

071306T4EEN

ELECTRICAL ENGINEERING (POWER OPTION) LEVEL 6

ENG/OS/PO/CC/01/6

Apply Engineering Mathematics

March/April 2026



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

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATE

1. This paper consists of **TWO** sections: **A** and **B**.
2. Attempt **ALL** questions in section **A** and any other **THREE** (3) questions in section **B**.
3. Marks for each question are indicated in the brackets.
4. Candidates are provided with a separate answer booklet
5. **DO NOT** write on the 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. Given vector $a = 4i - j + 3k$, find the magnitude of vector a (4 marks)
2. Given that $(a + b) + j(a - b) = 9 + j10$, Find the values of a and b (3 marks)
3. Given that $\sin A = \frac{12}{13}$ and $\cos B = \frac{7}{25}$ and A and B are acute angles, Determine the values of :

i. $\sin(A + B)$ (3 marks)

ii. $\cos(A - B)$ (3 marks)

4. Prove the identity:

$$\frac{1 + \cos \theta}{\sin \theta} + \frac{\sin \theta}{1 + \cos \theta} = 2 \operatorname{Cosec} \theta \quad (3 \text{ marks})$$

5. Use implicit differentiation to determine the equation of normal to the curve.

$$x^2 + y^2 - 4xy + 6x + 4y = 8 \text{ at point } (1,1). \quad (4 \text{ marks})$$

6. Given the matrices $A = \begin{bmatrix} 3 & 6 \\ 2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 4 & 3 \end{bmatrix}$ and find $[AB]^{-1}$ (4 marks)

7. Prove that (4 marks)

$$\frac{\tan x + \sec x}{\sec x \left(1 + \frac{\tan x}{\sec x}\right)} = 1$$

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

9. Show that the equation $2x^3 - 7x^2 - x + 12 = 0$ has a better approximation to the root

$$\text{given by } x_n = \frac{4x_n^3 - 7x_n^2 - 1}{6x_n^2 - 14x_n - 1} \quad (4 \text{ marks})$$

10. Resolve into partial fractions (5 marks)

$$\frac{11 - 3x}{x^2 + 2x - 3}$$

SECTION B (60 MARKS)*Attempt Any **THREE (3)** Questions in This Section*

11.

- a. 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

$$\text{i. } x_{n+1} = \frac{2x_n^3 + x_n^2 + 3}{3x_n^2 + 2x_n} \quad (12 \text{ marks})$$

- b. The table in figure 1 represents a polynomial function and an error is suspected in one of the effects (8 marks)

x	1	2	3	4	5	6	7	8	9
F(x)	0	3	18	48	108	195	318	483	696

- i. Use the finite table to locate and correct the errors
- ii. Use the Newton Gregory interpolation formula to determine $f(3.7)$

12.

- a. Find the inverse laplace transform of (10 marks)
- b. Determine the half -range Fourier Cosine Series for (10 marks)

13.

- a. Find the stationary points of the surface $Z = x^3 - xy + y^3$ and distinguish them (10 marks)
- b. The area A of a triangle is given by $A = \frac{1}{2}ac\sin B$ where B is the angle between sides a and c. If a is increasing at 0.4 units/s, c is decreasing at 0.8 units/s and B is increasing at 0.2 units/s, Find the rate of change of the area of the triangle correct to 3 significant figures, where a is 3 units, c is 4 units and B is $\frac{\pi}{6}$ radians (10 marks)

14.

- a. Show that the general solution of the differential equation $x^2 \frac{dy}{dx} = x^2 - y^2 + xy$ may be expressed as in the form $x - y = c(x + y)$ where c is an arbitrary constant (11 marks)

- b. Express $\sin(x + h)$ as a series of powers of h and evaluate $\sin 44^\circ$ correct to 5 decimal place.

(9 marks)