

**NATIONAL COMPETENCY BASED CURRICULUM**

**FOR**

**COMPUTER PROGRAMMING**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted in the formulation of the Policy Framework for Reforming Education and Training. A key feature of this policy is the radical change in the design and delivery of the TVET training. This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum for Computer Programming level 6 has been developed.

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with ICT Sector Skills Advisory Committee (SSAC) have developed Occupational Standards for Computer Programmer. These standards will be the basis for development of competency-based curriculum for Computer Programming Level 6.

This curriculum has been developed following the CBET framework policy; the CBETA Standards and guidelines provided by the TVET Authority and the Kenya National Qualification framework designed by the Kenya National Qualification Authority.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course

I am grateful to the Council Members, Council Secretariat, ICT SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGMENT

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 was received from various organizations.

I recognize with appreciation the role of ICT Sector Skills Advisory Committee (SSAC) 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 all those who participated in the process of developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that workers in ICT Sector acquire competencies that will enable them to perform their work more efficiently

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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# ABBREVIATIONS AND ACRONYMS

A Control version

AIDS Acquired Immunodeficiency Syndrome

APK Android Package Kit

BC Basic Unit

CBET Competency Based Education and Training

CC Common unit

CDACC Curriculum Development, Assessment and Certification Council

CEO Council Secretary

CR Core Unit

CRUD Create, Retrieve, Update, Delete

CU Curriculum

DBMS Database Management System

DSDM Dynamic Systems Development Methodology

EMS Environmental Management Systems

HIVAcquired Immunodeficiency Virus

ICT Information Communication Technology

IEEE Institute of Electrical and Electronics Engineers

ISO International Organisation for Standardisation

JDK Java Development Kit

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

LAN Local Area Network

LCD Liquid Crystal Display

MAN Metropolitan Area Network

MIS Management Information System

OOP Object Oriented Programming

OSH Occupational Health and Safety

PAN Personal Area Network

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal Protective Equipment

Q&A Questions and Answer

RAM Random Access Memory

ROM Read Only Memory

SDK Software Development Kit

SQL Structured Query Language

SSAC Sector Skills Advisory Committee

SWOT Strength Weakness Opportunity Threat

TVET Technical and Vocational Education and Training

UML Unified Modeling Language

WAN Wide Area Network

# KEY TO UNIT CODE

 **ICT/CU /CP /BC /01/6 A**

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

 Version control

# OVERVIEW

Computer Programming Level 6 qualification consists of competencies that a person must achieve to enable him/her to understand computing basics, apply discrete mathematical concepts, demonstrate programming concepts , design and use a database, data structures and algorithms, apply object oriented programming concepts using JAVA, event driven programming concepts using VB.net, develop client side web applications, develop server side web applications, develop mobile applications and understand agile development concepts.

These qualifications consist of the following basic, common and core units of learning:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ICT/CU/CP/BC/01/6/A | Communication Skills | 40 | 4.0 |
| ICT/CU/CP/BC/02/6/A | Digital Literacy | 60 | 6.0 |
| ICT/CU/CP/BC/03/6/A | Numeracy Skills | 60  | 6.0 |
| ICT/CU/CP/BC/04/6/A | Entrepreneurial Skills | 100 | 10.0 |
| ICT/CU/CP/BC/05/6/A | Employability Skills | 80 | 8.0 |
| ICT/CU/CP/BC/06/6/A | Environmental Literacy | 40 | 4.0 |
| ICT/CU/CP/BC/07/6/A | Occupational Safety and Health Practices | 40 | 4.0 |
| **Subtotal 1** | **420** | **42**.**0** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ICT/CU/CP/CC/01/6/A | Basic Electronics and Equipment Maintenance  | 170 | 17.0 |
| **Subtotal 2** |  |  |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factors** |
| ICT/CU/CP/CR/01/6/A | Computing Basics | 100 | 10.0 |
| ICT/CU/CP/CR/02/6/A | Discrete Mathematical Concepts | 150 | 15.0 |
| ICT/CU/CP/CR/03/6/A | Programming Concepts Using  | 170 | 17.0 |
| ICT/CU/CP/CR/04/6/A | Design And Use a Database | 170 | 17.0 |
| ICT/CU/CP/CR/05/6/A | Data Structures and Algorithms | 170 | 17.0 |
| ICT/CU/CP/CR/06/6/A | Object Oriented Programming Concepts using JAVA | 170 | 17.0 |
| ICT/CU/CP/CR/07/6/A | Event Driven Programming Concepts using VB.NET | 170 | 17.0 |
| ICT/CU/CP/CR/08/6/A | Client-Side Web Applications | 170 | 17.0 |
| ICT/CU/CP/CR/09/6/A | Server-Side Web Applications | 170 | 17.0 |
| ICT/CU/CP/CR/10/6/A | Mobile Applications  | 170 | 17.0 |
| ICT/CU/CP/CR/11/6/A | Agile Development Concepts | 150 | 15.0 |
| ICT/CU/CP/CR/12/6/A | Industrial Attachment | 480 | 48.0 |
| **Subtotal 3** | **2240** | **224.0** |
| **Grand Total** | **2830** | **283.0** |

The core units of learning are independent of each other and may be taken independently.

The total duration of the **course is 2,830 hours** (94weeks at 30 hours per week) inclusive of industrial attachment.

