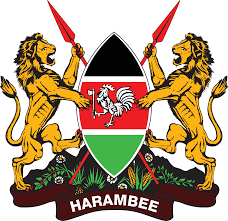
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**REPUBLIC OF KENYA**

**COMPETENCY-BASED MODULAR CURRICULUM**

**FOR**

**SOFTWARE DEVELOPMENT**

**KNQF LEVEL 6**

**PROGRAMME ISCEDCODE: 0613 554 A**

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for socio-economic development. Quality education and training contribute to achievement focused on Kenya’s development blueprint and sustainable development goals.

Reforms in the education and training sector are necessary for achievement of Kenya Vision 2030 and meeting the provisions the Constitution of Kenya. The education sector had to be aligned to the Constitution and this resulted in formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 1 of 2019). A key feature of this policy is the change in the design and delivery of TVET training. The reforms include making TVET competency-based, developing the curriculum in collaboration with industry, certifying learners based on demonstrated competence, and allowing multiple entry and exit points in TVET programmes.

These reforms emphasize the role of industry as key collaborators in curriculum development to ensure it aligns with their competence needs. It is against this background that this Curriculum has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the ICT sector’s growth and sustainable development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

**PREFACE**

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act, CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

**COUNCIL SECRETARY/ CEO**

# ACKNOWLEDGEMENT

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the ICT National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the ICT sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the ICT Sector acquire competencies to perform their work more efficiently and effectively.

**CEO / CHIEF PRINCIPAL**

|  |  |
| --- | --- |
|  |  |

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# ACRONYMS **AND** ABBREVIATIONS

|  |  |
| --- | --- |
| **Acronym/Abbreviation** | **Description** |
| API | Application Programming Interface |
| ASCII | American Standard Code Information Interchange |
| BCD | Binary Coded Decimal |
| CBET | Competency Based Education and Training |
| CSS | Cascading Style Sheet |
| DBMS | Database Management System |
| DNS | Domain Name Service |
| FTP | File Transfer Protocol |
| GCE | General Certificate of Education |
| GIT | Global Information Tracker |
| HDD | Hard Disk Drive |
| HTML | Hypertext Mark-up Language |
| ICT | Information Communication Technology |
| IDE | Integrated Development Environment |
| ISCED | International Standard Classification of Education |
| ISO | International Organization For Standardization |
| KACE | Kenya Advanced Certificate of Education |
| KCE | Kenya Certificate of Education |
| KCSE | Kenya Certificate of Secondary Education |
| KNQF | Kenya National Qualification Framework |
| MVC | Model View Controller |
| OOP | Object Oriented Programming |
| OSHA | Occupation Safety and Health Administration |
| PDF | Portable Document Format |
| PERT | Program Evaluation Review Techniques |
| PHP | Hypertext Pre-Processor |
| SDK | Software Development Kit |
| SMART | Specific Measurable Achievable Realistic Time-Bound |
| SQL | Structured Query Language |
| SSD | Solid State Disk |
| SSL | Secure Socket Layer |
| TLS | Transport Layer Security |
| TV | Television |
| TVET | Technical Vocational Education and Training |
| TVETA | Technical and Vocational Education Training Authority |
| UX | User experience |
| WBS | Work Breakdown Structure |

# KEY TO UNIT CODE

XX X X XXX X X

ISCED level, Programme Orientation and Level of Completion

Unit of Competence Number

Version Control

Sector/Industry

Sub Sector

Occupational Area

# COURSE OVERVIEW

## Description of the Course

The Software Development KNQF Level 6 curriculum prepares learners with the technical skills and knowledge needed to design, develop, and maintain software applications. It comprises of basic learning in communication skills, work ethics and entrepreneurial skills. In additional, this curriculum entails the following foundational common units; computer operations, discrete mathematics and project management. Core units of learning include advanced computerized database systems, computerized database systems management, software requirements analysis, web application development, object oriented programming, desktop application, mobile application development and application end-user support. The program emphasizes practical experience through 480 hours of industry training, bridging the gap between classroom learning and industry demands. Graduates are equipped for careers in software development, web and mobile applications, database management, and IT support, making them ready to thrive in the dynamic ICT sector.

**Summary of Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Unit Duration**  **(Hours)** | **Credit**  **Factor** |
| **MODULE I** | | | |
| 0611 441 03A | COMPUTER APPLICATIONS | 90 | 9.0 |
| 0613 451 06A | STRUCTURED PROGRAMMING | 220 | 22.0 |
| 0611 451 07A | SOFTWARE SYSTEM REQUIREMENTS | 110 | 11.0 |
| **Sub Total** | | **420** | **42.0** |
| **MODULE II** | | | |
| 0541 451 04A | DISCRETE MATHEMATICAL CONCEPTS | 160 | 16.0 |
| 0611 451 08A | APPLICATION END-USER  SUPPORT | 150 | 15.0 |
| **Sub Total** | | **310** | **31.0** |
| **MODULE III** | | | |
| 0413 441 01A | ENTREPRENEURIAL SKILLS | 40 | 4.0 |
| 0612 451 09A | COMPUTERIZED DATABASE SYSTEMS | 250 | 25.0 |
| **Sub Total** | | **380** | **38.0** |
| **MODULE IV** | | | |
| 0688 451 05A | PROJECT MANAGEMENT PRINCIPLES | 110 | 11.0 |
| 0417 441 02 A | WORK ETHICS AND PRACTICES | 40 | 4.0 |
| 0417 441 02A | WEB APPLICATION  DEVELOPMENT | 250 | 25.0 |
| **Sub Total** | | **400** | **40.0** |
| **MODULE V** | | | |
| 0613 551 02A A | OBJECT ORIENTED PROGRAMMING | 170 | 17.0 |
| 0613 551 03A | DESKTOP APPLICATION  DEVELOPMENT | 240 | 24.0 |
| **Sub Total** | | **410** | **41.0** |
| **MODULE VI** | | | |
| 0613 551 04 A | MOBILE APPLICATION DEVELOPMENT | 270 | 27.0 |
| 0031 541 01A | COMMUNICATION SKILLS | 40 | 4.0 |
| **Sub Total** | | **310** | **31.0** |
| **Industry Training** | | 480 | 48.0 |
| **Grand Total** | | **2710** | **271.0** |

## Entry Requirements

An individual enrolling for this course should have any of the following minimum requirements:

* 1. Kenya Certificate of Secondary Education (K.C.S.E.) with a minimum mean grade of C- (C minus) or DIVISION III, Kenya Advanced Certificate of Education (K.A.C.E) 1 Principal and 1 subsidiary or General Certificate of Education (G.C.E) Advanced level or its equivalent qualification
  2. Software Developer KNQF level 5 Certificate or its equivalent as determined by TVETA.

## Trainer Qualification

A trainer for any of the units of competency in this course must:

1. Have at minimum a KNQF Level 7 qualification or its equivalent in a trade area related to this course.
2. Be registered by TVETA.

**Industry Training**

An individual enrolled in this course will be required to undergo Industry training for a minimum period of 480 hours in ICT sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

## Assessment

The course shall be assessed formatively and summatively:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency.
3. During summative assessment basic and common units may be integrated in the core units or assessed as discrete units.
4. Theoretical and practical weighting for each unit of learning shall be as follows;
5. 30:70 for units in module one, module two, module three and module four.
6. 40:60 for units in module five and module six.
7. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score

For a candidate to be declared competent in a unit of competency, the candidate must meet the following conditions:

1. Obtained at least 40% in theory assessment in formative and summative assessments.
2. Obtained at least 60% in practical assessment in formative and summative assessment where applicable.
3. Obtained at least 50% in the weighted results between formative assessment and summative assessment where the former constitutes 60% and the latter 40% of the overall score.
4. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 - 79 | Proficient |
| 50 - 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

## Certification

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with KenyaNational TVET Certificate in Software Development KNQF Level 6 the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in a certifiable element within a unit.

