



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
**CERTIFICATE IN INFORMATION COMMUNICATION TECHNOLOGY &
MAINTENANCE (CICM 14S)**

AMA 1152: MATHEMATICS

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

Instructions to Candidates:

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) Define the term ‘Naperian Logarithms’ (2 marks)

b) Transpose the formula to make f the subject: (4 marks)

$$\frac{R}{r} = \sqrt{\frac{f+p}{f-p}}$$

c) Derive the quadratic formula and hence solve for x in the following equation. (6 marks)

$$5x^2 + 12x + 3 = 0$$

d) Solve the 3 unknowns in the following set of equations:

$$3x + 2y - z = 19$$

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

$$2x + 4y - 5z = 32$$

(6 marks)

e) Solve the following by completing the square:

$$4x^2 - 16x + 3 = 0$$

(6 marks)

f) Linearize the following:

$$y = ax^n$$

(2 marks)

g) Differentiate the following and give an example of each:

- Symmetric and skew-symmetric matrices.

(4 marks)

Question Two

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 1 & 5 \\ 6 & 0 & 2 \end{pmatrix} \quad \text{find } |A|$$

a) Given the matrix (2 marks)
 And hence find A^{-1} (6 marks)

b) Solve for x in the following equation:

$$\frac{x+2}{2} - \frac{x+5}{3} = \frac{2x-5}{4} + \frac{x+3}{6}$$

(4 marks)

$$A = \begin{pmatrix} 2 & 1 \\ 4 & 0 \end{pmatrix}, B = \begin{pmatrix} 2 & 7 \\ 0 & 1 \end{pmatrix}$$

- c) Given that find
- (i) A^2 (3 marks)
 - (ii) $A + 2B$ (3 marks)
 - (iii) Predict the order of $A \times A \times 3B$ (2 marks)

Question Three

- a) Solve the following set of equations using Gaussian elimination method:

$$x_1 - 4x_2 - 2x_3 = 21$$

$$2x_1 + x_2 + 2x_3 = 3$$

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

(8 marks)

- b) Solve the equation below:

$$5.4^{x+3} \times 8.2^{2x-1} = 4.8^{3x}$$

(4 marks)

- c) Solve the following pair of equations:

$$2(x + 2y) + 3(3x - y) = 38$$

$$4(3x + 2y) - 3(x + 5y) = -8$$

(4 marks)

- d) A girl lying at the top of a cliff, 120m high sees two rocks whose angles of depression are 10° and 30° . If the rocks are in line with the foot of the cliff, find the distance between the rocks.

(4 marks)

Question Four

- a) A boy 120cm tall, is standing 50m from a flag post on a level ground. He finds that the angle of elevation to the top of the flag post is 15° . Calculate the height of the flag post. (2 marks)

- b) Show that the following equation holds:

$$\frac{2 - \cos^2 x = 1}{1 + \sin^2 x}$$

(3 marks)

$$\sin^2(x) + \cos^2(x) = 1$$

- c) Show that and hence derive the subsequent trigonometric identities.

(8 marks)

$$y = 5x + 6$$

- d) Find the x and y intercept of the line with equation (2 marks)

e) Derive the cosine rule. (5 marks)

Question Five

a) Rewrite the following without logarithms:

(i) $\log w = 2(\log A + \log W) - (\log 32 + 2 \log \pi + 2 \log r + \log C)$ (1 mark)

(ii) $\log S = \log K - \log 2 + 2 \log \pi + 2 \log n + \log y + \log r + 2 \log L - 2 \log h - \log g$ (1 mark)

(iii) $\ln I = \ln(2x) - \{\ln(KR + r) - \ln K + KL\}$ (1 mark)

b) Find the equation of the line passing through the points (4, 5), (8, 7) (2 marks)

c) State whether or not the following can each be expressed as a product of linear factors:

(i) $x^2 - 19x + 18 = 0$ (1 mark)

(ii) $2x^2 + 11x + 28 = 0$ (1 mark)

(iii) $x^2 + 5x - 24 = 0$ (1 mark)

(iv) $x^2 + 4x - 21 = 0$ (1 mark)

(v) $x^2 - 9x + 18 = 0$ (1 mark)

d) A metallic pipe 12m long is leaning against a vertical wall, with its foot 3m from the wall.

(i) Find the angle the pipe makes with the horizontal (1 mark)

(ii) Find the height of the wall where the pipe reaches. (2 marks)

e) Simplify without using tables:

(i) $\tan 30^\circ \sin 60^\circ$ (2 marks)

(ii) $\frac{\cos 30^\circ}{\tan 30^\circ}$ (2 marks)

f) Solve for x if:

(i) $3^x = 243$ (1 mark)

(ii) $2^{x-1} = \frac{32}{\sqrt{2}}$ (1 mark)

(iii) $x^{-3/4} = 27$ (1 mark)