**Entry Requirements**

An individual entering 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**

1. Craft certificate (Level 5) in ICT or a related course

**Or**

1. Equivalent qualifications as determined by Kenya National Qualifications Authority (KNQA)

**Industrial attachment**

An individual enrolled in this course will be required to undergo an industrial attachment in a Programming firm for a period of at least 480 hours. Attachment will be undertaken upon completion of the course or the unit of learning.

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an internal accredited verifier while external assessment is the responsibility of TVET/CDACC.

**Certification**

A candidate will be issued with a Certificate of Competency on demonstration of competence in a unit of competency. To attain National qualification in Computer Programming Level 6, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider.

# BASIC UNITS OF LEARNING

##

# COMMUNICATION SKILLS

**UNIT CODE:** ICT/CU/CP/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to demonstrate communication skills .It involves, meeting communication needs of clients and colleagues; developing communication strategies, establishing and maintaining communication pathways, conducting interviews, facilitating group discussion and representing the organization.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues
 | * Communication process
* Modes of communication
* Medium of communication
* Effective communication
* Barriers to communication
* Flow of communication
* Sources of information
* Organizational policies
* Organization requirements for written and electronic communication methods
* Report writing
* Effective questioning techniques (clarifying and probing)
* Workplace etiquette
* Ethical work practices in handling communication
* Active listening
* Feedback
* Interpretation
* Flexibility in communication
* Types of communication strategies
* Elements of communication strategy
 | * Interview
* Written texts
 |
| 1. Develop communication strategies
 | * Dynamics of groups
* Styles of group leadership
* Openness and flexibility in communication
* Communication skills relevant to client groups
 | * Interview
* Written texts
 |
| 1. Establish and maintain communication pathways
 | * Types of communication pathways
 | * Interview
* Written texts
 |
| 1. Promote use of communication strategies
 | * Application of elements of communication strategies
* Effective communication techniques
 | * Interview
* Written texts
 |
| 1. Conduct interview
 | * Types of interview
* Establishing rapport
* Facilitating resolution of issues
* Developing action plans
 | * Interview
* Written texts
 |
| 1. Facilitate group discussion
 | * Identification of communication needs
* Dynamics of groups
* Styles of group leadership
* Presentation of information
* Encouraging group members participation
* Evaluating group communication strategies
 | * Interview
* Written texts
 |
| 1. Represent the organization
 | * Presentation techniques
* Development of a presentation
* Multi-media utilization in presentation
* Communication skills relevant to client groups
 | * Interview
* Written texts
 |

**Suggested Methods of Instruction**

* Discussion
* Role playing
* Simulation
* Direct instruction

**Recommended Resources**

* Desktop computers/laptops
* Internet connection
* Projectors
* Telephone

# NUMERACY SKILLS

**UNIT CODE:** ICT/CU/CP/BC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Numeracy Skills.

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes the competencies required to demonstrate numeracy skills. It involves applying a wide range of mathematical calculations for work; applying ratios, rates and proportions to solve problems; estimating, measuring and calculating measurement for work; using detailed maps to plan travel routes for work; using geometry to draw and construct 2D and 3D shapes for work; collecting, organizing and interpreting statistical data; using routine formula and algebraic expressions for work and using common functions of a scientific calculator.

**Summary of Learning Outcomes**

1. Apply a wide range of mathematical calculations for work
2. Apply ratios, rates and proportions to solve problems
3. Estimate, measure and calculate measurement for work
4. Use detailed maps to plan travel routes for work
5. Use geometry to draw and construct 2D and 3D shapes for work
6. Collect, organize and interpret statistical data
7. Use routine formula and algebraic expressions for work
8. Use common functions of a scientific calculator

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply a wide range of mathematical calculations for work
 | * Fundamentals of mathematics
* Addition, subtraction, multiplication and division of positive and negative numbers
* Algebraic expressions manipulation
* Forms of fractions, decimals and percentages
* Expression of numbers as powers and roots
 | * Written tests
* Assignments
* Supervised exercises
 |
| 1. Apply ratios, rates and proportions to solve problems
 | * Rates, ratios and proportions
* Meaning
* Conversions into percentages
* Direct and inverse proportions determination
* Performing calculations
* Construction of graphs, charts and tables
* Recording of information
 | * Written tests
* Assignments
* Supervised exercises
 |
| 1. Estimate, measure and calculate measurement for work
 | * Units of measurements and their symbols
* Identification and selection of measuring equipment
* Conversion of units of measurement
* Perimeters of regular figures
* Areas of regular figures
* Volumes of regular figures
* Carrying out measurements
* Recording of information
 | * Assignments
* Supervised exercises
* Written tests
 |
| 1. Use detailed maps to plan travel routes for work
 | * Identification of features in routine maps and plans
* Symbols and keys used in routine maps and plans
* Identification and interpretation of orientation of map to North
* Demonstrate understanding of direction and location
* Apply simple scale to estimate length of objects, or distance to location or object
* Give and receive directions using both formal and informal language
* Planning of routes
* Calculation of distance, speed and time
 | * Written
* Practical test
 |
| 1. Use geometry to draw and construct 2D and 3D shapes for work
 | * Identify two dimensional shapes and routine three dimensional shapes in everyday objects and in different orientations
* Explain the use and application of shapes
* Use formal and informal mathematical language and symbols to describe and compare the features of two dimensional shapes and routine three dimensional shapes
* Identify common angles
* Estimate common angles in everyday objects
* Evaluation of unknown angles
* Use formal and informal mathematical language to describe and compare common angles
* Symmetry and similarity
* Use common geometric instruments to draw two dimensional shapes
* Construct routine three dimensional objects from given nets
 |  |
| 1. Collect, organize and interpret statistical data
 | * + Classification of data
* Grouped data
* Ungrouped data
	+ Data collection
* Observation
* Recording
	+ Distinguishing between sampling and census
	+ Importance of sampling
	+ Errors in sampling
	+ Types of sampling and their limitations e.g.
* Stratified random
* Cluster
* Judgmental
	+ Tabulation of data
* Class intervals
* Class boundaries
* Frequency tables
* Cumulative frequency
	+ Diagrammatic and graphical presentation of data e.g.
* Histograms
* Frequency polygons
* Bar charts
* Pie charts
* Cumulative frequency curves
* Interpretation of data
 | * Assignments
* Supervised exercises
* Written tests
 |
| 1. Use routine formula and algebraic expressions for work
 | * + Solving linear equations
	+ Linear graphs
* Plotting
* Interpretation
* Applications of linear graphs
* Curves of first and second degree
* Plotting
* Interpretation
 | * Assignments
* Supervised exercises
* Written tests
 |
| 8. Use common functions of a scientific calculator | * Identify and use keys for common functions on a calculator
* Calculate using whole numbers, money and routine decimals and percentages
* Calculate with routine fractions and percentages
* Apply order of operations to solve multi-step calculations
* Interpret display and record result
 | * Written
* Practical test
 |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Practical work by trainee
* Exercises