The certificates will be issued by the Qualification Awarding Institution.

# MODULE I

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| COMMON | 0611 441 03A | COMPUTER APPLICATIONS | 90 |
| COMMON | 0613 451 06A | STRUCTURED PROGRAMMING | 220 |
| CORE | 0611 451 07A | SOFTWARE SYSTEM  REQUIREMENTS | 110 |
| **TOTAL** | | | 4**20** |

## COMPUTER APPLICATIONS

**UNIT CODE:** 0611 441 03A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Computer Applications

**Duration of Unit:** 90 hours

**UNIT DESCRIPTION**:

This unit covers the competencies required in performing word processing, operating spreadsheet program, preparing PowerPoint presentation, performing document production and managing online resources.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Perform word processing | 30 |
| 1. Operate spreadsheet program | 25 |
| 1. Prepare PowerPoint presentation | 15 |
| 1. Perform document production | 10 |
| 1. Manage online resources | 10 |
| **TOTAL** | **90** |

**Learning outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Perform word processing | * 1. Ergonomics risk factors   2. Creation of word document      1. Introduction to word processing      2. Types of word processors      3. Creating word documents   3. Creating and manipulating tables      1. Inserting tables      2. Working with tables   4. Performing Mail merging   5. Inserting Word processing objects      1. Picture      2. Shapes      3. Table      4. Charts   6. Generating list of figures and table of content      1. List of figures      2. Table of content | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 2. Operate spreadsheet programs | * 1. Creating Spreadsheet workbook      1. Introduction to spreadsheets      2. Types of spreadsheets programs      3. Components of a spreadsheet program   Cell data entries   * + 1. Formatting and editing worksheets   1. Performing Cell referencing      1. Relative      2. Absolute   2. Application of Formula and functions      1. Sum      2. Average      3. Max      4. Min      5. Rank   3. Generating Charts      1. Charts         1. Pie charts         2. Bar charts         3. Line graphs         4. Column graphs | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 3.Prepare PowerPoint presentation | * 1. Creating PowerPoint slides      1. Introduction to PowerPoint      2. Types of presentation programs      3. Creation of PowerPoint slides      4. Slide layouts      5. Formatting and editing   2. Exhibiting Presentation views      1. Outline      2. Normal      3. Slide sorter      4. Notes page      5. Reading view   3. Performing animations transitions   4. Presenting Slideshow | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 4. Document production | * 1. Printing documents      1. Introduction to document production      2. Types of printers      3. Document printing   2. Document scanning      1. Types of scanners      2. Document scanning   3. Document duplication | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |
| 5. Manage online resources | * 1. Online file transfer      1. Introduction to online resources      2. Creating up online user accounts      3. E-mailing      4. Teleconferencing   2. Online document processing      1. Online data entry      2. File conversion      3. Google documents      4. E- tasks      5. Online file transfer   3. Performing online collaboration      1. Introduction to online collaboration      2. Types of online collaboration tools         1. Video conferencing         2. Chatting         3. Cloud computing         4. Social media         5. Online calendar         6. Mailing | * Practical * Oral questions * Written tests * Observation * Portfolio of evidence |

**Suggested Delivery Methods**

* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Group discussions
* Direct instructions

**Recommended resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 5:1 |
|  | Flip Charts |  | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 25:1 |
|  | Computer laboratory |  | 1 | 25:1 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers |  | 1 ream | 1:20 |
|  | Foolscaps |  | 1 ream | 1:20 |
|  | Toners |  | 2 pcs | 13:1 |
|  | Assorted colour of whiteboard markers |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Computers |  | 25 pcs | 1:1 |
|  | Projector |  | 1 pcs | 25:1 |
|  | Reprographic machines |  | 1 pcs | 25:1 |
|  | Scanner |  | 1 pcs | 25:1 |
|  | Printers |  | 2 pcs | 13:1 |
|  | Whiteboard |  | 1 pcs | 25:1 |
|  | Flash drives |  | 5 pcs | 5:1 |
|  | External Hard drive |  | 5 pcs | 5:1 |
|  | System Software suite |  | 5 pcs | 5:1 |
|  | Application Software suite |  | 5 pcs | 5:1 |
|  | Computer Repair Tool box |  | 5 | 5:1 |

## STRUCTURED PROGRAMMING

**UNIT CODE:** 0613 451 06A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Structured Programming

**Duration of Unit:** 220 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to apply structured programming. It involves applying computer programming basics, writing program code, implementing program logic and implementing modular programming.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Apply Computer Programming basics | 30 |
| 1. Write program Code | 40 |
| 1. Implement Program logic | 70 |
| 1. Implement modular programming | 80 |
| **TOTAL** | **220** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| * + - 1. Apply Computer Programming basics | * 1. Programming Language Types      1. Overview of programming language categories      2. procedural      3. object-oriented      4. functional   2. Programming Paradigms      1. Explanation of common programming paradigms (e.g., imperative, declarative)      2. Choosing the appropriate paradigm based on project needs   3. Program Development Life Cycle      1. Stages of the program development life cycle (e.g., planning, design, implementation)      2. Best practices for adapting the life cycle to work requirements      4. Overview of program design tools (e.g. algorithms, flowcharts, wireframes, pseudocodes, decision table/trees)   4. Selecting design tools based on user requirements and project complexity | * Practical Activities * Project work * Group work * Observation * Portfolio of Evidence * Written tests |
| * + - 1. Write program Code | * 1. Program Writing Tools      1. Common program writing tools and IDEs (e.g. codeblocks, Turbo C, Eclipse)      2. Evaluating tools based on system requirements and developer preferences   2. Declaring Identifiers      1. Types of identifiers         1. Variable,         2. Functions         3. Arrays.      2. Ensuring identifiers align with program design specifications      3. Creating a naming convention guide for different types of identifiers.      4. Evaluating identifier   3. Initializing Variables and Constants      1. Importance of proper initialization in programming      2. Techniques for initialization based on design specifications      3. Writing code snippets demonstrating correct and incorrect initialization.      4. Best coding practices         1. Creating Comments in a program         2. Indenting statement         3. Program blocks of code      5. Conducting a workshop on variable and constant initialization techniques. | * Practical Activities * Project work * Group work * Observation * Portfolio of Evidence * Written tests |
| * + - 1. Implement Program logic | * 1. Application of Data types      1. Data types   2. Application of program data control structures      1. Loops         1. For loops         2. While loops         3. Do while loops      2. Conditionals statements         1. If statements         2. Case statements      3. Best practices for implementing control structures as per design requirements      4. Solving coding challenges that require the use of different control structures.      5. Creating flowcharts to visually represent control structures in a program.   3. Application of Data Structures      1. Overview of common data structures (e.g., arrays, linked lists)      2. Selecting appropriate data structures based on design specifications      3. Implementing various data structures in a programming language of choice.      4. Comparing performance metrics of different data structures in a small project. | * Practical Activities * Project work * Group work * Observation * Portfolio of Evidence * Written tests |
| * + - 1. Implement modular programming | * 1. Creation of Subroutines      1. Benefits of using subroutines (e.g., modularity, reusability)      2. Designing subroutines to meet user needs      3. Functions and subprograms         1. In built functions         2. User defined functions            1. Function parameters            2. Function return types      4. Design and implement a subroutine library for common tasks.      5. Program to create subroutines based on given specifications.   2. Application of data structures in looping through arrays in a function      1. Using various looping control structures         1. For loop         2. While         3. Do .. while   3. Perform debugging      1. Common debugging techniques and tools   4. Compiling a program      1. Compiling a series of programs with intentional error to learn about error messages. | * Practical Activities * Project work * Group work * Observation * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 11 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

## SOFTWARE SYSTEM REQUIREMENTS

**UNIT CODE:** 0611 451 07A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Establish Software System Requirements

**Duration of Unit:** 110 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to establish software system requirements. It involves gathering user requirements, analyzing user requirements, and planning application deliverables.

