

## DISCRETE MATHEMATICAL CONCEPTS

**UNIT CODE: 0541 551 11A**

### Relationship to Occupational Standards

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

**Duration of Unit: 160 Hours**

### 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 operations, and demonstrating graph theory.

### Summary of Learning Outcomes

| LEARNING OUTCOMES                         | DURATION (HOURS) |
|-------------------------------------------|------------------|
| 1. Carry out set theory operations        | 32               |
| 2. Perform matrix operations              | 26               |
| 3. Apply number system                    | 26               |
| 4. Apply logic gates                      | 30               |
| 5. Perform sequence and series operations | 20               |
| 6. Demonstrate graph theory               | 26               |
| <b>TOTAL</b>                              | <b>160</b>       |

### Learning Outcomes, Content and Suggested Assessment Methods

| Learning Outcome                   | Content                                                                                                                                            | Suggested Assessment Methods                                                                                     |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 1. Carry out set theory operations | 1.1. Identify sets Characteristics<br>1.1.1. Definition<br>1.1.2. Order and Uniqueness<br>1.2. Methods of set representation<br>1.2.1. Roster Form | <ul style="list-style-type: none"><li>• Practical Activities</li><li>• Project work</li><li>• Demonstr</li></ul> |

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                       |
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|                              | <p>1.2.2. Set Builder Form</p> <p>1.3. Cardinality of a set.</p> <p>1.3.1. Finite</p> <p>1.3.2. Infinite</p> <p>1.4. Types of sets</p> <p>1.4.1. Finite set</p> <p>1.4.2. Infinite set</p> <p>1.4.3. Empty set</p> <p>1.4.4. Subset</p> <p>1.4.5. Universal set</p> <p>1.5. Venn Diagrams</p> <p>1.5.1. Drawing Venn diagrams</p> <p>1.6. Set Operations</p> <p>1.6.1. Union</p> <p>1.6.2. Intersection</p> <p>1.6.3. Difference</p> <p>1.6.4. Complement</p> | <p>ation</p> <ul style="list-style-type: none"> <li>• Group Work</li> <li>• Observation</li> <li>• Portfolio of Evidence</li> <li>• Written tests</li> </ul>                                                                          |
| 2. Perform matrix operations | <p>2.1. Applying Matrix order</p> <p>2.1.1. Dimension of matrix</p> <p>2.1.2. Types of Matrices</p> <p>2.1.2.1. Row matrix</p> <p>2.1.2.2. Column matrix</p> <p>2.1.2.3. Square matrix</p> <p>2.1.2.4. Zero matrix</p> <p>2.2. Matrix operations</p> <p>2.2.1. Addition</p> <p>2.2.2. Multiplication</p> <p>2.2.3. Subtraction</p> <p>2.3. Transpose of a matrix</p> <p>2.3.1. Swapping rows and columns</p> <p>2.4. Transpose operations</p>                 | <ul style="list-style-type: none"> <li>• Practical Activities</li> <li>• Project work</li> <li>• Demonstration</li> <li>• Group Work</li> <li>• Observation</li> <li>• Third Party report</li> <li>• Portfolio of Evidence</li> </ul> |

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|                         | <p>2.4.1. Transpose</p> <p>2.4.2. Sum</p> <p>2.4.3. Product</p> <p>2.5. Adjoint of a square matrix identification</p> <p>2.6. Inverse of a square matrix identification.</p> <p>2.6.1. Trace of a matrix application</p> <p>2.6.2. Application of matrices</p> <p>2.6.3. Computer Graphics</p> <p>2.6.4. Statistics</p> <p>2.6.5. Systems of Linear Equations</p>                                                                                                      | <ul style="list-style-type: none"> <li>• Written tests</li> </ul>                                                                                                                                                                                              |
| 3. Apply number Systems | <p>3.1. Number systems</p> <p>3.1.1. Definition of terms</p> <p>3.1.2. Absolute values</p> <p>3.1.3. Place values</p> <p>3.1.4. Types of number systems</p> <p>3.1.4.1. Decimal</p> <p>3.1.4.2. Binary</p> <p>3.1.4.3. Octal</p> <p>3.1.4.4. Hexadecimal</p> <p>3.2. Base conversion</p> <p>3.2.1. Decimal to Other number system</p> <p>3.2.2. Other number systems to decimal</p> <p>3.2.3. Binary to other number systems</p> <p>3.2.4. Other number systems to</p> | <ul style="list-style-type: none"> <li>• Practical Activities</li> <li>• Project work</li> <li>• Demonstration</li> <li>• Group Work</li> <li>• Observation</li> <li>• Third Party report</li> <li>• Portfolio of Evidence</li> <li>• Written tests</li> </ul> |

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|                      | <p>binary</p> <p>3.3. Number systems arithmetic operations</p> <p>3.3.1. Binary arithmetic</p> <p>3.3.1.1. Addition, subtraction, multiplication and division</p> <p>3.3.1.2. Ones and Twos complement</p> <p>3.3.2. Octal arithmetic</p> <p>3.3.2.1. Addition and subtraction</p> <p>3.3.3. Hexadecimal arithmetic</p> <p>3.3.3.1. Addition and subtraction</p> <p>3.4. Binary codes</p> <p>3.4.1. Binary coded decimal (BCD)</p> <p>3.4.1.1. BCD operations</p> <p>3.4.1.2. Addition and subtraction</p> <p>3.4.2. ASCII</p> <p>3.4.3. Gray Code</p> <p>3.4.4. Excess-3</p> |                                                                                                                                                 |
| 4. Apply logic gates | <p>4.1. Types of Logic gates</p> <p>4.1.1. AND</p> <p>4.1.2. OR</p> <p>4.1.3. NOT</p> <p>4.1.4. NAND</p> <p>4.1.5. NOR</p> <p>4.1.6. XOR</p>                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Practical Activities</li> <li>• Project work</li> <li>• Demonstration</li> <li>• Group Work</li> </ul> |

