061906T4TEL

TELECOMMUNICATION ENGINEERING LEVEL 6

ENG/OS/TLE/CC/01/6/A

Apply Engineering Mathematics

November /December 2025

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

WRITTEN ASSESSMENT

TIME: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. The paper consists of **TWO** sections; **A & B**
2. You are provided with a separate answer booklet
3. Marks for each question are as indicated
4. Do Not write on the question paper

This paper consists of FOUR (4) printed pages.

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

SECTION A (40 MARKS)

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

1. Simplify: $\dfrac{\frac{1}{2}\log 625 - \log 125 + \log 25}{3\log 5}$. (5 marks)
2. The increase in resistance of strip conductors due to eddy currents at power frequencies is given by the equation $(3+\alpha)^4$. By use of Maclaurin's series find the expansion of the equation (4 marks)
3. The three vectors A=-2i – j +2k, B=i – 3j -k and C=ai – j are coplanar. Determine the value of constant a. (4 marks)
4. Make R the subject of the formulae. (4 marks)

$$H = \sqrt{\frac{PT}{R^2 - QS}}$$

5. A second order servo system transfer function is represented by the following Laplace transform equation $T_{(s)} = \left\{\frac{4s^3-14s^2+3s+13}{(s+2)(s-1)^3}\right\}$

By use of inverse Laplace transforms represent the system in time domain. (4 Marks)

6. Given $\phi = x^2y^2z^3 - 3xy^2 + xyz^2$. Determine at a point (1, -2, 1). Find $\nabla\phi$. (4Marks)
7. Factorize the binomial expansion of $\sqrt{\frac{1+\frac{1}{2}x}{1-\frac{1}{2}x}}$ ignoring terms above x^3. (4marks)
8. A batch of 40 solar charge controllers contains 5 which are defective. If a controller is drawn at random from the batch and tested and then a second controller is drawn at random, calculate the probability of having one defective charge controller both with and without replacement. (3 Marks)
9. Use Demoivres theorem to expand cos5θ. (4 Marks)
10. Given the complex numbers Z_1=3+4j, Z_2=5-6j and Z_3=4+7j, determine in polar form. (4 marks)

SECTION B (60 MARKS)

*Answer any **THREE** questions in this section.*

11.

a) Use Newton Raphson method to solve the equation $x^3 - 3x - 5$ near 1.8 correct to 7 decimal places. (10 marks)

b) Table 1 represents a polynomial f(x)

Table 1

x	0	1	2	3	4	5	6	7
$f(x)$	5	12	37	92	182	340	557	857

Determine;

(i) $f(x)$

(ii) $f(3.8)$using Gregory – Newton forward difference interpolation.

(10 marks)

12.

a) Determine the Fourier series of the function; (8 marks)

$$f(x) = \begin{cases} 6, & -\pi \le x \le 0 \\ -6, & 0 \le x \le \pi \end{cases}$$

b) Given that $f(x) = \sin x, 0 \le x \le \pi$, determine the Fourier cosine series. (12 marks)

13.

a) Determine the surface area of the part of a cone $z^2 = 4(x^2 + y^2)$ that lies between the planes z = 0 and z = 4. (7 marks)

b) Verify Stoke's Theorem for the vector field $\mathbf{F} = z^2\,\mathbf{i} - 3xy\,\mathbf{j} + x^3y^3\,\mathbf{k}$, where S is the part of the plane z = 4 - 2x - y that lies above the region in the xy-plane bounded by x =0, y =0, and x + y=2. The surface S is oriented upwards. (13 marks)

14.

(a) Given that n=1 satisfies the following equation, determine the other values of n.

(9 marks)

$$\begin{vmatrix} 2-n & 3 & -2 \\ 1 & 4-n & -2 \\ 2 & 10 & -5-n \end{vmatrix} = 0$$

(b) Use crammers' rule to solve the following system of equation. (11 marks)

$$x + y + z = 4$$

$$2x - 3y + 4z = 33$$

$$3x - 2y - 2z = 2$$