for x, y and z in the following simultaneous equations using Crammer's rule.

$$2x + 3y - z = 4$$
$$3x + y + 2z = 13$$
$$x + 2y - 5z = -11$$

                                                        (12 marks)

c) Table 1 shows the distribution or marks of 42 students in mathematics CAT.

Table 1

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	1	8	10	9	8	4	2

Determine:
      (i) The mean mark
      (ii) The standard deviation   **(7 marks)**

Question Two

a) Determine the value of x for which:

$$\begin{vmatrix} x & x+3 & x+2 \\ 3 & -3 & -1 \\ 2 & -2 & -2 \end{vmatrix} = 0$$

                                                      (3 marks)

b) Use the method of determining the inverse of a matrix to solve the following simultaneous equations:

$$2x + y + z = 6$$
$$x + 2y + 3z = 6.5$$
$$4x - 2y - 5z = 2$$

                                                     (17 marks)

Question Three

a) Table 2 shows the distribution by time in minutes taken by 65 employees to complete a certain task:

Table 2

Time (min)	50-60	60-70	70-80	80-90	90-100	100-110	110-120
Frequency	8	10	16	14	10	5	2

Calculate:
- **(i)** Lower and upper quartile
- **(ii)** Third decile
- **(iii)** 35th percentile **(10 marks)**

b) Table 3 shows the distribution of lengths of 100 bolts in millimeters:

Table 3

Length	100-103	104-107	108-111	112-115	116-119	120-123
Frequency	1	15	42	31	8	3

By taking the assumed mean to be 109.5 use coding procedure to determine:
(i) The mean length
(ii) The standard deviation **(10 marks)**

Question Four

a) Define the following periodic function: **(4 marks)**

x

b) Obtain the half-range sine series to represent the function defined by:

$$f(x) = 6 \quad 0 \le x \le \pi$$

$$f(x) = f(x + 2\pi)$$

(6 marks)

c) Determine the Fourier series of the periodic function defined by:

$$fx = 0 \qquad -\pi \leq x \leq 0$$
$$f(x) = 2 \qquad 0 \leq x \leq \pi$$

$$f(x) = f(x + 2\pi)$$

(10 marks)

Question Five

a) In a motor firm selling cars, the total cost of three Subaru Cars, two Nissan cars and Four Mercedes cars is ksh 9, 160, 1000, the total cost for two Subaru cars, two Nissan cars and three Mercedes cars is ksh 7,180,000; the total cost of four Subaru cars three Nisan cars and four Mercedes cars is ksh 10,800,000.

(i) Represent this information in a matrix form **(3 marks)**
(ii) Use the inverse of a matrix method to determine the price of each type of the cars.
(17 marks)