**Recommended Resources**

* Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice

# DIGITAL LITERACY

**UNIT CODE:** ICT/CU/CP/BC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 60 hours

**Unit Description**

This unit describes competencies required to demonstrate digital literacy. It involves in identifying computer software and hardware, applying security measures to data, hardware, software in automated environment, computer software in solving task, internet and email in communication at workplace, desktop publishing in official assignments and preparing presentation packages.

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software
 | * Concepts of ICT
* Functions of ICT
* History of computers
* Components of a computer
* Classification of computers
 | * Written tests
* Oral presentation
 |
| 1. Apply security measures to data, hardware, software in automated environment
 | * Data security and control
* Security threats and control measures
* Types of computer crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT
 | * Written tests
* Oral presentation
* Project
 |
| 1. Apply computer software in solving tasks
 | * Operating system
* Word processing
* Spread sheets
* Data base design and manipulation
* Data manipulation, storage and retrieval
 | * Oral questioning
* Project
 |
| 1. Apply internet and email in communication at workplace
 | * Computer networks
* Network configurations
* Uses of internet
* Electronic mail (e-mail) concept
 | * Oral questioning
* Written report
 |
| 1. Apply desktop publishing in official assignments
 | * Concept of desktop publishing
* Opening publication window
* Identifying different tools and tool bars
* Determining page layout
* Opening, saving and closing files
* Drawing various shapes using DTP
* Using colour pellets to enhance a document
* Inserting text frames
* Importing and exporting text
* Object linking and embedding
* Designing of various publications
* Printing of various publications
 | * Oral questioning
* Written report
* Project
 |
| 1. Prepare presentation packages
 | * Types of presentation packages
* Procedure of creating slides
* Formatting slides
* Presentation of slides
* Procedure for editing objects
 | * Oral questioning
* Written report
* Project
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Computers
* Printers
* Storage devices
* Internet access

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** ICT/CU/CP/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 100 hours

**Unit Description**

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship and self-employment. It also involves identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation and developing business innovative strategies.

**Summary of Learning Outcomes**

* 1. Demonstrate understanding of who an entrepreneur
	2. Demonstrate knowledge of entrepreneurship and self-employment
	3. Identify entrepreneurship opportunities
	4. Create entrepreneurial awareness
	5. Apply entrepreneurial motivation
	6. Develop business innovative strategies
	7. Develop Business plan

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate knowledge of entrepreneurship and self-employment
 | * Importance of self-employment
* Requirements for entry into self-employment
* Role of an Entrepreneur in business
* Contributions of Entrepreneurs to National development
* Entrepreneurship culture in Kenya
* Born or made entrepreneurs
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
 |
| 1. Identify entrepreneurship opportunities
 | * Business ideas and opportunities
* Sources of business ideas
* Business life cycle
* Legal aspects of business
* Assessment of product demand
* Business environment
* Factors to consider when evaluating business environment
* Technology in business
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Create entrepreneurial awareness
 | * Forms of businesses
* Sources of business finance
* Factors in selecting source of business finance
* Governing policies on Small Scale Enterprises (SSEs)
* Problems of starting and operating SSEs
 | * Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Apply entrepreneurial motivation
 | * Internal and external motivation
* Motivational theories
* Self-assessment
* Entrepreneurial orientation
* Effective communications in entrepreneurship
* Principles of communication
* Entrepreneurial motivation
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 1. Develop business innovative strategies
 | * Innovation in business
* Small business Strategic Plan
* Creativity in business development
* Linkages with other entrepreneurs
* ICT in business growth and development
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |
| 6. Develop Business Plan | * Business description
* Marketing plan
* Organizational/Management
* plan
* Production/operation plan
* Financial plan
* Executive summary
* Presentation of Business Plan
 | * Case studies
* Individual/group assignments
* Projects
* Written tests
* Oral questions
* Third party report
* Interviews
 |

**Suggested Methods of Instruction**

* Direct instruction
* Project
* Case studies
* Field trips
* Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training

