DISCRETE MATHEMATICAL CONCEPTS

ISCED UNIT CODE: 0541 541 01A

TVET CDACC UNIT CODE: IT/CU/ICTA/CC/01/6/MA

Duration of Unit: 120 Hours

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Apply Discrete Mathematical Concepts

Unit Description

This unit covers the competence to apply discrete mathematical concepts. It involves carrying out set theory operations, performing matrix operations, applying number systems, applying logic gates, performing sequence and series and demonstrating graph theory.

Summary of Learning Outcomes

Learning Outcomes	Duration (Hours)
1. Carry out set theory operations	20
2. Perform matrix operations	20
3. Apply Number Systems	20
4. Apply logic Gates	20
5. Perform sequence and series operations	20
6. Demonstrate graph theory	20
Total Hours	**120**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Carry Out Set Theory Operations	1.1 Sets representation 1.1.1 Introduction to set theory operations 1.1.1.1 Definition of key terms 1.1.1.2 Set builder notation 1.1.2 Identification sets properties 1.1.3 Order and Uniqueness 1.1.4 Methods of set representation 1.1.4.1 Roster Form 1.1.4.2 Set Builder Form 1.1.4.3 Finite 1.1.4.4 Infinite 1.1.4.5 Statement form 1.1.4.6 Tabular form 1.2 Set application 1.2.1 Types of sets 1.2.1.1 Finite Set 1.2.1.2 Infinite Set 1.2.1.3 Subset 1.2.1.4 Proper Subset 1.2.1.5 Universal Set 1.2.1.6 Empty or Null 1.2.1.7 Equal 1.2.1.8 Equivalent Set 1.2.1.9 Singleton Set or Unit Set 1.2.1.10 Overlapping Set 1.2.1.11 Disjoint Set 1.3 Set Operations 1.3.1 Cardinality of a set. 1.3.2 Union	• Practical Activities • Project work • Demonstration • Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests

	1.3.3 Intersection 1.3.4 Difference 1.3.5 Complement 1.3.6 Venn Diagrams	
2. Perform Matrix Operations	2.1 Identification of matrices 2.1.1 Definition of key terms 2.1.1.1 Matrix 2.1.1.2 Dimension 2.1.1.3 Elements 2.1.1.4 Application of matrices 2.1.1.4.1 Computer Graphics 2.1.1.4.2 Robotics 2.1.1.4.3 Machine learning 2.1.2 Types of matrices 2.1.2.1 Row matrix 2.1.2.2 Column matrix 2.1.2.3 Zero matrix 2.1.2.4 Square matrix 2.1.2.5 Diagonal matrix 2.1.2.6 Upper Triangular Matrix 2.1.2.7 Lower Triangular Matrix 2.1.2.8 Scalar matrix 2.1.2.9 Identity matrix 2.1.2.10 Transposed matrix 2.1.2.11 Symmetric matrix 2.1.2.12 Skew-symmetric matrix	• Practical Activities • Project work • Demonstration • Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests

	2.1.2.13 Orthogonal matrix 2.2 Matrix operations 2.2.1 Sum of matrices 2.2.1.1 2 x 2 matrices 2.2.1.2 3 x 3 matrices 2.2.2 Matrix subtraction 2.2.2.1 2 x 2 matrices 2.2.2.2 3 x 3 matrices 2.2.3 Product of two matrices 2.3 Determinant of a matrix 2.3.1 Determinant of a 2 x 2 matrix 2.3.2 Determinant of a 3 x 3 matrix 2.3.3 Solving simultaneous equations using matrix method 2.3.3.1 Cramer's rule 2.3.3.2 Gaussian elimination method 2.4 Inverse of a matrix 2.4.1 Inverse of a 2 x 2 matrix 2.4.2 Inverse of a 3 x 3 matrix 2.4.3 Transpose 2.4.3.1 Of 2 x 2 matrix 2.4.3.2 Of 3 x 3 matrix 2.4.4 Co-factor method 2.4.4.1 Adjoint 2.4.4.2 Minor 2.4.4.3 Transpose 2.4.4.4 Determinant	
3. Apply Number	3.1 Identification of number systems 3.1.1 Definition of terms	• Practical Activities

