



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN MECHANICAL ENGINEERING (DMEN V)

AMA 2350: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION

SERIES: APRIL 2015

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table*

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 **THREE** printed pages

Question One (Compulsory)

a) For the function defined by:

$$f(x) = 0 \quad -\pi \leq x \leq 0$$

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

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

- (i) Sketch the function between $-\pi$ to π
 (ii) Obtain the Fourier series for the function (12 marks)

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

$$2x - y + 3z - z = 0$$

$$x + 3y - z - 11 = 0$$

$$2x - 2y + 5z - 3 = 0$$

(12 marks)

c) The following table shows the number of children in family in a housing estate:

No. of children	0	1	3	4	5	6
No. of families	1	5	27	10	4	2

Calculate:

- (i) The mean number of children per family
 (ii) The standard deviation (6 marks)

Question Two

a) Solve for x if:

$$\begin{vmatrix} 2-x & 3 & 4 \\ 1 & -x & 0 \\ 0 & 1 & -x \end{vmatrix} = 4$$

(4 marks)

$$M = \begin{pmatrix} 1 & 2 & 1 \\ 3 & -4 & -2 \\ 5 & 3 & 5 \end{pmatrix}$$

b) Determine the inverse of the following matrix:

Hence use your result to solve the following simultaneous equations.

$$x_1 + 2x_2 + x_3 = 4$$

$$3x_1 - 4x_2 - 2x_3 = 2$$

$$5x_1 + 3x_2 + 5x_3 = -1$$

(16 marks)

Question Three

- a) The time taken by employees to complete an operation was recorded on 80 occasions:

Time (min)	10	10.5	11	11.5	12	12.5	13
Frequency (f)	4	8	14	22	19	10	3

By using an assumed mean of 11.5, use coding procedure to determine:

- (i) The mean
 (ii) The standard deviation (9 marks)

- b) The table below shows distribution of marks of 100 students in Mathematics examination.

Marks	1 – 10	11 – 20	21 – 30	31 – 40	41 – 50	51 – 60
Frequency	3	16	26	31	16	8

Calculate:

- (i) Median mark
 (ii) Lower and upper quartile
 (iii) 80th percentile (11 marks)

Question Four

- a) A function $f(x)$ is defined by:

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

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

Obtain the half-range sine series to represent the function. (7 marks)

- b) Determine the inverse of the matrix:

$$M = \begin{pmatrix} 2 & 1 & -1 \\ 10 & 1 & 3 \\ 2 & -1 & 1 \end{pmatrix}$$

(13 marks)

Question Five

- a) Define the periodic function depicted by the following figure:

0

(4 marks)

b) Determine the Fourier series for the function:

$$f(x) = \frac{x}{2} \quad 0 \leq x \leq 2\pi$$

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

(16 marks)