**Recommended Resources**

* Case studies
* Business plan templates
* Computers
* Overhead projectors
* Internet
* Mobile phone
* Video clips
* Films
* Newspapers and Handouts
* Business Journals
* Writing materials

# EMPLOYABILITY SKILLS

**UNIT CODE:** ICT/CU/CP/BC/05/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 80 hours

**Unit Description**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead a workplace team
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Manage ethical performance

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management
 | * Self-awareness
* Formulating personal vision, mission and goals
* Strategies for overcoming life challenges
* Managing emotions
* Emotional intelligence
* Assertiveness versus aggressiveness
* Expressing personal thoughts, feelings and beliefs
* Developing and maintaining high self-esteem
* Developing and maintaining positive self-image
* Setting performance targets
* Monitoring and evaluating performance
* Articulating ideas and aspirations
* Accountability and responsibility
* Good work habits
* Self-awareness
* Values and beliefs
* Self-development
* Financial literacy
* Healthy lifestyle practices
* Adopting safety practices
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate interpersonal communication
 | * Meaning of interpersonal communication
* Listening skills
* Types of audience
* Public speaking
* Writing skills
* Negotiation skills
* Reading skills
* Meaning of empathy
* Understanding customers’ needs
* Establishing communication networks
* Assertiveness
* Sharing information
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate critical safe work habits
 | * Stress and stress management
* Time concept
* Punctuality and time consciousness
* Leisure
* Integratingpersonal objectives into organizational objectives
* Resources mobilization
* Resources utilization
* Setting work priorities
* Developing healthy relationships
* HIV and AIDS
* Drug and substance abuse
* Managing emerging issues
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Lead a workplace team
 | * Leadership qualities
* Power and authority
* Team building
* Determination of team roles and objectives
* Team parameters and relationships
* Individual responsibilities in a team
* Forms of communication
* Complementing team activities
* Gender and gender mainstreaming
* Human rights
* Developing healthy relationships
* Maintaining relationships
* Conflicts and conflict resolution
* Coaching and mentoring skills
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Plan and organize work
 | * Functions of management
* Planning
* Organizing
* Time management
* Decision making concept
* Task allocation
* Developing work plans
* Developing work goals/objectives and deliverables
* Monitoring work activities
* Evaluating work activities
* Resource mobilization
* Resource allocation
* Resource utilization
* Proactive planning
* Risk evaluation
* Problem solving
* Collecting, analysing and organising information
* Negotiation
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Maintain professional growth and development
 | * Avenues for professional growth
* Training and career opportunities
* Assessing training needs
* Mobilizing training resources
* Licenses and certifications for professional growth and development
* Pursuing personal and organizational goals
* Managing work priorities and commitments
* Recognizing career advancement
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate workplace learning
 | * Managing own learning
* Mentoring
* Coaching
* Contributing to the learning community at the workplace
* Cultural aspects of work
* Networking
* Variety of learning context
* Application of learning
* Safe use of technology
* Taking initiative/proactivity
* Flexibility
* Identifying opportunities
* Generating new ideas
* Workplace innovation
* Performance improvement
* Managing emerging issues
* Future trends and concerns in learning
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Demonstrate problem solving skills
 | * Critical thinking process
* Data analysis tools
* Decision making
* Creative thinking
* Development of creative, innovative and practical solutions
* Independence in identifying and solving problems
* Solving problems in teams
* Application of problem-solving strategies
* Testing assumptions
* Resolving customer concerns
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |
| 1. Manage ethical performance
 | * Meaning of ethics
* Ethical perspectives
* Principles of ethics
* Ethical standards
* Organization code of ethics
* Common ethical dilemmas
* Organization culture
* Corruption, bribery and conflict of interest
* Privacy and data protection
* Diversity, harassment and mutual respect
* Financial responsibility/accountability
* Etiquette
* Personal and professional integrity
* Commitment to jurisdictional laws
* Emerging issues in ethics
 | * Written tests
* Oral questioning
* Interviewing
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of Instruction**

1. Demonstrations
2. Simulation/Role play
3. Group Discussion
4. Presentations
5. Assignments
6. Q&A

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE**:ICT/CU/CP/BC/06/6/A

**Relationship to Occupational Standards**:

This unit addresses the Unit of Competency: Demonstrate Environmental Literacy

**Duration of Unit:** 40 hours

**Unit Description**

This unit describes the competencies required demonstrate environmental literacy.it involves controlling environmental hazard, controlling environmental pollution, complying with workplace sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs, monitoring activities on environmental protection/programs, analysing resource use and developing resource conservation plans.

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs
8. Analyze resource use
9. Develop resource conservation plans