Systems	3.1.1.1 Number systems 3.1.1.2 Absolute values 3.1.1.3 Place values 3.1.1.4 Bits 3.1.1.5 Most significant bit 3.1.1.6 Least Significant bits 3.1.1.7 Base 3.1.2 Types of number systems 3.1.2.1 Decimal 3.1.2.2 Binary 3.1.2.3 Octal 3.1.2.4 Hexadecimal 3.2 Base conversion 3.2.1 Decimal to Other number system 3.2.2 Other number systems to decimal 3.2.3 Binary to other number systems 3.2.4 Other number systems to binary 3.3 Number systems arithmetic operations 3.3.1 Binary arithmetic 3.3.1.1 Addition, subtraction, multiplication and division 3.3.2 Complement 3.3.2.1 Prefixing 3.3.2.2 One's complement 3.3.2.3 Two's complement 3.3.3 Octal arithmetic 3.3.4 Addition and subtraction 3.3.5 Hexadecimal arithmetic	• Project work • Demonstration • Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests

	3.3.6 Addition and subtraction 3.4 Binary codes 3.4.1 Binary coded decimal (BCD) 3.4.2 ASCII 3.4.3 EBCDIC 3.4.4 Gray Code 3.4.5 Excess-3 3.5 Representation of binary coded decimal 3.6 BCD arithmetic 3.6.1 addition 3.6.2 subtraction	
4. Apply logic Gates	4.1 Identification of Logic gates 4.1.1 Definition of terms in logic gates 4.1.2 Types of Logic gates 4.1.2.1 AND 4.1.2.2 OR 4.1.2.3 NOT 4.1.2.4 NAND 4.1.2.5 NOR 4.1.2.6 XOR 4.1.2.7 XNOR 4.2 Application of Boolean Algebra 4.2.1 Logic expressions 4.2.2 Logic circuit diagrams 4.2.3 Truth tables 4.2.4 Laws of Boolean algebra 4.2.4.1 Commutative 4.2.4.2 associative 4.2.4.3 distributive and more 4.2.4.4 identity laws	• Practical Activities • Project work • Demonstration • Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests

	4.2.4.5 Null laws 4.2.4.6 complement laws 4.2.4.7 commutative laws 4.2.5 De-Morgan's theorems 4.2.6 Application of Karnaugh's Maps 4.3 Application of logic gates 4.3.1 Computer processors 4.3.2 Digital signal processing 4.3.3 Memory devices 4.3.4 Error detection and correction	
5. Perform sequence and series operations	5.1 Summation of sequence 5.1.1 Key terms of sequences. 5.1.1.1 Term 5.1.1.2 Index 5.1.1.3 General term (nth term) 5.1.1.4 Finite sequence 5.1.1.5 Infinite sequence 5.2 Arithmetic series 5.2.1 Arithmetic sum 5.2.2 General form of an arithmetic sequence 5.2.3 Arithmetic progression 5.3 Geometric series 5.3.1 General form of Geometric sequence 5.3.2 Geometric progression	• Practical Activities • Project work • Demonstration • Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests
6. Demonstrate graph theory	6.1 Key Graph terminologies structure and components of graph 6.1.1 Graph (G) 6.1.2 Vertex/Node	• Practical Activities • Project work • Demonstration

	6.1.3 Edge 6.1.4 Degree of a vertex 6.1.5 Path 6.1.6 Cycle 6.1.7 Connected Graph 6.1.8 Directed Graph (Digraph) 6.1.9 Undirected Graph 6.2 Types of graphs 6.2.1 Bar graphs 6.2.2 Line graphs 6.2.3 Histogram 6.2.4 Ogive curves 6.3 Representation of graphs 6.3.1 Adjacency Matrix 6.3.2 Adjacency List 6.3.3 Incidence Matrix 6.4 Application of graphs 6.4.1 Computer Networks 6.4.2 Social Networks 6.4.3 Transport Networks 6.4.4 Scheduling and Task Management	• Group discussions • Observation • Third Party report • Portfolio of Evidence • Written tests

Suggested Delivery Methods

- Instructor led facilitation using active learning strategies
- Demonstration by trainer
- Practical work by trainees
- Viewing of related videos
- Field Visits

- Group discussions
- Role plays
- Group projects

Recommended Resources for 25 Trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Trainee: Item)
A	Learning Materials			
1.	Textbooks		5 pcs	5:1
2.	Handouts			
3.	PowerPoint presentations	For trainer's use		
4.	Assorted colour of whiteboard markers	For trainer's use	2 packets	
5.	e-Didactics	For trainer's use		
6.	Flashcards			
7.	Flip charts			
8.	Whiteboard			
B	Learning Facilities & infrastructure			
9.	Lecture/theory room		1	25:1
C	Consumable materials			
10.	Printing Papers		1 ream	1:20
11.	Toners		2 pcs	13:1

12.	Internet			
13.	Graph papers		1 ream	1:5
D	Tools and Equipment			
14.	Projectors		1	25:1
15.	Printers		4	6:1
16.	Computers/Smartphones		25 pcs	1:1