



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

ELECTRICAL ENGINEERING

MODULE: Engineering Maths 1

PAPER NO: 321/22/M06/1

DURATION: 3 Hours

MAY/JUNE 2024 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

- 1) Answer all questions.
- 2) Start question on a new page.

PAPER NO: 321/22/M07/1 - ENGINEERING MATHS 1

QUESTION 1

- a) Find the equation of the line passing through the point with coordinates $(2, 4)$ and $(8, 7)$ (4 marks)
- b) Solve i) $x^2 + 5x + 6 = 0$ (3 marks)
- ii) $2x^2 - x - 7 = 0$ (3 marks)

QUESTION 2

- a) Express $x^2 + 5x - 7$ in the form $(x + A)^2 + B$ and hence solve the equation $x^2 + 5x - 7 = 0$ (4 marks)
- b) Express $\frac{3x-4}{x^2-5x-6} - \frac{2}{x-6}$ as a single fraction in its simplest form. (4 marks)
- c) Solve the equations
- $$x - y = 2 \quad (2 \text{ marks})$$
- $$2x^2 - 3y^2 = 15$$

QUESTION 3

Simplify

- a) $\frac{2^3 \times 2^7}{4^3}$ (2 marks)
- b) $(x^2)^7 \times x^{-3}$ (3 marks)
- c) $\sqrt[3]{a^4 b^5} \times \frac{b^{\frac{1}{3}}}{a}$ (3 marks)
- d) $\left(\frac{25}{9}\right)^{-\frac{3}{2}}$ (2 marks)

PAPER NO: 321/22/M07/1 - ENGINEERING MATHS 1

QUESTION 4

- a) Simplify each of the following logarithms, giving final answer as a number not involving a logarithm.

i) $2 \log_{12} 3 + 4 \log_{12} 2$ (3 marks)

ii) $\log_8 25 + \log_8 10 - 3 \log_8 5$ (3 marks)

- b) Solve the following exponential equations.

$3 \times \left(\frac{1}{3}\right)^x = 0,0042$ (4 marks)

QUESTION 5

- a) Using surd form evaluate

$$\frac{3 \tan 60^\circ - 2 \cos 30^\circ}{\tan 30^\circ}$$
 (5marks)

- b) Draw the graph of $y = \sin A$ in the interval 0° to 360° (5 marks)

QUESTION 6

Prove the following identities

a) i) $(1 - \cos A)(1 + \sec A) \equiv \sin A \tan A$ (5 marks)

ii) $\tan \theta + \cot \theta = 2 \operatorname{cosec} 2\theta$ (3 marks)

- b) Solve the equation

$\tan 2\theta = 1$ for $0^\circ \leq \theta \leq 360^\circ$ (2 marks)

QUESTION 7

Relative to a fixed origin O the respective positions vectors of the points A, B, C are as follows:

$\begin{pmatrix} 3 \\ 2 \\ 9 \end{pmatrix}, \begin{pmatrix} -5 \\ 11 \\ 6 \end{pmatrix} \text{ and } \begin{pmatrix} 4 \\ 0 \\ -8 \end{pmatrix}$

- a) Determine the component from the vectors $\overline{AB}$ and $\overline{AC}$ (5 marks)

- b) Hence find the nearest degree the angle $\hat{BAC}$. (5 marks)

PAPER NO: 321/22/M07/1 - ENGINEERING MATHS 1

QUESTION 8

- a) Eliminate θ from the equation

$$x = 2 \cos \theta \text{ and } y = 3 \sin \theta \quad (4 \text{ marks})$$

- b) Prove that

i) $\sin 3A \equiv 3 \sin A - 4 \sin^3 A$ (3 marks)

ii) $\frac{\sin(A-B)}{\cos A \cos B} \equiv \tan A - \tan B$ (3 marks)

QUESTION 9

- a) Convert the following hexadecimal numbers into their decimal equivalent.

$$C9_{16} \quad (2 \text{ marks})$$

$$BD_{16} \quad (2 \text{ marks})$$

- b) Convert the following decimal numbers into their hexadecimal equivalent.

i) 162_{10} (3 marks)

ii) 239_{10} (3 marks)

QUESTION 10

- a) Solve the simultaneous equation:

$$3y - x + 10 = 0$$

$$x^2 + y^2 = 20 \quad (6 \text{ marks})$$

- b) Solve the equations:

i) $3(3^{2x}) - 7(3^x) + 2 = 0$ (2 marks)

ii) $\log(x-1) + \log(x+1) = 2 \log(x+2)$ (2 marks)