071306T4EEN

ELECTRICAL ENGINEERING (POWER OPTION) LEVEL 6

ENG/OS/PO/CC/ 01 / 6

Apply Engineering Mathematics

Nov/Dec 2025

TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. Marks for each question are indicated in the brackets.
2. This paper consists of **TWO** sections: **A** and **B**.
3. Candidates are provided with a separate answer booklet
4. **DO NOT** write on this question paper.

This paper consists of FOUR (4) printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A (40 MARKS)

*Attempt **ALL** the questions in this section.*

1. A piece of timber 273cm is cut in the ratio 3:7:11. Determine the lengths of the three pieces (3marks)

2. $\sec 2x = \cot x$. (3marks)

3. Three numbers are in arithmetic progression. Their sum and their product is 80. Determine the three numbers (3marks)

4. Find $\int \frac{2x^3-3x}{4x} dx$ (2marks)

5. Simplify the expression $\frac{log125-\frac{1}{2}log25+log625}{log3125+\frac{1}{2}log25}$ (3marks)

6. Express the equation of the parabola $y^2 = 8 - 4x$ in polar form $y^2 = 8 - 4x$

(4marks)

7. Solve for x: $\begin{vmatrix} x-2 & 2 & 2 \\ -1 & x & -2 \\ 2 & 0 & 4 \end{vmatrix} = 0$ (4marks)

8. Given that $P\sinh x + Q\cosh x = 5e^x + 3e^{-x}$. Determine of P and Q. (4marks)

9. Given that $A = \begin{pmatrix} 2 & 4 & -6 \\ 4 & 0 & 2 \\ 6 & 2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & -4 & 6 \\ 2 & -2 & 4 \\ 2 & 2 & 2 \end{pmatrix}$, Find 3A – 4B (3marks)

10. Solve the following equation by completing the square. (4marks)

$3y^2 = 0$

11. Expand $(3 - 2x)^5$ in ascending powers of x, up and including the term in $(x)^3$ (3marks)

12. Find the inverse Laplace transform of $\frac{S}{(S^2+5S+6)}$ (4mark)

SECTION B (60 MARKS)

*Attempt Any **THREE** Questions in This Section*

13.

a) Given that $z_1 = 2 + 5j, z_2 = 1 - 3j$ *and* $z_3 = 2 + 3j$, determine (6marks)

$4z_1^2 + 3z_2z_3$, in the form $a + bj$

b) Solve the equation (7marks)

$2^{2x+1} - 7(2^x) + 6 = 0$

c) Solve the following simultaneous equations using the Crammers rule. (7marks)

x + y + z = 4

2x - 3y + 4z = 33

3x - 2y - 2z = 2

14.

a) Locate the stationary points of the $f(x, y) = x^2 + 2y^2 - 6x + 12y$, and determine their nature. (8marks)

b) Three forces F_1, F_2 *and* F_3 in a newton, necessa mechanical system satisfy the simultaneous equations;

$$F_1 - 2F_2 + F_3 = 1$$
$$F_1 + 3F_2 - 2F_3 = 2$$
$$F_1 + F_2 + F_3 = 7$$

Solve the equations using elimination method. (7marks)

c) Given that x_n is an approximation to the root of the equation $x^3 + x^2 - 3 = 0$, Use the Newton Raphson method to show that a better approximation is given by

$$x_{n+1} = \frac{2x_n^3 + x_n^2 + 3}{3x_n^2 + 2x_n}$$ (5marks)

15.

a) In a pack of 12 capacitors and a pack of 20 resistors, there are 2 defective capacitors and 3 defective resistors respectively. A capacitor and a resistor are selected at random from the packs. Determine the probability that;

i. one is defective (3mark

ii. both are defective (3mark

iii. none is defective (3marks)

b) Given Fourier series function, $f(x) = x + x^2, for -\pi < x < \pi$

i. Calculate the constant a_0 (5marks)

ii. Calculate the constant a_n (6marks)

16.

a) Express $7sin\boldsymbol{\theta} - 5cos\boldsymbol{\theta}$ in the form $Rsin(\boldsymbol{\theta} - \alpha)$, where $R > 0$ and $0^\circ \leq \alpha \leq 90°$ (8marks)

$$7sin\boldsymbol{\theta} - 5cos\boldsymbol{\theta} = Rsin(\boldsymbol{\theta} - \alpha)$$

$$7sin\theta - 5cos\theta = 8.485\sin(\theta - 35.54°)$$

b) Hence solve the equation:

$7sin\theta - 5cos\theta = 4.3$ for values of Θ between 0° and 360°, inclusive (5marks)

c) Solve the differential equations (7marks)

$$= 5\int x^2 - 3x\,dx$$