Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

GENDD401

DATABASE DEVELOPMENT

Develop Database

Competence

RQF Level: 4

Learning Hours 70

Credits: 7

Sector: ICT and Multimedia

Trade: Networking and Internet Technologies

Module Type: General

Curriculum: ICTNIT4001-TVET Certificate IV in Networking and Internet Technologies

1200

Issue Date: September 2023

<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the skills, knowledge and attitude required to Develop Database.
This module is intended to prepare Learner pursuing TVET Level 4 in Networking and Internet Technologies.
At the end of this module the learner will be able to analyse database, design database, implement database and secure database.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">N/A</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>Group project and presentation</td><td>20%</td></tr>
<tr><td>Individual project /Work</td><td>50%</td></tr>
<tr><td colspan="2"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
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Elements of Competence and Performance Criteria

Elements of competency	Performance criteria
1. Analyse Database	1.1 Database fundamentals are properly described based on database standards
	1.2 Data dictionary is clearly described based on database model
	1.3 Database Task requirements are properly identified based on user requirements

2. Design Database	2.1 Conceptual Database schema is properly designed based on system requirements
	2.2 Logical Database schema is properly designed based on system requirements
	2.3 Database optimization is effectively enforced based on database schema
	2.4 Physical Database Schema is appropriately created based on the Physical Data Model.
3.Implement Database	3.1 Data definition language commands are effectively applied based on database schema
	3.2 Data manipulation language commands are effectively applied based on database schema
	3.3 Data control language commands are effectively applied based on database schema
	3.4 Data Query Language commands are effectively applied based on database schema
	3.5 Transaction Control Language commands are effectively applied based on database schema
4. Secure Database	4.1 Access control is properly enforced based on database security measures
	4.2 Auditing and logging are clearly managed based on the security policies
	4.3 Data encryption is correctly implemented based on data security measures
	4.4 Backup and Recovery of data are regularly configured based on DBMS

Intended Knowledge, Skills and Attitude

Knowledge	Skills	Attitude
✓ Describe database concepts ✓ Identify database requirements ✓ Identify database Relationship ✓ Describe SQL concepts ✓ Explain database Optimization	✓ Analyze Database ✓ Install MySQL ✓ Design database ✓ Develop a database ✓ Configure of database backup and restore ✓ Secure database	✓ Communicate effectively ✓ Multi-tasking ✓ Teamwork ✓ Flexibility ✓ Self-confidence ✓ Integrity ✓ Honesty ✓ Self-motivation ✓ Decisiveness ✓ Punctuality ✓ Creativity ✓ Patience ✓ Accountability ✓ Problem solving ✓ Time Management ✓ Decision Making

Course content

Learning outcomes	At the end of the module the learner will be able to:
	1. Analyse Database 2. Design Database 3. Implement Database 4. Secure Database

Learning outcome 1: Analyse Database	Learning hours: 15

Indicative content

- **Description of database fundamental**
  - ✓ Definition of key terms
    - Database
    - Data
    - Information
    - Entities
    - Attributes/Field
    - Cardinalities
    - Property
    - Records
    - Table
    - Database schema
    - Database management System (DBMS)
    - Structured Query language (SQL)
  - ✓ Application of database
  - ✓ Identification of database models
    - Relational database
    - Hierarchical database
    - Network database
    - Object oriented model
  - ✓ Identification of database Relationship
    - Define relationships
    - One to one
    - One to many
    - Many to many

- ✓ Determination of data types
  - Character
  - Number
  - Date
- **Description of data dictionary**
  - ✓ Definition of data dictionary
  - ✓ Elements of data dictionary
- **Identification of database requirements**
  - ✓ Types of database requirements
    - Functional requirement
    - Non-functional requirement
  - ✓ Methods to collect data
    - Interview
    - Documentation
    - Questionnaire
    - Observation

Resources required for the learning outcome	
Equipment	▪ Computer
Materials	▪ Internet
Tools	▪
Facilitation techniques	▪ Brainstorming ▪ Demonstration ▪ Group discussion practical work

Formative assessment methods /(CAT)	▪ Written assessment ▪ Oral presentation ▪ Performance assessment

Learning outcome 2: Design Database	**Learning hours: 20**
Indicative content	

- **Description of database schema**
  - ✓ Introduction of database schema
  - ✓ Types of database schema
  - ✓ Data abstraction levels
  - ✓ Types of data independence
- **Design of conceptual database schema**
  - ✓ Description of conceptual database schema
  - ✓ Entity relationship diagram (ERD)
    - Description of ERD
    - Components of ERD
    - Create an ERD
    - Draw an ERD (MS-Visio, Draw-Max)
- **Design of logic database schema**
  - ✓ Description of logic database schema
  - ✓ Table constraints
    - NOT NULL Constraint.
    - UNIQUE Constraint.
    - DEFAULT Constraint.
    - CHECK Constraint.
    - PRIMARY KEY Constraint.