**Summary of Learning Outcomes**

1. To gather user requirements
2. To analyze user requirements
3. To plan application deliverables

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Gather user requirements | 20 |
| 1. Analyze user requirements | 40 |
| 1. Plan application deliverables | 50 |
| **TOTAL** | **110** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Gather user requirements | * 1. Key project stakeholders      1. Project team         1. Team members & their roles         2. Project managers   1.1.2 System users   * + - 1. Developers       2. System Analysts       3. End-users       4. System Administrators   1.1.3 Organization management   * + - 1. Organization structure   1. Data collection tools   1.2.1 Methods of data collection   * + - 1. Questionnaires       2. Observations       3. Experimentation       4. Interviews       5. Surveys       6. Case Studies     1. Preparation of data collection tools        1. Questionnaires        2. Observations checklist        3. Interviews Questions   1. Collection of user requirements data:      1. Questionnaires      2. Observations      3. Experimentation      4. Interviews      5. Surveys      6. Case Studies | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Analyze user requirements | * 1. Types of user Requirements      1. Functional Requirements      2. Non-Functional Requirements      3. Technical Requirements      4. Budget and Timeline      5. Legal and Regulatory Requirements   2. Identification of System application requirements.      1. Purpose and Goals   3. Analysis of system application requirements      1. Feasibility Analysis:      2. Requirements Prioritization      3. Functional Analysis      4. Non-functional Analysis      5. Design Analysis      6. Risk Analysis   4. Documenting system application requirements specifications process      1. Functional Requirements      2. Non-Functional Requirements      3. Design Requirements      4. Technical Requirements      5. Assumptions and Constraints      6. Glossary      7. Appendices      8. Reviewing and revising system application requirement specifications. | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Plan application deliverables | * 1. System requirement Review Process      1. Review Criteria:         1. Traceability         2. Change Management         3. Version Control:         4. Testing and Validation      2. Legal Issues         1. Governing laws and international treaties         2. End-User License Agreement      3. Dispute resolution      4. Termination of Contracts   2. Creating a Project work plan      1. Project Scope      2. Key deliverables         1. Internal deliverables         2. External deliverables      3. Milestones      4. Timelines      5. Duties and responsibilities      6. Quality criteria definition      7. Constraints and dependencies      8. Resource sharing      9. Communication planning   3. Project development agreement      1. Contents      2. Importance      3. Sign-off | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
| 1. 1 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + MS Project / Ms Visio   + Visual Paradigm   + Clickup | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

# MODULE II

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| COMMON | 0541 451 04A | DISCRETE MATHEMATICAL CONCEPTS | 160 |
| CORE | 0611 451 08A | APPLICATION END-USER SUPPORT | 150 |
| **TOTAL** | | | 3**10** |

## DISCRETE MATHEMATICAL CONCEPTS

**UNIT CODE:** 0541 451 04A

**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 |
| 1. Perform matrix operations | 26 |
| 1. Apply number system | 26 |
| 1. Apply logic gates | 30 |
| 1. Perform sequence and series operations | 20 |
| 1. Demonstrate graph theory | 26 |
| **TOTAL** | **160** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| * + - 1. Carry out set theory operations | * 1. Identify sets Characteristics      1. Definition      2. Order and Uniqueness   2. Methods of set representation      1. Roster Form      2. Set Builder Form   3. Cardinality of a set.      1. Finite      2. Infinite   4. Types of sets      1. Finite set      2. Infinite set      3. Empty set      4. Subset      5. Universal set   5. Venn Diagrams      1. Drawing Venn diagrams   6. Set Operations      1. Union      2. Intersection      3. Difference      4. Complement | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| * + - 1. Perform matrix operations | * 1. Applying Matrix order      1. Dimension of matrix      2. Types of Matrices         1. Row matrix         2. Column matrix         3. Square matrix         4. Zero matrix   2. Matrix operations      1. Addition      2. Multiplication      3. Subtraction   3. Transpose of a matrix      1. Swapping rows and columns   4. Transpose operations      1. Transpose      2. Sum      3. Product   5. Adjoint of a square matrix identification   6. Inverse of a square matrix identification.      1. Trace of a matrix application      2. Application of matrices      3. Computer Graphics      4. Statistics      5. Systems of Linear Equations | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Apply number Systems | * 1. Number systems      1. Definition of terms      2. Absolute values      3. Place values      4. Types of number systems         1. Decimal         2. Binary         3. Octal         4. Hexadecimal   2. Base conversion      1. Decimal to Other number system      2. Other number systems to decimal      3. Binary to other number systems      4. Other number systems to binary   3. Number systems arithmetic operations      1. Binary arithmetic         1. Addition, subtraction, multiplication and division         2. Ones and Twos complement      2. Octal arithmetic         1. Addition and subtraction      3. Hexadecimal arithmetic         1. Addition and subtraction   4. Binary codes      1. Binary coded decimal (BCD)         1. BCD operations         2. Addition and subtraction      2. ASCII      3. Gray Code      4. Excess-3 | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Apply logic gates | * 1. Types of Logic gates      1. AND      2. OR      3. NOT      4. NAND      5. NOR      6. XOR      7. XNOR   2. Logic expressions      1. Logic circuit diagrams      2. Truth tables   3. Simplifying logic expressions      1. De-Morgan's theorems      2. Laws of Boolean algebra         1. Commutative         2. Associative         3. Distributive and more         4. Identity laws         5. Null laws         6. Complement laws         7. Commutative laws      3. Boolean expressions simplification.      4. Application of Boolean Algebra.      5. Application of Karnaugh’s Maps | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Perform sequence and series operations | * 1. Key terms of sequences.      1. Term      2. Index      3. General term (nth term)      4. Finite sequence      5. Infinite sequence   2. Summation of a sequence.      1. Arithmetic sum   3. Arithmetic series      1. General form of an arithmetic sequence      2. Sum of the first n terms   4. Geometric series      1. General form of a geometric sequence | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Demonstrate graph theory | * 1. Key Graph terminologies      1. Node      2. Edge      3. Vertex      4. Adjacent   2. Types of graphs      1. Null      2. Simple      3. Multigraph      4. Directed graphs      5. Undirected graphs   3. Representation of graphs      1. Adjacency Matrix      2. Adjacency List      3. Incidence Matrix   4. Application of graphs      1. Computer Networks      2. Social Networks      3. Transport Networks      4. Scheduling and Task Management | * Practical Activities * Project work * Demonstration * Group Work * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

