



ZIMBABWE

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

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

ELECTRICAL ENGINEERING

MODULE: Engineering Mathematics

PAPER NO: 321/22/M06/1

DURATION: 3 Hours

NOVEMBER/DECEMBER 2025 EXAMINATION

REQUIREMENTS

1. Non-programmable calculator.
2. Answer booklet.

INSTRUCTIONS TO CANDIDATE

1. Answer all questions.
2. Start a new question on a new page.
3. No mark will be awarded for a wrongly copied question.

SECTION A

QUESTION 1

Simplify the following

a) $\frac{t^{3/2} \times t^2}{t^{5/2}}$ (2 marks)

b) $\frac{4^{1/5} \times 8^{1/2}}{2^2 \times 32^{-2/5}}$ (4 marks)

c) Prove that $\log MN = \log M + \log N$ (4 marks)

QUESTION 2

a) Solve using the determinant method

$$\begin{aligned} 3x - 2y &= 12 \\ x + 3y &= -7 \end{aligned}$$
 (7 marks)

b) Simplifying

$$\frac{2\sqrt{5}+1}{2\sqrt{5}+3}$$
 (3 marks)

c) Solve for x given that

$$\log_3 9 = x$$
 (2 marks)

QUESTION 3

- a) Solve using quadratic formula

$$3x^2 - 4x + 1 = 0 \quad (3 \text{ marks})$$

- b) Use completing the square method to solve and leave your answer in the form.

$$x^2 + 4x + 1 = 0 \quad (3 \text{ marks})$$

- c) Solve the following and give your answer to 3 significant figures

$$3x = 8 \quad (2 \text{ marks})$$

QUESTION 4

- a) Solve for x

$$9^{(x-1)} = 27^{(x-1)} \quad (3 \text{ marks})$$

- b) Solve the equation

$$\log_3 x - 4 \log_x 3 + 3 = 0 \quad (4 \text{ marks})$$

- c) Evaluate

$$\frac{4^{1.5} \times 8^{\frac{1}{3}}}{2^2 \times 32^{\frac{-2}{5}}} \quad \text{Using law of indices.} \quad (3 \text{ marks})$$

QUESTION 5

- a) $\frac{\log 25 - \log 125 + 0.5 \log 625}{3 \log 5}$ (3 marks)
- b) $(x^2 y) \left(\frac{2}{x}\right)^2$ (3 marks)
- c) Given $\log 3 = 0.47712$
Calculate $\log 0.9$ (4 marks)

QUESTION 6

- a) Show that $\cos(y - \pi) + \sin\left(y + \frac{\pi}{2}\right) = 0$ (3 marks)
- b) Without using a calculator evaluate $\sin 90^\circ$. (3 marks)
- c) Evaluate θ from the equations
 $y = 5 \tan \theta, x = 4 \sec \theta$ (4 marks)

QUESTION 7

- a) Show that
 $\tan\left(x + \frac{\pi}{4}\right) \tan\left(x - \frac{\pi}{4}\right) = -1$ (6 marks)
- b) Using surd form evaluate
 $\frac{3 \tan 60^\circ - 2 \cos 30^\circ}{\tan 30^\circ}$ (4 marks)

QUESTION 8

- a) Show that $\frac{1 - \sin^2 \theta}{1 + \sin \theta} = 1 - \sin \theta$ (2 marks)
- b) If $\cos A = 0.781$ and $\sin A = 0.625$ without finding the angle calculate the other four (4) ratios. (4 marks)
- c) Determine all angles between 0° and 36° whose *sine* is -0.4638 . (4 marks)

QUESTION 9

- a) Distinguish between a scalar and vector quantity giving one example of each. (4 marks)
- b) If $A = 2i + 3j$ $B = 6i + 5j$ find
- i) $A \cdot B$ (dot product) (2 marks)
- ii) The angle between A and B (4 marks)

QUESTION 10

- a) Convert
- i) 101.0101_2 to a decimal number. (3 marks)
- ii) 0.40625_{10} to a binary number. (4 marks)
- iii) 11110011.10001_2 to a decimal number via octal (3 marks)

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