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** |  **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard
 | * Purposes and content of Environmental Management and Coordination Act 1999
* Storage methods for environmentally hazardous materials
* Disposal methods of hazardous wastes
* Types and uses of PPE in line with environmental regulations
* Occupational Safety and Health Standards (OSHS)
 | * Written questions
* Oral questions
 |
| 1. Control environmental Pollution control
 | * Types of pollution
* Environmental pollution control measures
* Types of solid wastes
* Procedures for solid waste management
* Different types of noise pollution
* Methods for minimizing noise pollution
 | * Written questions
* Oral questions
* Role play
 |
| 1. Demonstrate sustainable resource use
 | * Types of resources
* Techniques in measuring current usage of resources
* Calculating current usage of resources
* Methods for minimizing wastage
* Waste management procedures
* Principles of 3Rs (Reduce, Reuse, Recycle)
* Methods for economizing or reducing resource consumption
 | * Written questions
* Oral questions
* Role play
 |
| 1. Evaluate current practices in relation to resource usage
 | * Collection of information on environmental and resource efficiency systems and procedures,
* Measurement and recording of current resource usage
* Analysis and recording of current purchasing strategies.
* Analysis of current work processes to access information and data
* Identification of areas for improvement
 | * Written questions
* Oral questions
* Role play
 |
| 1. Identify Environmental legislations/conventions for environmental concerns
 | * Environmental issues/concerns
* Environmental legislations /conventions and local ordinances
* Industrial standard /environmental practices
* International Environmental Protocols (Montreal, Kyoto)
* Features of an environmental strategy
 | * Written questions
* Oral questions
 |
| 1. Implement specific environmental programs
 | * Community needs and expectations
* Resource availability
* 5s of good housekeeping
* Identification of programs/Activities
* Setting of individual roles /responsibilities
* Resolving problems /constraints encountered
* Consultation with stakeholders
 | * Written questions
* Oral questions
* Role play
 |
| 1. Monitor activities on Environmental protection/Programs
 | * Periodic monitoring and Evaluation of activities
* Gathering feedback from stakeholders
* Analyzing data gathered
* Documentation of recommendations and submission
* Setting of management support systems to sustain and enhance the program
* Monitoring and reporting of environmental incidents to concerned /proper authorities
 | * Oral questions
* Written tests
* Practical test
 |
| 1. Analyze resource use
 | * Identification of resource consuming processes
* Determination of quantity and nature of resource consumed
* Analysis of resource flow through different parts of the process.
* Classification of wastes for possible source of resources.
 | * Written tests
* Oral questions
* Practical test
 |
| 1. Develop resource Conservation plans
 | * Determination of efficiency of use/conversion of resources
* Causes of low efficiency of use of resources
* Plans for increasing the efficiency of resource use
 | * Written tests
* Oral questions
* Practical test
 |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Company environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ICT/CU/CP/BC/07/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Occupational Safety and Health Practices

**Duration of Unit:** 40 hours

**Unit Description**

This unit specifies the competencies required to demonstrate occupational health and safety practices. It involves identifying workplace hazards and risk, identifying and implementing appropriate control measures to hazards and risks and implementing OSH programs, procedures and policies/guidelines.

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Control OSH hazards
3. Implement OSH programs

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks
 | * Identification of hazards in the workplace and/or the indicators of their presence
* Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace
* Gathering of OSH issues and/or concerns
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |
| 1. Control OSH hazards
 | * Prevention and control measures e.g. use of PPE
* Risk assessment
* Contingency measures
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |
| 1. Implement OSH

 programs | * Company OSH program, evaluation and review
* Implementation of OSH programs
* Training of team members and advice on OSH standards and procedures
* Implementation of procedures for maintaining OSH-related records
 | * Oral questions
* Written tests
* Portfolio of evidence
* Third party report
 |

**Suggested Methods of Instruction**

* Assigments
* Discussion
* Q&A
* Role play
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

# COMMON UNIT OF LEARNING

# BASIC ELECTRONICS

**UNIT CODE:** ICT/CU/CP/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Basic Electronic Skills

**Duration of Unit:** 170 hours

**Unit description**

This unit specifies the competencies required to apply basic electronics skills. It involves identifying electric circuits and electronic components, understanding semi-conductor theory, identifying and classifying memories, applying number systems and binary coding and identifying emerging trends in electronics.

**Summary of Learning Outcomes**

1. Identify electric circuits
2. Identify Electronic components
3. Understand Semi-conductor theory
4. Identify and classify memory
5. Apply number systems and binary coding
6. Identify emerging trends in electronics

|  |  |  |
| --- | --- | --- |
| **Learning outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Identify electrical circuits
 | * + Definition of electrical circuit.
	+ Basic electrical quantities and their units
* E.m.f in volts
* Current in Amperes
* Power in watts
* Energy in joules
* Resistance in ohms
	+ Types of electrical circuits
* Simple a.c circuits
* Simple d.c circuits
 | * Practical exercises
* Written
* Observation
* Oral
 |
| 1. Identify electronic components
 | * + Identification of electronic components
* Resistor
* Capacitor
* Diode
* Inductor
	+ Characteristic of electronic components.
	+ Application of electronic components.
	+ Identification of integrated circuit characteristics
 | * Practical exercises
* Written
* Observation
* Oral
 |
| 1. Understand semi-conductor theory
 | * + Definition of semiconductor and related terms
* Atom
* Atomic structure
	+ Description of the structure of matter
	+ Explanation of electrons in conductors and semiconductors
	+ Types of semiconductors materials
* Silicon
* germanium
	+ Explanation of P-type and N-types materials
* P-type
* N-type
	+ Description of P-N junction diodes operations
* Forward biasing
* Reverse biasing
* Operations of transistors
* PNP type
* NPN type
 | * Practical exercises
* Written
* Observation
* Oral
 |
| 1. Identify and classify memory
 | * + Definition of memory
	+ Classification of memories
* RAM
* ROM
* DAM
* Types of memories
* Semiconductor memories
* Magnetic memories
 | * Written
* Observation
* Oral
 |
| 1. Apply number systems and binary coding
 | * + Definition of number system and binary code
	+ Types of number systems
* Decimal
* Binary
* Octal
* Hexadecimal
	+ Base conversion
	+ Binary arithmetic
* Addition
* Subtraction
* Multiplication
* Division
	+ Binary codes
* 8421 BCD
* Excess-3
* Represent decimal numbers in BCD
* BCD arithmetic
* Addition
* Subtraction
* Multiplication
* Division
 | * Written
* Observation
* Oral
 |
| 1. Emerging trends in Electronics
 | * Description of emerging trends
* Explanation of challenges of emerging trends
* Coping with the emerging trends
 | * Written
* Observation
* Oral
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised activities and projects in a workshop;
* Visiting lecturer/trainer from the ICT sector;
* Industrial visits.