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

## APPLICATION END-USER SUPPORT

**UNIT CODE:** 0611 451 08A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Offer Application End-User Support

**Duration of Unit:** 150 Hours

**UNIT DESCRIPTION:**

This unit covers the competencies required to offer Application End-user support. It involves developing application technical documents, performing application user training, gathering user feedback and performing application maintenance.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To develop application technical documents | 32 |
| 1. To perform application user training | 42 |
| 1. To gather user feedback | 33 |
| 1. To perform application maintenance | 43 |
| **TOTAL** | **150** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Develop application technical documents | * 1. Identify types of application technical Documents   2. Prepare application technical documents      1. Contents / format & importance of each      2. Software requirement specification      3. Technical design documents      4. User interface design document      5. Database design document      6. Test plan and test case      7. Installation and deployment guide      8. User manual or user guide      9. API documentation   3. Validation of application technical documents | * Written tests * Practical Activities * Project work * Third Party report * Portfolio of Evidence |
| 1. Perform application user training | * 1. Training needs assessment      1. Definition of TNA      2. Reasons for carrying out TNA      3. End User Training      4. Importance of end user training      5. User & customer training methods         1. Classroom mode / face-to-face training         2. Automated online (virtual / Simulation) training         3. Self-paced learning modules         4. On-the-Job / On-Site training   2. Prepare end user training resources      1. Tutorials      2. Frequently asked questions      3. Demo videos      4. User manuals      5. Charts, Help windows, Videos   3. Prepare user training schedule   4. Practices when conducting user training | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Gather user feedback | * 1. Method of gathering user feedback      1. Surveys      2. Form builders      3. Questionnaires      4. Observation   2. Preparation of Data collection tools      1. Surveys      2. Form builders      3. Questionnaires      4. Observation   3. Collection of User Feedback      1. Surveys      2. Feedback forms      3. Social media monitoring      4. Beta tests      5. User analytics   4. Customer feedback analysis      1. What it is      2. Why it’s important      3. Feedback analysis methods | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Perform application maintenance | * 1. Carrying out technical assistance      1. Customer relation practices   2. Monitoring & reporting on application Performance   3. Performing application optimization   4. Performing security Application updates      1. Security update      2. System updates   5. Perform routine system maintenance   6. Performing system updates | * Practical Activities * Project work * Demonstration * Group Work * Role Plays * 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
  + Role plays
  + Project work by trainees
  + Group Work
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 111111 | Internet connection | * 1. For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * 1. Genuine Windows/Linux   2. Genuine Microsoft office Software   3. Google Workspace Account   4. Antivirus Software   5. Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

# MODULE III

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| BASIC | 0413 441 01A | ENTREPRENEURIAL  SKILLS | 40 |
| CORE | 0612 451 09A | COMPUTERIZED  DATABASE SYSTEMS | 340 |
| **TOTAL** | | | **380** |

## ENTREPRENEURIAL SKILLS

**UNIT CODE:** 0413 441 01A

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Entrepreneurial skills.

**Duration of unit:** 40 hours

**UNIT DESCRIPTION**

This unit covers the competencies required to apply entrepreneurship skills. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, and developing business innovative strategies and business plans.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To apply financial literacy | 6 |
| 1. To apply the entrepreneurial concept | 4 |
| 1. To Identify entrepreneurship opportunities | 6 |
| 1. To apply business legal aspects | 6 |
| 1. To innovate Business Strategies | 6 |
| 1. To develop business plan | 12 |
| **TOTAL** | **40** |

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply financial literacy | 1. Personal finance management 2. Balancing between needs and wants 3. Budget Preparation 4. Savings management 5. Factors to consider when deciding where to save 6. Debt management 7. Factors to consider before taking a loan 8. Investment decisions 9. Types of investments 10. Factors to consider when investing money 11. Insurance services     * Insurance products available in the market     * Insurable risks | * Observation * Project * Written assessment * Oral assessment * Third party report * Interviews |
| 1. Apply entrepreneurial concept | * 1. Difference between Entrepreneurs and Business persons   2. Types of entrepreneurs   3. Ways of becoming an entrepreneur   4. Characteristics of Entrepreneurs   5. salaried employment and self-employment   6. Requirements for entry into self-employment   7. Roles of an Entrepreneur in an enterprise   8. Contributions of Entrepreneurship | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Identify entrepreneurship opportunities | * 1. Sources of business ideas   2. Factors to consider when evaluating business opportunity   3. Business life cycle | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Apply business legal aspects | * 1. Forms of business ownership   2. Business registration and licensing processing   3. Types of contracts and agreements   4. Employment laws   5. Taxation laws | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Innovate business Strategies | * 1. Creativity in business   2. Innovative business strategies   3. Entrepreneurial Linkages   4. ICT in business growth and development | * Observation * Project * Written assessment * Oral assessment * Third party report |
| 1. Develop Business Plan | * 1. Business description   2. Marketing plan   3. Organizational/Management plan   4. Production/operation plan   5. Financial plan   6. Executive summary   7. Business plan presentation   8. Business idea incubation | * Observation * Written assessment * Project * Oral assessment * Third party report |

**Suggested Methods of Instruction**

* Direct instruction with active learning strategies
* Project (Business plan)
* Case studies
* Field trips
* Group Work
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training
* Guest speakers

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Internet connection | For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Learning guide | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |

## COMPUTERISED DATABASE SYSTEMS MANAGEMENT

**UNIT CODE:** 0612 451 09A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Manage Computerised Database System**

**Duration of Unit**: 340 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to manage computerized database system. It involves, designing database system, creating database system, Manipulating Computerized Database, managing database security and performing database maintenance

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To design database system | 60 |
| 1. To create database system | 100 |
| 1. To manipulate computerized database | 90 |
| 1. To manage database security | 50 |
| 1. To perform database maintenance | 40 |
| **TOTAL** | **340** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Design database system | * 1. Identification of Database design approaches      1. Design approaches         1. Top – down design method         2. Bottom – up design method         3. Centralized design         4. Decentralized design   2. Identification of database design tools      1. Types of design tools   3. Database structures.      1. Database structure      2. Database models         1. Record-based model         + Hierarchical models         + Network Models         + Relational Models         1. Object-based data models         + Entity-Relationship (ER)         + Semantic         + Functional         + Object-oriented         1. Physical data models         + unifying model and         + the frame memory      3. Database schema   4. Database design architecture      1. Schema design      2. Database management system architecture      3. Data Warehousing and Big Data Architecture         1. Multi-user DBMS architectures         2. Web service and service oriented Architectures         3. Distributed DBMS      4. Data Warehousing and Big Data Architecture   5. Database normalisation.      1. Types of normalisations      2. Process of normalization   6. Entity Relationship diagrams   7. Database design report      1. Key components of database design report | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Create database system | * 1. Database management software identification      1. Selecting Appropriate DBMS   2. Database development environment configuration.      1. Setting Up the Environment      2. Development Tools   3. Database objects      1. Tables      2. Indexes      3. Tools      4. Stored procedures and functions   4. Data attributes.      1. Types of attributes   5. Data relationships.      1. Types of relationships         1. One to one         2. One to many         3. Many to many   6. Workplace safety and health practices      1. Importance      2. Digital safety   7. E-waste storage and disposal   8. E-waste management      1. Storage and Disposal      2. Erasure | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Manipulate computerized database | * 1. Database business rules      1. Unique constraints      2. Referential integrity   2. Inserting data into database   3. Insert statement in SQL   4. Data retrieval from the database      1. Selecting data from database   5. Data modification using queries.      1. Updating data in database      2. Modifying queries in database   6. Data deletion      1. Deleting data in table      2. Dropping database | * Practical Activities * Project work * Demonstration * Group Work * Third Party report * Portfolio of Evidence * Written tests |
| 1. Manage database security | * 1. Database security risks identification      1. Common security risks         1. Unauthorized Access         2. SQL Injection Attacks         3. Data Leakage         4. Insider Threats         5. Weak Authentication and Access Control         6. Inadequate Patching         7. Malware   2. Identification of database security control measures      1. Control measures         1. Access Control and Authentication         2. SQL Injection Prevention         3. Encryption         4. Regular Security Audits and Monitoring         5. Patching and Updates         6. Data Masking and Anonymization         7. Backup and recovery plans         8. User Activity Logging         9. Firewalls   3. Database security control measures implementation.      1. Policy Development      2. Access Management      3. Configuration Hardening      4. Testing   4. Carrying out Monitoring and auditing of database security   5. Performing database security documentation      1. Database maintenance schedule preparation   6. Training database users      1. End Users      2. Application Programmer or Specialized users or Back-End Developer      3. System Analysts      4. Database Administrator (DBA)      5. Temporary Users or Casual Users | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Perform database maintenance | * 1. Database maintenance schedule preparation      1. Maintenance plans      2. Daily tasks      3. Weekly tasks      4. Monthly tasks      5. Quarterly tasks      6. Annual tasks      7. Database maintenance schedule preparation         1. Key elements in preparation of maintenance schedule   2. Database performance monitoring      1. Resource Utilization      2. Query Performance      3. Transaction Log Monitoring      4. Connection Monitoring      5. Alerting Systems   3. Database performance optimization      1. Query Optimization      2. Indexing Strategy      3. Partitioning      4. Configuration Tuning      5. Archiving   4. Database maintenance report generation      1. Report components      2. Report generation process | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |

**Suggested Delivery Methods**

1. Instructor led facilitation using active learning strategies
2. Demonstration by trainer
3. Practical work by trainees
4. Viewing of related videos
5. Field Visits
6. Group Work
7. Role plays
8. Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 111111 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

# MODULE IV

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| COMMON | 0688 451 05A | PROJECT MANAGEMENT PRINCIPLES | 110 |
| BASIC | 0417 441 02 A | WORK ETHICS AND PRACTICES | 40 |
| CORE | 0613 451 10A | WEB APPLICATION DEVELOPMENT | 250 |
|  |  | **TOTAL** | **400** |

## PROJECT MANAGEMENT PRINCIPLES

**UNIT CODE:** 0688 451 05A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Project Management Principles**

**Duration of Unit:** 110 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to apply project management principles. It involves executing project initiation, performing project planning, performing project monitoring, and performing project closure.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To execute project initiation | 20 |
| 1. To perform project planning | 40 |
| 1. To perform project monitoring | 40 |
| 1. To perform project closure | 10 |
| **TOTAL** | **110** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| * + - 1. Execute project initiation | * 1. Identification of Project scope      1. KeyComponents Listing         1. Project goals and objectives         2. Deliverables         3. Inclusions and exclusions         4. Constraints and assumptions      2. Scope formulation process         1. Review client or stakeholder needs.         2. Document the project requirements.         3. Define project boundaries         4. Confirm scope with stakeholders   2. Determination of Project deliverables      1. Internal Deliverables      2. External Deliverables      3. Steps to Determine project deliverables:         1. Identifying key outcomes         2. Breaking down the project         3. Defining milestones         4. Clarifying project acceptance criteria   3. Identification of project objectives      1. SMART Objectives:   4. Project initiation document (PID) preparation.      1. Key Sections of the PID:         1. Project Purpose and Justification         2. Project Scope         3. Project Deliverables         4. Project Objectives:         5. Stakeholder Analysis         6. Project Organization         7. Project Timeline and Milestones         8. Budget and Resource Plan         9. Risk Assessment         10. Quality Management      2. Importance of the PID: | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Perform project planning | * 1. Preparation of Project budget      1. Steps of preparing budget      2. Budgeting techniques   2. Determination of Project schedule      1. Steps of preparing schedule      2. Project scheduling tools         1. Critical path method         2. Program Evaluation and Review Technique (PERT)   3. Allocation of Project resources      1. Identify resources      2. Allocate based on availability      3. Balance resources      4. Monitor and adjust   4. Determination Project work breakdown structures (WBS)      1. Identify major project deliverables      2. Divide deliverables into smaller tasks      3. Assign resources and timelines      4. Use a numbering system   5. Preparation of Project quality plan      1. Quality objectives      2. Quality assurance activities      3. Quality control measures      4. Acceptance criteria   6. Formation of Project team.      1. Identify required skills      2. Select team members      3. Define roles and responsibilities      4. Build team collaboration   7. Project team Roles and responsibilities      1. Define responsibilities      2. Assign roles      3. Document roles and responsibilities      4. Get sign-off   8. Preparation of Project plan.      1. Project objectives      2. Scope statement      3. Schedule      4. Resource plan      5. Risk management plan      6. Communication plan      7. Change management plan      8. Project Approval | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Perform project monitoring | * 1. Tracking Project costs      1. Steps to Track Costs:         1. Set a baseline budget:         2. Record actual expenses:         3. Compare planned vs. actual costs         4. Use Earned Value Management         5. Report cost status      2. Tools for Tracking Costs   2. Monitoring Project deliverables and objectives      1. Define key deliverables      2. Set up a monitoring schedule      3. Track against the project plan      4. Use performance indicators      5. Report to stakeholders      6. ISO quality Standards   3. Monitoring Project team performance      1. Steps to Monitor Team Performance   4. Assessing Project risks      1. Steps to Assess Risks:         1. Identify potential risks         2. Evaluate risk impact and probability         3. Prioritize risks         4. Conduct a SWOT analysis      2. Types of Project Risks:         1. Technical risks         2. Schedule risks         3. Budget risks         4. Resource risks.   5. Managing Project risks.      + 1. Steps to manage risks | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Perform project closure | * 1. Performing Project review      1. Key Objectives of a Project Review      2. Steps to Perform a Project Review      3. Post-Project Review Techniques   2. Review of Final project budget      1. Steps to Review the Final Budget      2. Key Considerations   3. Preparation of detailed project review report      1. Key Components of the Project Review Report      2. Purpose of the report | * Practical Activities * Project work * Demonstration * Group Work * 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 Work
  + Role plays
  + Group projects

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + MS Project / Ms Visio   + Visual Paradigm   + Clickup | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

## WORK ETHICS AND PRACTICES

**UNIT CODE**: 0417 441 02 A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply work ethics and practices.

**Duration of Unit:** 40 hours

**UNIT DESCRIPTION**

This unit covers competencies required to apply work ethics and practices. It involves the ability to: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving, and promote customer care.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To apply self-management skills | 10 |
| 1. To promote ethical practices and values | 4 |
| 1. To promote teamwork | 10 |
| 1. To maintain professional and personal development | 10 |
| 1. To apply problem-solving skills | 4 |
| 1. To promote customer care. | 2 |
| **TOTAL** | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply self-management skills | * 1. Self-awareness   2. Formulating personal vision, mission, and goals   3. Healthy lifestyle practices   4. Strategies for overcoming work challenge   5. Emotional intelligence   6. Coping with Work Stress.   7. Assertiveness versus aggressiveness and passiveness   8. Developing and maintaining high self-esteem   9. Developing and maintaining positive self-image   10. Time management   11. Setting performance targets   12. Monitoring and evaluating performance targets | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote ethical work practices and values | * 1. Integrity   2. Core Values, ethics and beliefs   3. Patriotism   4. Professionalism   5. Organizational codes of conduct   6. Industry policies and procedures | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Teamwork | * 1. Types of teams   2. Team building   3. Individual responsibilities in a team   4. Determination of team roles and objectives   5. Team parameters and relationships   6. Benefits of teamwork   7. Qualities of a team player   8. Leading a team   9. Team performance and evaluation   10. Conflicts and conflict resolution   11. Gender and diversity mainstreaming   12. Developing Healthy workplace relationships   13. Adaptability and flexibility   14. Coaching and mentoring skills | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Maintain professional and personal development | * 1. Personal vs professional development and growth   2. Avenues for professional growth   3. Recognizing career advancement   4. Training and career opportunities   5. Assessing training needs   6. Mobilizing training resources   7. Licenses and certifications for professional growth and development   8. Pursuing personal and organizational goals   9. Managing work priorities and commitments   10. Dynamism and on-the-job learning | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Apply Problem-solving skills | * 1. Causes of problems   2. Methods of solving problems   3. Problem-solving process   4. Decision making   5. Creative thinking and critical thinking process in development of innovative and practical solutions | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Customer Care | * 1. Identifying customer needs   2. Qualities of good customer service   3. Customer feedback methods   4. Resolving customer concerns   5. Customer outreach programs   6. Customer retention | * Observation * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |

**Suggested Methods of Instruction**

* Instructor lead facilitation of theory using active learning strategies.
* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Projects
* Case studies
* Assignments

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | For reference | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Assorted colour of whiteboard markers | For trainer’s use | 2 packets |  |
|  | e-Didactics | For trainer’s use |  |  |
|  | Flashcards | Writing | 25pcs | 25:1 |
|  | Flip charts | Writing | 200 pcs | 25:1 |
|  | Whiteboard | Writing | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 25:1 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing Papers |  | 1 ream | 1:20 |
|  | Toners |  | 2 pcs | 13:1 |
|  | Internet connection |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Projectors |  | 1 | 25:1 |
|  | Printers |  | 4 | 6:1 |
|  | Computers/Mobile Phones |  | 25 pcs | 1:1 |

