

## SECURE DATABASES

**ISCED UNIT CODE:** 0612554 04A

**TVET CDACC UNIT CODE:** SEC/CU/CS/CR/04/5/MA

### Relationship to Occupational Standards

This unit addresses the unit of competency: Secure databases

**Duration of Unit:** 120 hours

### Unit Description

This unit covers the competencies required to secure databases. It involves identifying types of databases, identifying database threats and vulnerabilities, installing database patches, installing security management systems for database, monitoring database security, monitoring access control and managing database backups.

### Summary of Learning Outcomes

| Learning Outcomes                       | Durations (Hours) |
|-----------------------------------------|-------------------|
| 1. Identify database management system  | 18                |
| 2. Design a database                    | 22                |
| 3. Create a database                    | 30                |
| 4. Implement database security measures | 14                |
| 5. Monitor database security            | 20                |
| 6. Manage database backups              | 16                |
| <b>Total Hours</b>                      | <b>120</b>        |

### Learning Outcomes, Content and Suggested Assessment Methods

| Learning Outcome                | Content                                        | Suggested Assessment Methods                                                               |
|---------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1. Identify database management | 1.1 Meaning of terms<br>1.2 Types of databases | <ul style="list-style-type: none"><li>• Written tests</li><li>• Oral questioning</li></ul> |

|                                          |   |                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                 |
|------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| systems                                  |   | 1.3 Classification of databases<br>1.4 Database organization approaches<br>1.4.1 Hierarchical Database Approach<br>1.4.2 Network Database Approach<br>1.4.3 Relational Database Approach (RDBMS)<br>1.4.4 Object-Oriented Database Approach (OODBMS)<br>1.4.5 NoSQL Database Approach<br>1.5 Database design cycle | <ul style="list-style-type: none"> <li>• Observation</li> <li>• Practical tests</li> </ul>                                                      |
| 2. Design database                       | a | 2.1 Design a relational database.<br>2.2 Create entity relationship<br>2.2.1 Connotations of entity relationship<br>2.2.2 Drawing ERDS<br>2.3 Perform Normalisation                                                                                                                                                | <ul style="list-style-type: none"> <li>• Written tests</li> <li>• Oral questioning</li> <li>• Observation</li> <li>• Practical tests</li> </ul> |
| 3. Create database                       | a | 3.1 Querying a database using MySQL<br>3.1.1 Identify categories of SQL statements.<br>3.1.2 Design SQL statements.<br>3.1.3 Design SQL Queries.<br>3.1.4 Use SQL statements to query a database.                                                                                                                  | <ul style="list-style-type: none"> <li>•</li> </ul>                                                                                             |
| 4. Implement database security measures. |   | 4.1 Identify database authorization techniques.<br>4.1.1 Role-Based Access Control (RBAC).<br>4.1.2 Attribute-Based Access Control (ABAC).<br>4.1.3 Least Privilege principle.<br>4.1.4 Multi factor authentication for database access.<br>4.2 Identify Concurrency Control                                       | <ul style="list-style-type: none"> <li>• Observation</li> <li>• Oral questioning</li> <li>• Practical tests</li> <li>• Written tests</li> </ul> |

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                 |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | <p>techniques</p> <p>4.2.1 Locking mechanisms (e.g., exclusive locks, shared locks)</p> <p>4.2.2 Two-phase locking.</p> <p>4.2.3 Timestamp ordering.</p> <p>4.2.4 Optimistic Concurrency Control.</p>                                                                                                                                                                                                                                         |                                                                                                                                                 |
| 5. Monitor the database performance. | <p>5.1 Identify database monitoring techniques</p> <p>5.1.1 Transaction Auditing</p> <p>5.1.2 Privileged User Auditing</p> <p>5.1.3 Log-Based Auditing</p> <p>5.1.4 Trigger-Based Auditing</p> <p>5.2 Use tools to monitor database activities</p> <p>5.3 Conduct Security Mitigation.</p> <p>5.3.1 Review &amp; Strengthen Access Controls</p> <p>5.3.2 Contain and Neutralize Threats</p> <p>5.3.3 Apply Security Patches &amp; Updates</p> | <ul style="list-style-type: none"> <li>•</li> </ul>                                                                                             |
| 6. Manage database backups.          | <p>6.1 Understanding Backup Fundamentals</p> <p>6.1.1 Backup types</p> <p>6.1.2 Backup storage solutions</p> <p>6.2 Conducting back up strategies</p> <p>6.2.1 Backup frequency and retention policies.</p> <p>6.2.2 Implement the backup rule</p> <p>6.3 Configuring and Managing Backup Systems</p>                                                                                                                                         | <ul style="list-style-type: none"> <li>• Written tests</li> <li>• Oral questioning</li> <li>• Observation</li> <li>• Practical tests</li> </ul> |

#### **Suggested Methods of instructions**

- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos

- Group discussions

### Recommended Resources for 25 trainees

| S/No.    | Category/Item                                   | Description/<br>Specifications | Quantity | Recommended<br>Ratio<br>(Trainee: Item) |
|----------|-------------------------------------------------|--------------------------------|----------|-----------------------------------------|
| <b>A</b> | <b>Learning Materials</b>                       |                                |          |                                         |
| 1.       | Textbooks                                       |                                | 5 pcs    | 5:1                                     |
| 2.       | PowerPoint presentations                        | For trainer's use              |          |                                         |
| 3.       | Assorted colour of whiteboard markers           | For trainer's use              |          |                                         |
| 4.       | e-Didactics                                     | For trainer's use              |          |                                         |
| 5.       | Flashcards                                      |                                |          |                                         |
| 6.       | Flip charts                                     |                                |          |                                         |
| 7.       | Whiteboard                                      |                                |          |                                         |
| <b>B</b> | <b>Learning Facilities &amp; infrastructure</b> |                                |          |                                         |
| 8.       | Lecture/theory room                             |                                | 1        | 25:1                                    |
| 9.       | Consumable materials                            |                                |          |                                         |
| 10.      | Printing Papers                                 |                                | 1 ream   | 1:20                                    |
| 12.      | Toners                                          |                                | 2 pcs    | 13:1                                    |
| 13.      | Internet                                        |                                |          |                                         |
| <b>D</b> | <b>Tools and Equipment</b>                      |                                |          |                                         |
| 14.      | Projectors                                      |                                | 1        | 25:1                                    |
| 15.      | Printers                                        |                                | 4        | 6:1                                     |
| 16.      | Computers.                                      |                                | 25 pcs   | 1:1                                     |
| 17.      | MySQL Database                                  |                                | 25 pcs   | 1:1                                     |
|          | MySQL Workbench<br>Community Edition            |                                | 25 pcs   | 1:1                                     |