**Recommended Resources**

**Tools**

* Screw Drivers
* Pliers
* Wire cutters
* Wire Strippers
* Clamps
* Vises

**Equipment**

* Voltmeter
* Ohmmeter
* Ammeter
* Multimeter
* Power supplies
* LCR meter

**Materials and supplies**

**•** Circuits

• Semiconductor materials

• Conductors e.g. copper, gold, silver

• Insulators e.g. rubber, glass, mica

# CORE UNITS OF LEARNING

# COMPUTING BASICS

**UNIT CODE:** ICT/CU/CP/CR/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Understand Computing Basics

**Duration of Unit:** 100 hours

**Unit description**

This unit covers the competence to understand computing basics. It involves understanding computer system models, outlining computer components, demonstrating data representation techniques, understanding basic network concepts, recognizing ethical, legal and social issues in computing

**Summary of Learning Outcomes**

1. Understand computer system models
2. Outline computer components
3. Demonstrate data representation techniques
4. Understand basic network concepts.
5. Recognise ethical, social and legal issues in computing

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Understand Computer system models
 | * + Definition of computer system
	+ Classification of computer systems
* General purpose
* Desktops
* Notebooks
* Smart phones
* Tablets
* Special purpose
* Security
* Medical equipment
* Manufacturing
* Home Appliances
* Wearables
* Internet of Things (IOT)
	+ Features of general purpose computers
	+ Features of special purpose computers
 | * Written tests
* Oral tests
 |
| 1. Outline computer components
 | * + Definition of hardware and software
	+ Types of software
* Application software
* System software
* Utility software
* Language translators
	+ Functions of hardware
	+ Functions of software
	+ Troubleshooting
* Troubleshooting hardware components
* Windows OS troubleshooting
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Demonstrate data representation techniques
 | * + Definition of terms
* Data
* Data representation
* Digitization
	+ Data formats
* Text
* Audio
* Video
* Image
	+ Methods of data representation
* Bit
* Byte
* Qubit
 | * Written tests
* Oral tests
 |
| 1. Understand basic network concepts
 | * Definition of terms
* Network
* Nodes
* Host
* Network Interface Card
* Packets
* Network components
* Hub
* Network interface card
* Switch
* Connecting media
* Network Operating System
* Types of networks
* LAN
* WAN
* MAN
* PAN
* Network topologies
* Star
* Bus
* Ring
* Mesh
* Advantages of networks
* Requirements for internet connection
* IP Address Types
* Static IP Addressing
* Dynamic IP addressing using DHCP
* Definition of network troubleshooting
* Demonstration of basic network troubleshooting tools
* Ping
* Pathping
* Ipconfig
* Tracert
* Nslookup
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Recognize ethical, social and legal issues in computing
 | * Definition of computing ethics
* Legal and ethical issues in computing
* Legal issues
* Digital ownership
* Data gathering
* Security
* Ethical issues
* Privacy
* Communication
* Computer crimes
* Social issues and emerging trends in computing
 | * Written tests (Case Studies)
* Oral tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised activities and projects in a workshop;
* Visiting lecturer/trainer from the ICT sector;
* Industrial visits.

**Recommended Resources**

**Tools**

• Internet

**Equipment**

• Computer

• Network devices

**Materials and supplies**

• Stationery

• Instructional materials

**Reference materials**

• Manufacturer manuals for troubleshooting

• Trainer-recommended resources including web resources

# DISCRETE MATHEMATICAL CONCEPTS

**UNIT CODE:** ICT/CU/CP/CR/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Discrete Mathematical Concepts

**Duration of Unit**: 150 hours

**Unit Description:**

This unit describes the competencies required to apply discrete mathematical concepts. It involves illustrating Boolean Algebra expression, carrying out Set Theory operations, performing Matrix operations, illustrating Relations and Functions, carrying out Recursion, performing Sequences and Series and demonstrating Graph theory.

**Summary of Learning Outcomes:**

1. Illustrate Boolean Algebra Expressions
2. Carry Out Set Theory Operations
3. Perform Matrix Operations
4. Illustrate Relations and Functions
5. Carry Out Recursion
6. Perform Sequences and Series
7. Demonstrate Graph Theory

