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0715 0654C**MECHANICAL PRODUCTION TECHNICIAN LEVEL 6****ENG/OS/MEM/CC/02/6**

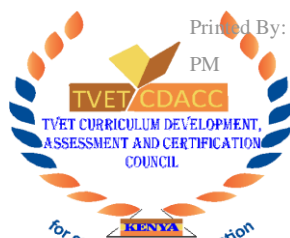
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Apply Engineering Mathematics

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November/December 2025

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PM

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

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WRITTEN ASSESSMENT**Time: 3 HOURS**

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

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This paper consists of THREE (3) 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)

Answer ALL questions in this section

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1. The surface area of a sphere is 201.1 cm^2 . Find the diameter of the sphere. (4 Marks)
2. The sum of 7 terms of an Arithmetic Progression (AP) series is 35 and the common difference is 1.2. Determine the first term of the series. (4 Marks)
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3. Show that a line through the points A (6, 0) and B (0, 12) is perpendicular to a line through points P (8, 10) and Q (4, 8). (4 Marks)
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4. Find the values of a and b given that $2 - j3 = \sqrt{(a + jb)}$ (4 Marks)
5. Solve the equation: $\log(x - 1) + \log(x + 1) = 2 \log(x + 2)$. (4 Marks)
6. Determine the value of $(3.039)^4$, correct to 6 significant figures using binomial theorem. (4 Marks)
7. Determine the gradient of the curve $x^2 + 2xy - 2y^2 + x = 2$ at a point $(-4, 1)$. (4 Marks)
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8. Find the volume of a closed cone whose perpendicular height is 40 cm and its base is made up of a circle of radius 14 cm. (4 Marks)
9. Determine the Cartesian form of the following pair of parametric equations. (4 Marks)
- $x = 2t - 1$
 $y = 12t^2 - 14t + 6$
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10. Use the interpolation formula to estimate the value of $f(x)$ at $x = 2.5$, given the data points: (4 Marks)

x	2.0	3.0	4.0
$f(x)$	4.0	9.0	16.0

SECTION B (60 MARKS)**Answer Any THREE Questions in this section**

11.

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a. Prove the trigonometric identity:

$$\frac{1 + \cot \theta}{1 + \tan \theta} = \cot \theta$$

(6 Marks)

b. Solve the equation $6 \cos^2 \theta + 5 \cos \theta - 6 = 0$ for values of θ from 0° to 360° .

(6 Marks)

c. Determine the area of parallelogram whose sides are the vectors $\vec{A} = -2\mathbf{i} - 3\mathbf{j} + 2\mathbf{k}$ and $\vec{B} = -3\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$.

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(4 Marks)

d. Find the locus of a point which moves so that its distance from a point (2, -3) is always 4 units.

(4 Marks)

12.

a. Solve the differential equation.

$$2 \frac{d^2 y}{dx^2} - 11 \frac{dy}{dx} + 12y = 3x - 2$$

(12 Marks)

b. Evaluate the following integrals.

(8 Marks)

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i. $\int 3t e^{2t} dt$

ii. $\int x^3 e^x dx$

13.

a. Prove the hyperbolic identities

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i. $\cosh^2 x - \sinh^2 x = 1$

(4 Marks)

ii. $1 - \tanh^2 x = \operatorname{sech}^2 x$

(4 Marks)

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iii. $\coth^2 x - 1 = \operatorname{cosech}^2 x$

(4 Marks)

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b. Given $Ae^x + Be^{-x} = 4 \cosh x - 5 \sinh x$ Determine the values of A and B (5 Marks)c. Given, $T = 2\pi \sqrt{\frac{l}{g}}$ Determine % change in T when l increases by 2% and g decreases by 1%.

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(3 Marks)

14.

a. Use Newton's method to find the positive root of $(x + 4)^3 - e^{1.92x} + 5 \cos \frac{x}{3} = 9$ Correct to three significant figures.

(10 Marks)

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b. Determine the first four terms of the power series for $\cos x$.

(10 Marks)