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|                                           | <p>4.1.7. XNOR</p> <p>4.2. Logic expressions</p> <p>4.2.1. Logic circuit diagrams</p> <p>4.2.2. Truth tables</p> <p>4.3. Simplifying logic expressions</p> <p>4.3.1. De-Morgan's theorems</p> <p>4.3.2. Laws of Boolean algebra</p> <p>4.3.2.1. Commutative</p> <p>4.3.2.2. Associative</p> <p>4.3.2.3. Distributive and more</p> <p>4.3.2.4. Identity laws</p> <p>4.3.2.5. Null laws</p> <p>4.3.2.6. Complement laws</p> <p>4.3.2.7. Commutative laws</p> <p>4.3.3. Boolean expressions simplification.</p> <p>4.3.4. Application of Boolean Algebra.</p> <p>4.3.5. Application of Karnaugh's Maps</p> | <ul style="list-style-type: none"> <li>• Observati on</li> <li>• Third Party report</li> <li>• Portfolio of Evidence</li> <li>• Written tests</li> </ul>                                        |
| 5. Perform sequence and series operations | <p>5.1. Key terms of sequences.</p> <p>5.1.1. Term</p> <p>5.1.2. Index</p> <p>5.1.3. General term (nth term)</p> <p>5.1.4. Finite sequence</p> <p>5.1.5. Infinite sequence</p> <p>5.2. Summation of a sequence.</p> <p>5.2.1. Arithmetic sum</p> <p>5.3. Arithmetic series</p> <p>5.3.1. General form of an arithmetic sequence</p>                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Practical Activities</li> <li>• Project work</li> <li>• Demonstr ation</li> <li>• Group Work</li> <li>• Observati on</li> <li>• Third Party</li> </ul> |

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|                             | <p>5.3.2. Sum of the first n terms</p> <p>5.4. Geometric series</p> <p>5.4.1. General form of a geometric sequence</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p>report</p> <ul style="list-style-type: none"> <li>• Portfolio of Evidence</li> <li>• Written tests</li> </ul>                                                                                                                                               |
| 6. Demonstrate graph theory | <p>6.1. Key Graph terminologies</p> <p>6.1.1. Node</p> <p>6.1.2. Edge</p> <p>6.1.3. Vertex</p> <p>6.1.4. Adjacent</p> <p>6.2. Types of graphs</p> <p>6.2.1. Null</p> <p>6.2.2. Simple</p> <p>6.2.3. Multigraph</p> <p>6.2.4. Directed graphs</p> <p>6.2.5. Undirected graphs</p> <p>6.3. Representation of graphs</p> <p>6.3.1. Adjacency Matrix</p> <p>6.3.2. Adjacency List</p> <p>6.3.3. Incidence Matrix</p> <p>6.4. Application of graphs</p> <p>6.4.1. Computer Networks</p> <p>6.4.2. Social Networks</p> <p>6.4.3. Transport Networks</p> <p>6.4.4. Scheduling and Task Management</p> | <ul style="list-style-type: none"> <li>• Practical Activities</li> <li>• Project work</li> <li>• Demonstration</li> <li>• Group Work</li> <li>• Observation</li> <li>• Third Party report</li> <li>• Portfolio of Evidence</li> <li>• Written tests</li> </ul> |

### Suggested Delivery Methods

- Instructor led facilitation using active learning strategies
- Demonstration by trainer

- Practical work by trainees
- Viewing of related videos
- Field Visits
- Group Work
- Role plays
- Group projects

### Recommended Resources for 25 Trainees

| S/No.    | Category/Item                                      | Description/<br>Specifications                              | Quantity | Recommended Ratio<br>(Item: Trainee) |
|----------|----------------------------------------------------|-------------------------------------------------------------|----------|--------------------------------------|
| <b>A</b> | <b>Learning Materials</b>                          |                                                             |          |                                      |
| 1.       | Internet connection                                | ✓ 5mbps                                                     | 1        | 1:1                                  |
| 2.       | Flip charts                                        | A1                                                          | 1        | 1:25                                 |
| 3.       | Textbooks                                          | For reference                                               | 3        | 3:25                                 |
| <b>B</b> | <b>Learning Facilities &amp; infrastructure</b>    |                                                             |          |                                      |
| 4.       | Theory Room                                        | furnished with 25 Arm-chairs and a suitable trainer's table | 1        | 1:25                                 |
| <b>C</b> | <b>Consumable materials</b>                        |                                                             |          |                                      |
| 5.       | Printing papers                                    | A4                                                          | 5 Reams  | 1:25                                 |
| 6.       | White board markers                                | Assorted colors                                             | 20       | 4:5                                  |
| <b>D</b> | <b>Tools and Equipment</b>                         |                                                             |          |                                      |
| 7.       | External storage media                             | HDD / SSD / Flash                                           | 1        | 1:25                                 |
| 8.       | Printer                                            | Working printer                                             | 2        | 1:12                                 |
| 9.       | 1 Smart-board / Smart TV / Projector (with screen) | Where available                                             | 1        | 1:25                                 |
| 10.      | Whiteboard/Chalkboard                              | 4 X 8 Feet                                                  | 1        | 1:25                                 |