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Illustrate Boolean Algebra expressions
 | * Definition of Boolean algebra
* Uses of Boolean algebra
* Key Terminology
* Boolean value
* Boolean function
* Truth table
* Logic gate
* Digital logic
* Basic Operations
* AND
* OR
* NOT
* Secondary Operations
* NAND
* NOR
* X-OR
* X-NOR
* Writing Boolean Expressions
* Order of basic operations
* Symbols
* Simplification of Boolean expressions
* Using algebraic functions
* Using Truth tables
* Using Karnaugh Maps
* Boolean Laws and Theorems
* AND law
* OR law
* Inversion law
* Commutative
* Associative
* Distributive
* De-Morgan’s Theorems
* Simplification (Reduction) Rules for Boolean expressions
 | * Written tests
* Oral tests
 |
| 1. Carry out Set Theory operations
 | * Definition of a Set
* Characteristics of sets
* Elements
* Size
* Set representation
* Statement form
* Tabular form
* Set builder notation
* Cardinality of a set
* Types of sets
* Finite Set
* Infinite Set
* Subset
* Proper Subset
* Universal Set
* Empty or Null
* Equal
* Equivalent Set
* Singleton Set or Unit Set
* Overlapping Set
* Disjoint Set
* Venn Diagrams
* Set Operations
* Set Union and Set Intersection
* Properties of Union and Intersection
* Set Difference/Relative Complement
* Set Complement
* Cartesian Product
 | * Written tests
* Oral tests
 |
| 1. Perform Matrix operations
 | * Definition of Matrix
* Matrix order
* Types of matrices
* Square
* Symmetric
* Skew-symmetric
* Diagonal
* Identity
* Orthogonal
* Idemponent
* Involutary
* Singular and non-singular matrices
* Matrix operations
* Sum of two matrices
* Sum of a matrix and a scalar
* Matrix subtraction
* Product of two matrices
* Product of a matrix and a vector
* Transpose of a matrix
* Properties of transpose of a matrix
* Adjoint of a square matrix
* Inverse of a square matrix
* Trace of a matrix
* Application of matrices
 | * Written tests
* Oral tests
 |
| 1. Illustrate Relations and Functions
 | * Definition of Relation
* Domain and range of a relation
* Types of relations
* Empty
* Full
* Identity
* Reflexive
* Irreflexive
* Symmetric
* Anti-symmetric
* Transitive
* Equivalence
* Definition of Functions
* Types of functions
* One to one
* Many to one
 | * Written tests
* Oral tests
 |
| 1. Carry out Recursion
 | * Definition of recursion
* Recursion in exponents
* Recurrence Relations
* Types of Recursion Relations
* Linear
* Binary
* Multiple
 | * Written tests
* Oral tests
 |
| 1. Perform Sequence and Series
 | * Explanation of key terms
* Sequence
* Arithmetic Progression
* Geometric Progression
* Summation of a sequence
* Arithmetic series (Summation)
* Geometric series (Summation)
 | * Written tests
* Oral tests
 |
| 1. Demonstrate Graph Theory
 | * Definition of Graph
* Key Graph Terminologies
* Node
* Edge
* Adjacency
* Vertex
* Types and subtypes of graphs
* Null
* Simple
* Multigraph
* Directed graphs
* Directed Acyclic
* Tree
* Undirected
* Connected
* Complete
* Biconnected
* Representation of graphs
* Adjacency Matrix
* Adjacency List
* Applications of graphs
 | * Written tests
* Oral tests
 |

**Suggested Methods of Instruction**

* Presentations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Visiting lecturer/trainer from the Mathematics field.
* Industrial visits

**Recommended Resources**

**Tools**

• Internet

**Equipment**

• Calculator

• Computer

**Materials and supplies**

• Instructional material

• Stationery

# PROGRAMMING CONCEPTS

**UNIT CODE:** ICT/CU/CP/CR/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstrate Programming Concepts

**Duration of Unit:** 170 hours

**Unit Description**

This unit specifies competencies required to demonstrate programming concepts. It involves understanding programming basics, understanding the C# environment, performing data operations and using control statements.

**Summary of Learning Outcomes**

1. Understand programming basics
2. Understand the C# environment
3. Perform data operations
4. Use control statements

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Understand programming basics
 | * **Definition of Programming**
* **Phases of program development**
* Establish program requirements
* Design a program
* Coding
* Code test and debug
* Document
* Maintain
* Key terms in programming
* Algorithm
* Source code
* Executable
* Compiling
* Debugging
* Examples of programming languages
* C++
* C#
* Java
* Types of code
* Source code
* Object code
* Machine code
 | * Practical tests
* Oral tests
* Written tests
 |
| 1. Understand the C# environment
 | * C# installation
* Available compilers
* Microsoft
* Borland
* Installation requirements
* Hardware
* Operating system
* C# Environment
* Launching C#
* Customising the environment
* Syntax and Common Errors
* Demonstration of C# syntax
 | * Practical tests
* Oral tests
* Written tests
 |
| 1. Perform data operations
 | * C# data types
* char
* float
* integer
* double
* String
* Types of C# statements
* Declaration statements
* Executable statements
* Variables and Constants
* Declaring variables
* Accepting user input
* Displaying output
* Initialising variables
* Declaring constants
* Enumerated constants
* Data operations
* Number operations
* Arithmetic operators and their precedence
* Comparison Operators
* Logic Operators
* String operations
* Creating strings
* Concatenation
* Copying
* Creation of a C# program for specified operations
 | * Practical tests
* Oral tests
* Written tests
 |
| 1. Use control statements
 | * Types of Control Statements
* Decision
* if statement
* if-else statement
* nested if statements
* switch statement
* Looping
* do..while loop
* for loop
* while loop
* Demonstration of different control statements
* Creation of C# program using control statements
 | * Practical tests
* Oral tests
* Written tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical assignments;
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

**•** Visual studio

**Equipment**

**•** Computer

**Materials and supplies**

**•** Instructional materials

• Stationery

# DATABASE DESIGN AND DEVELOPMENT

**UNIT CODE:** ICT/CU/CP/CR/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Design and Develop Databases

**Duration of Unit:** 170 hours

**Unit Description:**

This unit describes the competencies required to design and develop a database. It involves understanding database concepts, designing a database, performing data definition language operations, performing data manipulation language operations and using views.