## WEB APPLICATION DEVELOPMENT

**UNIT CODE:** 0613 451 10A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Create Web Application

**Duration of Unit:** 250 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to create web application. It involves, designing web application, writing web application source code, testing web application, debugging web application and hosting web application

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To design web application | 40 |
| 1. To write web application source code | 100 |
| 1. To test web application | 30 |
| 1. To debug web application | 40 |
| 1. To host web application | 40 |
| **TOTAL** | **250** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| * + - 1. Design web application | * 1. Design Principles      1. User-centered Design         1. User's goals         2. User's tasks         3. Preferences      2. Information Architecture      3. Visual Design         1. Layout,         2. Typography,         3. Colour scheme,         4. Imagery.      4. Interaction Design      5. Accessibility      6. Web application design tools         1. Drafting application e.g Figma, illustrator or Photoshop basics   2. Designing of web application functionality      1. Creation of website application site map      2. Performance   3. Creation of web application interface design      1. Responsiveness of web pages   4. Designing of web application output      1. Rendering pdf, Excel documents | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| * + - 1. Write web application source code | * 1. Creation of user interface development tools.      1. Identification of front-End development tools         1. Hypertext Markup Language         2. HTML Tags, elements and attributes         3. Cascading Style Sheets         4. Embedded CSS         5. Inline CSS         6. External         7. JavaScript basics         8. Data types operation         9. Document Object Model (DOM)         10. JavaScript Frameworks overview e.g JQuery syntax and events   2. Performing Version control   3. Functionality and interactivity development   4. Responsive design implementation Methodology      1. Screen resolutions   5. Front-end Development      1. Hypertext Markup Language      2. Cascading Style Sheets      3. JavaScript basics      4. JavaScript Frameworks overview   6. Application Programming Interfaces (API)      1. API integration      2. Application API testing   7. Server-side coding tools      1. PHP coding basics   8. Back-end Development      1. Server-side coding tools e.g PHP coding basics      2. Back-end frameworks   9. Back-end database implementation      1. Database creation      2. Database connection      3. Database Manipulation through a web interface   10. Back-end API creation   11. Workplace safety and health practices       1. Applicable OSHA regulations and laws   12. E-waste storage and disposal   13. E-waste management | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 3. Test web application | * 1. Web application testing Types   2. Web application test plan      1. Test environment      2. Test scope      3. Schedule   3. Web application testing tools      1. Performance testing tools      2. functional testing tools      3. security testing tools      4. Cross-browser testing      5. Mobile-web application testing tools      6. Usability testing tools e,g Google analytics   4. Test report preparation      1. Types of Test reports | * Practical Activities * Project work * Demonstration * Group Work * Third Party report * Portfolio of Evidence * Written tests |
| 4. Debug web application | * 1. revise source code for errors      1. Types of Errors         1. Logical         2. Runtime         3. Syntax   2. Apply debugging tools; Error handling techniques      1. Source code revision      2. Debugging tools   3. Performing regression testing | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Host web application | * 1. Web hosting service identification      1. Types of web hosting techniques e.g Shared, Dedicated, Free, Cloud.   2. Domain acquisition and configuration      1. Domain lookup      2. Domain Registration      3. Domain Pricing   3. Web Server configuration      1. Domain Configuration      2. DNS      3. Control panel   4. Web application deployment tools      1. FTP      2. GITs      3. Docker   5. Web security measures      1. SSL / TLS Certificates      2. Firewalls      3. Updates and upgrades      4. Strong authentication      5. Backup solutions   6. Web application maintenance and monitoring      1. Server Maintenance      2. Database Maintenance      3. Application Updates      4. Monitoring tools         1. Performance monitoring         2. Up-time monitoring         3. Security monitoring         4. Log monitoring | * Practical Activities * Project work * Demonstration * Group Work * 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 Work
* Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
|  | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

# M**ODULE V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| CORE | 0613 551 02 A A | OBJECT ORIENTED PROGRAMMING | 170 |
| CORE | 0613 551 03 A | DESKTOP APPLICATION DEVELOPMENT | 240 |
|  |  | **Total** | **410** |

## OBJECT ORIENTED PROGRAMMING

**UNIT CODE:** 0613 551 02 A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Object Oriented Programing

**Duration of Unit:** 170 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to apply object oriented programming. It involves applying computer programming skills, demonstrating structured programming skills and demonstrating object oriented programming skills.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To apply computer programming skills | 30 |
| 1. To demonstrate structured programming skills | 40 |
| 1. To demonstrate object-oriented programming skills | 100 |
| **TOTAL** | **170** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Apply Computer Programming Skills | * 1. Programming Language Types      1. Overview of programming language categories         1. procedural         2. object-oriented         3. functional      2. Criteria for selecting languages based on user requirements   2. Programming Paradigms      1. Explanation of common programming paradigms (e.g., imperative, declarative)      2. Choosing the appropriate paradigm based on project needs   3. Program Development Life Cycle      1. Stages of the program development life cycle (e.g., planning, design, implementation)      2. Best practices for adapting the life cycle to work requirements   4. Program Design Tools      1. Overview of design tools (e.g. algorithms, flowcharts, wireframes, pseudocodes, decision table/trees)      2. Selecting design tools based on user requirements and project complexity   5. Program Writing Tools      1. Common program writing tools and IDEs (e.g.Visual Studio, codeblocks, DEV C++, Eclipse)      2. Evaluating tools based on system requirements and developer preferences | * Practical Activities * Project work * Group work * Observation * Portfolio of Evidence * Written tests |
| 1. Demonstrate structured programming skills | * 1. Declaring Identifiers      1. Guidelines for naming conventions and best practices      2. Ensuring identifiers align with program design specifications      3. Creating a naming convention guide for different types of identifiers.      4. Evaluating identifier   2. Initializing Variables and Constants      1. Importance of proper initialization in programming      2. Techniques for initialization based on design specifications      3. Writing code snippets demonstrating correct and incorrect initialization.      4. Conducting a workshop on variable and constant initialization techniques.   3. Applying Data Control Structures      1. Types of control structures (e.g., loops, conditionals)      2. Best practices for implementing control structures as per design requirements      3. Solving coding challenges that require the use of different control structures.      4. Creating flowcharts to visually represent control structures in a program.   4. Applying Data Structures      1. Overview of common data structures (e.g., arrays, linked lists)      2. Selecting appropriate data structures based on design specifications      3. Implementing various data structures in a programming language of choice.      4. Comparing performance metrics of different data structures in a small project.   5. Creating Subroutines      1. Benefits of using subroutines (e.g., modularity, reusability)      2. Designing subroutines to meet user needs      3. Functions and subprograms      4. Design and implement a subroutine library for common tasks.      5. Program to create subroutines based on given specifications.   6. Applying User-Defined Data Types      1. Overview of user-defined data types (e.g., structs, classes)      2. Criteria for selecting data types based on system requirements      3. Designing a class or struct for a real-world object      4. Collaborating on a group project that requires the use of user-defined data types.   7. Performing Debugging      1. Common debugging techniques and tools      2. Participating in a debugging workshop using a sample project.      3. Creating a debugging checklist based on work procedures.   8. Compiling Program      1. Steps involved in the compilation process      2. Ensuring compliance with system requirements during compilation      3. Compiling a series of programs with intentional errors to learn about error messages.      4. Researching and presenting on different compilers and their features. | * Practical Activities * Project work * Group work * Observation * Portfolio of Evidence * Written tests |
| 1. Demonstrate object-oriented programming skills | * 1. Implementing Objects and Classes      1. Overview of objects and classes in OOP      2. Implementation of classes      3. Creating a simple class and instantiating objects to demonstrate understanding.      4. Participating in a group project where each member implements a different class based on a shared design.   2. Declaring Object Methods      1. Defining class methods that fulfill application requirements      2. Best practices for method naming and functionality      3. Developing a class with various methods and demonstrating their usage in a small application.      4. Conducting a code review session focusing on method declarations and their alignment with application requirements.   3. Applying Namespaces      1. Understanding the role of namespaces in OOP      2. Implementing namespaces as per work procedures      3. Create a project that uses multiple namespaces to organize code effectively.      4. Explore and present on the benefits of using namespaces in a collaborative coding environment.   4. Applying Data Abstraction Concepts      1. Definition and importance of data abstraction      2. Implementing abstraction in line with work procedures      3. Designing an abstract class and demonstrate its use in a program.      4. Trainees work in pairs to identify and implement abstraction in existing codebases.   5. Applying Object Encapsulation      1. Understanding encapsulation and its significance      2. Implementing encapsulation in programs      3. Type of access modifiers         1. Private         2. Public         3. Protected      4. A class to demonstrate encapsulation by using private and public access modifiers.      5. Class presentation on advantages of encapsulation in a program.   6. Implementing Class Templates      1. Overview of class templates and their applications      2. Creating class templates      3. Write a generic class template and demonstrate its usage with different data types.      4. Collaborating on a project that requires the use of class templates for various functionalities.   7. Implementing Class Inheritance      1. Inheritance concepts and types of inheritance (single, multiple)      2. Applying inheritance in programs      3. Creating a class hierarchy to demonstrate inheritance concepts.      4. Participating in a coding challenge that requires implementing inheritance in a given scenario.   8. Implementing Polymorphism      1. Definition and types of polymorphism (compile-time vs. runtime)      2. Implementing polymorphism in a program      3. Develop a program to demonstrate both types of polymorphism.      4. Engage in a discussion or workshop on the practical applications and benefits of polymorphism in software development. | * Practical Activities * Project work * Group work * Observation * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 111111 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