- FOREIGN KEY Constraint.

✓ Convert conceptual database schema to logic database schema

- **Optimization of database**

✓ Data normalization

- First normal form (1NF)
- Second normal form (2NF)
- Third normal form (3NF)

✓ Indexing

- **Design of Physical database schema**

✓ Description of DBMS

✓ Preparation of DBMS Environment (MySQL)

✓ Convert logic database schema to physical database schema

Resources required for the learning outcome	
Equipment	▪ Computer
Materials	▪ Internet
Tools	▪ E-Draw max ▪ Microsoft Visio ▪ MySQL
Facilitation techniques	▪ Brainstorming ▪ Demonstration ▪ Group discussion practical work
Formative assessment methods /(CAT)	▪ Written assessment ▪ Oral presentation ▪ Performance assessment ▪ Project based assessment

Learning outcome 3: Implement Database	Learning hours: 20

Indicative content

- **Description to SQL**
  - ✓ Introduction of SQL
  - ✓ SQL sub-languages
  - ✓ SQL Operators
    - SQL Arithmetic Operators
    - SQL Bitwise Operators
    - SQL Compound Operators
    - SQL Logical Operators
- **Application of DDL commands**
  - ✓ CREATE
    - Database
    - Table
    - Table Constraints
  - ✓ Using keyword Alter
  - ✓ DROP
    - Database
    - Table
  - ✓ TRUNCATE Table
  - ✓ MODIFY
    - Database
    - Table
- **Application of DML commands**
  - ✓ INSERT
  - ✓ UPDATE
  - ✓ DELETE

- ✓ CALL
- ✓ EXPLAIN CALL
- ✓ LOCK

- **Application of data Query language (DQL) Commands**
  - ✓ SELECT
  - ✓ SQL aggregate function
  - ✓ SQL clause
- **Application of Data control Language (DCL) commands**
  - ✓ GRANT
  - ✓ REVOKE
- **Application of Transaction Control language (TCL) commands**
  - ✓ COMMIT
  - ✓ SAVEPOINT
  - ✓ ROLLBACK
  - ✓ SET Transaction
  - ✓ SET Constraints

Resources required for the learning outcome	
Equipment	▪ Computer
Materials	▪ Internet
Tools	▪ MySQL ▪ Apache ▪ XAMPP ▪ WAMP

	▪ LAMP ▪ Browsers
Facilitation techniques	▪ Brainstorming ▪ Demonstration ▪ Group discussion practical work
Formative assessment methods /(CAT)	▪ Written assessment ▪ Oral presentation ▪ Performance assessment ▪ Project based assessment

Learning outcome 4: Implement Database security	**Learning hours: 15**
Indicative content	

- **Enforcement of data access control**
  - ✓ Description of database security
    - Introduction of database security
    - Types of database security
  - ✓ Data access control
  - ✓ Access control policies
    - Identify the data classifications
    - Define roles and permission
  - ✓ Authentication
    - Identify user accounts
    - Create privileges
    - Configure the authentication system
    - Test the authentication system
    - Monitor and maintain

- ✓ Authorization
  - Create roles
  - Assign permissions/privilege to roles
  - Assign roles to users
  - Test the authorisation system
  - Monitor and maintain

- **Management of Auditing and logging**
  - ✓ Logging
    - Identify the logging requirements
    - Configure logging settings
    - Monitor log data
    - Analyse log data
    - Archive log data
    - Corrective action
  - ✓ Auditing
    - Identify the data that needs to be audited
    - Execution of SQL command
    - Configure audit settings
    - Review audit
    - Analyse audit data
    - Corrective action

- **Implementation of Data encryption**
  - ✓ Description of data encryption
  - ✓ Application of encryption technics
    - Symmetric Encryption
    - Asymmetric Encryption
    - Hashing

- **Configuration of database backup and restore**
  - ✓ Introduction of data backup and restore
  - ✓ Backup Method
    - Full backup
    - Differential backup
    - Incremental backup
  - ✓ Backup schedule
  - ✓ Create Backup
  - ✓ Perform recovery method
    - Full database recovery
    - Rollback recovery
    - Point-in-time recovery
  - ✓ Test your backup and recovery plan

Resources required for the learning outcome	
Equipment	▪ Computer
Materials	▪ Internet
Tools	▪ MySQL ▪ Apache ▪ XAMPP ▪ WAMP ▪ LAMP ▪ Browsers
Facilitation techniques	▪ Brainstorming ▪ Demonstration ▪ Group discussion practical work

Formative assessment methods /(CAT)	▪ Written assessment ▪ Oral presentation ▪ Performance assessment ▪ Project based assessment

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