ENGINEERING TECHNICIAN MATHEMATICS II

UNIT CODE: 0541 441 06A

TVET CDACC UNIT CODE: ENG/CU/MDE/CC/05/5/MA

UNIT DURATION: 60 hours.

Relationship to Occupational Standards

This unit addresses the unit of competency: Apply engineering technician mathematics II.

Unit Description: This unit describes the competencies required by a technician in order to apply technician mathematics. It enables the learner to; apply statistics and probability, matrices, and vector theorem, and carry out binomial expansion.

Summary of Learning Outcomes

S/No	Learning Outcome	Duration in hours.
1.	Apply statistics and probability	15
2.	Apply matrices	15
3.	Apply vector theorem	15
4.	Carry out binomial expansion	15
	TOTAL	**60**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply statistics and probability	2.2 Measures of central tendency mean, mode and median 2.3 Measures of dispersion	• Practical Assessment • Project

	2.4 Variance and standard deviation 2.5 Definition of probability 2.6 Laws of probability 2.7 Expectation variance and SD 2.8 Calculations involving discrete and continuous random variables. 2.9 Types of distributions 2.9.1 Binomial 2.9.2 Poisson 2.9.3 Normal 2.10 Mean, variance and SD of probability distributions Application of probability distributions	• Third Party Report • Portfolio of Evidence • Written Assessment Oral Questioning
2. Apply matrices	1.1 Introduction to matrices 1.1.1. Definition of a matrix. 1.1.2. Different types of matrices: row, column, square, rectangular, diagonal, identity, zero. 1.1.3. Notation and elements of a matrix. 1.1.4. Basic operations: addition, subtraction, scalar multiplication. 1.1.5. Special Matrices 1.1.5.1.Identity matrix, diagonal matrix, symmetric matrix, skew-symmetric matrix. 1.2 Matrix Multiplication 1.2.1. Rules and properties of matrix multiplication. 1.2.2. Properties of Matrix Multiplication 1.2.2.1.Associative, distributive, and	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

	commutative properties. 1.2.2.2.Transpose of a matrix and properties. 1.3 Determinants and Inverses 1.3.1. Calculating determinants for 2x2 and 3x3 matrices. 1.3.2. Methods to find the inverse (adjoint method, Gauss-Jordan elimination). 1.3.3. Conditions for the existence of an inverse. 1.4 Solving Systems of Linear Equations 1.4.1. Representation of linear systems using matrices. 1.4.2. Application of Cramer's rule for solving systems of linear equations. 1.4.3. Using the inverse matrix inverse method to solve linear systems. 2.11 Using the inverse determinant method to solve linear systems.	
3. Apply vector theorem	3.1 Vectors and scalar in two and three dimensions 3.2 Operations on vectors: Addition and subtraction 3.3 Position vectors 3.4 Resolution of vectors 1.5 Scalar and vector product	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

4. Carry out binomial expansion	1.1.Basic concepts of binomial theorem 1.1.1. Binomial expressions and notation. 1.1.2. Factorials and their use in binomial coefficients. 1.1.3. Binomial Coefficients 1.1.3.1.Definition and calculation using combinations (nCr). 1.1.3.2.Pascal's Triangle as a tool for finding binomial coefficients. 1.2.Binomial Expansion 1.2.1. General form of the binomial expansion expression 1.2.2. Binomial Expansion of $(a+b)^n$ where $n = 2,3,4 \ldots$ 1.2.3. Special cases 1.2.3.1.When $(1+x)^n$ 1.2.3.2.Negative and fractional binomial expansions using the binomial series 1.3.Applications of Binomial Expansion 1.3.1. Simplifying algebraic expressions using binomial expansion. 1.3.2. Solving polynomial equations. 1.4.Engineering Applications 3.5 Estimating values in engineering calculations.	• Practical Assessment • Project • Third Party Report • Portfolio of Evidence • Written Assessment • Oral Questioning

Suggested Delivery Methods

- Demonstration
- Discussions
- Practical

- Project work
- Direct instruction

List of Recommended Resources for 25 trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	**Learning Materials**			
1.	Textbooks	Engineering Mathematics by K.A. Stroud Advanced Engineering Mathematics by Erwin Kreyszig	5 pcs 5 pcs	1:5 1:5
B	**Learning Facilities & infrastructure**			
2.	Lecture/theory room	$60m^2$	1	1:25
3.	Computer	Operating System: 64-bit Windows 11 or 10 version 1809 or above Processor: 2.5 GHz (3+ GHz recommended), Memory: 8 GB (32GB recommended) Disk space: 10 GB Display: 1920 x 1080	25 pcs	1:1

		resolution Display Card: 2 GB GPU (8 GB recommended) and DirectX 11 compliant (DirectX 12 recommended)		
4.	Projector		1	1:25
5.	Interactive screen	Specifications: 77-inch interactive whiteboard with touch and pen functionality.	1	1:25
C	**Software**			
6.	MATLAB	License: Educational licenses available. Features: Matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, interfacing with programs in other languages.	Installed in 25 computers	1:1
7.	GeoGebra	License: Free educational software. Interactive geometry,	Installed in 25 computers	1:1

		algebra, statistics, and calculus applications		
D	**Consumables**			
8.	Pens, pencils, rulers and paper	Whiteboard markers, 2H pencils, plastic rulers, A2 white papers	Enough	