## DESKTOP APPLICATION DEVELOPMENT

**UNIT CODE:** 0613 551 03 A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Develop Desktop Application

**Duration of Unit:** 240 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to develop desktop application. It involves designing desktop application, writing desktop application source code, debugging desktop application, testing desktop application and deploying desktop application.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. To design desktop application | 60 |
| 1. To write desktop application source code | 60 |
| 1. To debug desktop application | 40 |
| 1. To test desktop application | 50 |
| 1. To deploy desktop application | 30 |
| **TOTAL** | **240** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Design desktop application | * 1. Desktop application design tools      1. Basic desktop application programming concepts         1. Events         2. Objects         3. Controls         4. Methods      2. Application development stages      3. Identifying Desktop Application Design Tools      4. Overview of desktop application design tools      5. Criteria for selecting tools      6. Case studies of tool selection in real-world applications   2. Designing Application Functionality      1. Techniques for gathering user requirements      2. Mapping user needs to application features      3. Prioritizing functionality based on user feedback   3. Creating the Application Interface      1. Principles of effective user interface design      2. Creating wireframes and prototypes      3. User testing and feedback incorporation   4. Designing Application Output      1. Types of application output (reports, visualizations)      2. Qualities of a good system user output      3. Methods for testing and validating system output | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| 1. Write desktop application source code | * 1. Identifying Development Tools      1. Overview of desktop application development tools      2. Visual Studio, Netbeans, JetBrains      3. Criteria for selecting tools based on system requirements      4. Examples of popular development environments (e.g., Visual Studio, Netbeans, JetBrains)      5. Parts of Integrated Development Environment      6. Types of controls and objects         1. Buttons         2. Textboxes         3. Labels         4. Combobox         5. Datagrid         6. Listview         7. Forms   2. Developing Application Interface      1. Implementing the interface design as per specifications      2. Using design patterns and frameworks (e.g., MVC)      3. Ensuring user experience (UX) best practices are followed   3. Designing the Database      1. Understanding user needs for data management      2. Choosing the right database model (e.g., relational vs. NoSQL)      3. Creating data schemas and relationships   4. Database Integration      1. Techniques for integrating databases with applications      2. Ensuring data consistency and integrity eg datafield constraints      3. Using APIs and ORM (Object-Relational Mapping) tools   5. Implementing Application Functionality      1. Writing source code to meet user requirements      2. Testing functionality through unit and integration tests      3. Iterative development and user feedback incorporation   6. Observing Workplace Safety and Health Practices      1. Overview of OSHA regulations relevant to software development      2. Best practices for maintaining a safe workplace      3. Importance of ergonomics and safe equipment usage   7. Identifying E-Waste Storage and Disposal Methods      1. Understanding e-waste regulations as per OSHA      2. Proper storage techniques for electronic waste      3. Safe disposal methods and recycling options   8. Demonstrating E-Waste Management      1. Implementing e-waste management practices in the workplace      2. Training staff on e-waste handling and disposal      3. Monitoring and reporting e-waste management efforts | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| 1. Debug desktop application | * 1. Checking Source Code for Bugs and Errors      1. Techniques for static code analysis      2. Manual code review practices   2. Performing Debugging with Tools      1. Overview of popular debugging tools (e.g., GDB, Visual Studio Debugger)      2. Best practices for using debugging tools effectively         1. Breakpoints         2. Step options         3. Running commands eg Break, Pause & Stop         4. Examining variables & expressions   3. Conducting Regression Testing      1. Types of regression testing (e.g., automated vs. manual)      2. Strategies for identifying test cases for regression   4. Documenting Source Code Changes      1. Importance of version control systems (e.g., Git)      2. Best practices for maintaining clear and concise documentation | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| 1. Test desktop application | * 1. Identifying Testing Types      1. Testing types         1. Unit test         2. Integration test         3. Usability test         4. System testing         5. Security test         6. Performance test         7. Compatibility test      2. Selecting appropriate testing types based on user requirements   2. Preparing Test Plan      1. Key components of a test plan (e.g., objectives, scope, resources)      2. Best practices for aligning the test plan with work procedures   3. Executing Tests as per Test Plan      1. Methods for executing various tests (manual vs. automated)      2. Tracking test progress and issues during execution   4. Preparing the Test Report      1. Essential elements of a test report (e.g., findings, recommendations)      2. Best practices for documenting results according to work procedures | * Practical Activities * Project work * Demonstration * Group Work * Observation * Portfolio of Evidence * Written tests |
| 1. Deploy desktop application | * 1. Identifying Deployment Strategy      1. Overview of deployment strategies (e.g., phased, big bang)      2. Factors influencing the choice of deployment strategy based on work procedures   2. Identifying Deployment Tools      1. Overview of popular deployment tools (e.g., InstallShield, NSIS)      2. Evaluating tools based on user requirements and application needs   3. Packaging the Application      1. Best practices for creating installation packages      2. Ensuring compliance with application requirements (e.g., dependencies, configurations)   4. Distributing the Application      1. Methods for distributing applications (e.g., direct download, app stores)      2. Ensuring distribution aligns with established work procedures | * Practical Activities * Project work * Demonstration * Group Work * Observation * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 111111 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

# MODULE VI

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Category** | **Unit Code** | **Unit Name** | **Unit Duration**  **(Hours)** |
| CORE | 0613 551 04 A | MOBILE APPLICATION  DEVELOPMENT | 270 |
| BASIC | 0031 541 01A | COMMUNICATION SKILLS | 40 |
| **Total** | | | **310** |

