TEVETA
Technical Education, Vocational and Entrepreneurship Training Authority

DIPLOMA IN ELECTRICAL TECHNOLOGY

LEVEL 6 YEAR I EXAMINATIONS

FINAL INTEGRATED SUMMATIVE EXAMINATION

SITTING: NOVEMBER/DECEMBER 2025

SUBJECT: ENGINEERING MATHEMATICS I

TIME: THREE (3) HOURS **TOTAL MARKS: 100**

PASS MARK: 50

INSTRUCTIONS TO CANDIDATE

1. Write your examination number and national registration card numbers on the answer booklet provided. Ensure to append your signature in the space provided on the answer booklet
2. Write your answer SCRIPT SERIAL NUMBER on the examination register Provided and the entry slip
3. There are Eight (8) questions in this paper.
4. Question ONE (1) is COMPULSORY. Attempt any other FOUR (4) questions.
5. Each question carries 20 marks.
6. Cell phones and programmable calculators are not allowed in the examination room
7. No candidate shall be allowed to leave the examination room in the first ONE (1) hour at the start of the examination and the last thirty (30) minutes before the end of examination

DO NOT TURN THIS PAPER UNTIL YOU ARE TOLD TO DO SO

QUESTION 1

a) Prove the identity $\frac{1+\cot\theta}{1+\tan\theta} = \cot\theta$ **[5 marks]**

b) use Cramer's rule to solve for a, b and c

$-4a + 2b + 3c = 0$

$3a - 4b + 3c = 8$

$-a + 5b - 2c = -5$ **[15 marks]**

[TOTAL: 20 MARKS]

QUESTION 2

a) Factorise; $25x^2 - 49$ **[3 marks]**

b) By completing the square method solve; $-4x^2 - 5x - 1 = 0$ **[6 marks]**

c) Given the Boolean expression $Z = \overline{P}.Q + P\overline{Q}$.construct

i. a truth table **[6 marks]**

ii. Its logic circuit diagram **[5 marks]**

[TOTAL: 20 MARKS]

QUESTION 3

a) A straight line $y = 2x - 4$ cuts the parabola with equation $y = x^2 - 3x$ at the points P and Q, Determine

i. the coordinates of P and Q **[5 marks]**

ii. distance between the points P and Q **[5 marks]**

b) The roots of an equation $2x^2 - 6x + 9$ are α and β, determine

i. $\frac{1}{\alpha} + \frac{1}{\beta}$ **[5 marks]**

ii. $(\alpha + 1)(\beta + 1)$ **[5 marks]**

[TOTAL: 20 MARKS]

QUESTION 4

a) Given vectors $\bar{u} = \langle 2, 0, -4\rangle$ and $\bar{v} = \langle 6, -2, 2\rangle$. Determine

i. $\bar{u}.\bar{v}$ **[4 marks]**

ii. The angle between $\bar{u}$ and $\bar{v}$ **[6 marks]**

b) Given matrix $A = \begin{bmatrix} 3 & 9 & -3 \\ 4 & 4 & 0 \\ -1 & -3 & 3 \end{bmatrix}$,determine the Adjoint of A **[10 marks]**

[TOTAL: 20 MARKS]

QUESTION 5

a) Convert the following numbers into their hexadecimal equivalent

i. 452_{10} **[5 marks]**

ii. 123_{10} **[5 marks]**

b) Perform the following binary operations

i. $1011101 + 1100001 + 110101$ **[5 marks]**

ii. 11011×101 **[5 marks]**

[TOTAL: 20 MARKS]

QUESTION 6

a) If $z_1 = 2 - j3, z_2 = 4 + j6$ and $z_2 = -4 - j2$, determine in the form $z = a + jb$ the value of $z_1 z_2 z_3$ **[6 marks]**

b) Rationalize the denominator $\frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}+\sqrt{5}}$ **[4 marks]**

c) Given that $A = \begin{bmatrix} 2 & 2 \\ -1 & 5 \end{bmatrix}$, determine the eigen values of this matrix **[10 marks]**

[TOTAL: 20 MARKS]

QUESTION 7

a) Express the following in the form $z = a + bi$

i. $\frac{3+2i}{4-2i}$ **[5 marks]**

ii. $\frac{4+i}{4-3i}$ **[5 marks]**

b) Given that $z = 2 - 3i$

i. Determine the modulus of z **[2 marks]**

ii. Calculate z^2 **[4 marks]**

iii. Workout the argument of z **[4 marks]**

[TOTAL: 20 MARKS]

QUESTION 8

An alternating current is given by $i(t) = 50sin\,(1000\pi t + 45°)$ amperes,

a) Express the current in phasor form **[5 marks]**

b) Hence, determine

i. The amplitude. **[2 marks]**

ii. The periodic time. **[5 marks]**

iii. The frequency **[3 marks]**

iv. The current when t = 5 sec **[5 marks]**

[TOTAL: 20 MARKS]