## MOBILE APPLICATION DEVELOPMENT

**UNIT CODE:** 0613 551 04 A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Develop Mobile Application

**Duration of Unit:** 270 Hours

**UNIT DESCRIPTION**

This unit covers the competencies required to develop mobile application. It involves designing mobile application, writing mobile application source code, debugging mobile application, testing mobile application and publishing mobile application.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Design Mobile Application | 80 |
| 1. Write mobile application source code | 110 |
| 1. Debug mobile application | 40 |
| 1. Test mobile application | 30 |
| 1. Publish mobile application | 10 |
| **TOTAL** | **270** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Design Mobile Application | * 1. Design principles and Guidelines      1. Operating system      2. Consistency      3. Device      4. Scalability      5. Simplicity      6. Mobile application design tools         1. Types of mobile application design tools e.g. Figma, Sketch, Adobe XD, InVision, Marvel   2. Mobile application functionality      1. Ease of Use (Usability)      2. Performance      3. Security      4. Compatibility      5. Offline Access   3. Mobile application interface   4. Mobile application output design | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence * Written tests |
| 1. Write mobile application source code | * 1. Mobile application development tools      1. Integrated Development Environment (IDE)      2. Graphic User Interface (      3. Emulator      4. Mobile SDK   2. Configure mobile application development environment      1. Android Studio      2. Xcode      3. Flutter      4. React Native      5. Visual Studio with Xamarin   3. Mobile application interface      1. Setup      2. Develop      3. Test and Debug      4. Publish   4. Mobile application functionality      1. User Authentication      2. Navigation      3. Data Input and Management      4. Notifications and Alerts      5. Search Functionality   5. Integrate backend with frontend      1. Define API Endpoints      2. Set Up the Backend Server      3. Implement Database Models      4. Develop API Logic      5. Connect Frontend to API      6. Manage State in Frontend      7. Handle Error Responses      8. Test the Integration   6. Integrate Mobile application components with APIs      1. Define Component Requirements      2. Design API Endpoints      3. Implement API Calls in Components      4. Manage Component State      5. Handle Errors and Loading States      6. Data Binding      7. Testing API Integration      8. Monitor API Performance      9. Iterate Based on Feedback      10. Documentation   7. Workplace safety and health practices      1. Observe health safety practices   8. Methods of e-waste storage and disposal      1. Recycling      2. Landfilling      3. Incineration      4. Refurbishing      5. Donation      6. Component Harvesting      7. Safe Storage      8. Exporting for Recycling      9. Electronic Waste Collection Events      10. Manufacturer Take-Back Programs   9. E-waste management is demonstration      1. Understanding E-waste      2. E-waste Collection Methods      3. E-waste Sorting and Processing      4. Recycling Techniques      5. Responsible Disposal Practices | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence   Written tests |
| 1. Debug mobile application | * 1. Checking of mobile application source code      1. Error handling techniques      2. Source code revision   2. Debugging tools-bring from range      1. Integrated Development Environment (IDE) Debuggers      2. Print Statements      3. Profiling Tools      4. Memory Debuggers      5. Browser Developer Tools      6. Static Code Analysis Tools      7. Remote Debugging Tools   3. Regression testing   4. Prepare debugging report. | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence   Written tests |
| 1. Test mobile application | * 1. Mobile application testing      1. Unit test      2. Integration test      3. Usability test      4. System testing      5. Security test      6. Performance test      7. Compatibility test   2. Mobile application test plan      1. Test environmental      2. Test scope      3. Schedule   3. Mobile application testing tools      1. Performance testing tools      2. functional testing tools      3. security testing tools      4. Cross-browser testing      5. Mobile-web application testing tools      6. Usability testing tools e,g. Google analytics   4. Test report preparation      1. Types of Test reports | * Practical Activities * Project work * Demonstration * Group Work * Observation * Third Party report * Portfolio of Evidence   Written tests |
| 1. Publish mobile application | * 1. Identification of mobile publishing tools      1. Adobe InDesign      2. Canva      3. Lucidpress      4. Joomag      5. FlipHTML5   2. Generation of mobile application bundle      1. Android App Bundle (AAB)      2. Universal APK      3. iOS App Bundle (IPA)      4. Flutter App Bundle      5. React Native Bundle      6. Cordova/PhoneGap Bundle   3. Mobile application published      1. Application distribution through application stores | * Practical Activities * Project work * Demonstration * Group Work * 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 Work
  + Role plays
  + Group projects

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | |  |  |
| 1. 111111 | Internet connection | * + For each computer | 1 | 1:1 |
|  | Flip charts | A1 | 1 | 1:25 |
|  | Textbooks | For reference | 3 | 3:25 |
| **B** | **Learning Facilities & infrastructure** | |  |  |
|  | Computer Laboratory | To accommodate 25 Learners | 1 | 1:25 |
|  | Theory Room | furnished with 25 Arm-chairs and a suitable trainer’s table | 1 | 1:25 |
| **C** | **Consumable materials** | |  |  |
|  | Printing papers | A4 | 2 Reams | 1:12 |
|  | Toner / Ink bottles | For printers | 2 pcs | 1:12 |
|  | White board markers | Assorted colors | 20 | 4:5 |
| **D** | **Tools and Equipment** | |  |  |
|  | Computers | * + Genuine Windows/Linux   + Genuine Microsoft office Software   + Google Workspace Account   + Antivirus Software   + Suitable IDE | 25 | 1:1 |
|  | External storage media | HDD / SSD / Flash | 1 | 1:25 |
|  | Printer | Working printer | 2 | 1:12 |
|  | 1 Smart-board / Smart TV / Projector (with screen) | Where available | 1 | 1:25 |
|  | Whiteboard/Chalkboard | 4 X 8 Feet | 1 | 1:25 |

## COMMUNICATION SKILLS

**UNIT CODE:** 0031 541 01A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Communication Skills

**Duration of Unit:** 40 hours

**UNIT DESCRIPTION**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**Summary of Learning Outcomes**

|  |  |
| --- | --- |
| **Learning Outcomes** | **Duration (Hours)** |
| 1. Apply communication channels | 10 |
| 1. Apply written communication skills | 12 |
| 1. Apply non-verbal communication skills | 4 |
| 1. Apply oral communication skills | 4 |
| 1. Apply group discussion skills | 10 |
| **TOTAL** | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply communication channels | * 1. Communication process      1. Principles of effective communication   2. Channels/medium/modes of communication      1. Factors to consider when selecting a channel of communication      2. Barriers to effective communication   3. Flow/patterns of communication      1. Sources of information      2. Organizational policies | * Oral questions * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply written communication skills | * 1. Types of written communication   2. Elements of communication   3. Organization requirements for written communication | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply non-verbal communication skills | * 1. Utilize body language and gestures   2. Apply body posture   3. Apply workplace dressing code | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply oral communication skills | * 1. Types of oral communication pathways   2. Effective questioning techniques   3. Workplace etiquette   4. Active listening | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply group discussion skills | * 1. Establishing rapport   2. Facilitating resolution of issues   3. Developing action plans   4. Group organization techniques   5. Turn-taking techniques   6. Conflict resolution techniques   7. Team-work | * Oral assessment * Written assessment * Observation * Portfolio of Evidence * Practical assessment |

**Suggested Methods of Instruction**

* Roleplaying
* Simulation
* Field trips
* Viewing of related videos
* Demonstrations
* Online Training
* Group Work.
* Instructor led facilitation using active learning strategies.

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Trainee: Item) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks | For reference | 5 pcs | 5:1 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Assorted colour of whiteboard markers | For trainer’s use | 2 packets |  |
|  | e-Didactics | For trainer’s use |  |  |
|  | Flashcards | Writing |  | 25:1 |
|  | Flip charts | Writing |  | 25:1 |
|  | Whiteboard | Writing |  | 25:1 |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room | Study room | 1 | 25:1 |
| **C** | **Consumable materials** |  |  |  |
|  | Printing Papers | Printing | 1 ream | 1:20 |
|  | Toners | Printing | 2 pcs | 13:1 |
|  | Internet |  |  |  |
| **D** | **Tools and Equipment** |  |  |  |
|  | Projectors | Projecting | 1 | 25:1 |
|  | Printers | Printing | 4 | 6:1 |
|  | Computers/Smartphones |  | 25 pcs | 1:1 |