**Summary of Learning Outcomes:**

1. Understand Database concepts
2. Design a database
3. Perform data definition language operations
4. Perform data manipulation language operations
5. Use Views

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Understand database concepts
 | * Definition of database
* Explanation of database terminologies
* Table
* Database engine
* Records
* Field
* Reasons of using databases
* Definition of relational model
* Relational Modelling Concepts
* Relations/tables
* Attributes/Columns
* Domain
* Tuples/Rows
* Primary Key
* Foreign Key
* Properties of a relation/table
* Comparison of RDBMS products
* Oracle
* MS SQL server
* My SQL
* Ms Access
* Installation of MS SQL server
* MS SQL server interface
* Properties of MS SQL server Database
 | * Oral tests
* Written tests
 |
| * + 1. Design a database
 | * Phases of database Design
* Conceptual database design (ERM Modeling)
* Logical database design
* Physical database design
* Entity modelling concepts
* Entities
* Attributes
* Relationships
* Designing an Entity Model using UML (Unified Modelling Language)
* Definition of normalisation
* Demonstration of normalisation
* Validating model according to the requirements / specified transactions (CRUDmatrix)
 | * Oral tests
* Written tests
 |
| * + 1. Perform data definition language operations
 | * Definition of SQL
* Data definition queries
	+ CREATE
	+ DROP
	+ ALTER
* Demonstration of CREATE TABLE statement
* Demonstration of CREATE TABLE constraints:
	+ PRIMARY KEY
	+ FOREIGN KEY
	+ NOT NULL
	+ CHECK
	+ UNIQUE
	+ DEFAULT
* Editing table schema using SQLALTER statement
	+ Adding an attribute
	+ Dropping an attribute
	+ Modifying attribute domain
* Dropping table using SQL DROP TABLE statement
 | * Practical tests
* Oral tests
* Written tests
 |
| * + 1. Perform data manipulation language operations
 | * Data manipulation query statements
	+ INSERT
	+ SELECT
	+ UPDATE
	+ DELETE
* Retrieving records using SELECT statement
	+ Components of a SELECT statement
	+ WHERE clause Options
	+ SQL Aggregate functions
* Insertion of records using INSERT INTO statements
	+ Inserting a single record
	+ Inserting several records
* Delete records using DELETE statement
* Update records using UPDATE. SET statement
* SQL Joins
	+ Definition of a join
	+ Types of joins
	+ Creating a simple join
 | * Practical tests
* Oral tests
* Written tests
 |
| * + 1. Using views
 | * Define a view
* Creating a view using CREATE VIEW statement
* Updating a view using REPLACE VIEW statement
* Dropping a view using the DROP VIEW statement
 | * Practical tests
* Oral
* Written tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical database design and SQL projects
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

• Microsoft Office with MSVisio Modelling tool

• MS SQL server software

**Equipment**

• Computers

**Materials and supplies**

• Instructional material

• Stationery

# ALGORITHMS AND DATA STRUCTURES

**UNIT CODE:** ICT/CU/CP/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Design Algorithms and Data Structures

**Duration of Unit:** 170 hours

**Unit Description**

This unit covers the competencies required to design algorithms and data structures. It involves understanding fundamental principles of algorithms and principles of data structures, demonstrating linked lists, representing stacks and queues, demonstrating search techniques, performing sorting techniques, illustrating graph data structure and tree data structure and

performing recursion.

**Summary of Learning Outcomes**

1. Understand fundamental principles of algorithms
2. Understand fundamental principles of data structures
3. Demonstrate linked lists
4. Represent stacks and queues
5. Demonstrate search techniques
6. Perform sorting techniques
7. Illustrate graph data structure
8. Illustrate tree data structure
9. Perform recursion

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Method** |
| 1. Understand fundamental principles of algorithms
 | * Definition of an Algorithm
* Characteristics of an Algorithm
* Principles of algorithm writing
* Algorithm Analysis
* Complexities of algorithms
* Space
* Time
* Greedy algorithms are outlined
* Counting coins
* Divide and conquer algorithms
* Divide /break
* Conquer/solve
* Merge/combine
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Understand fundamental concepts of data structures
 | * Key concepts in data structures
* Data
* Object
* Data type
* Explanation of Arrays
* Array insertion operations
* At the beginning
* At the given index
* After the given index
* Before the given index
* Array delete, search and update
* Demonstration of array operations
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Demonstrate linked lists
 | * + Linked lists
* Linked lists representation
* Types of linked lists
* Basic operations
	+ Doubly linked lists
* Representation
* Basic operations
	+ Circular linked lists
* Representation
* Basic operations
	+ Demonstration of basic operations for the various linked lists using C#
* Insertion
* Deletion
* Reverse
* Display
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Represent stacks and queues
 | * + Definition of Stacks
	+ Representation of stacks
	+ Basic operations
* Pop
* Push
	+ Definition of queues
	+ Representation of queues
	+ Basic operations
* Enqueue
* Dequeue
	+ Demonstration of stack and queues using C#
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Demonstrate search techniques
 | * + Definition of search
	+ Explanation of Linear Search
	+ Explanation of Binary Search
	+ Demonstration of linear search and binary search using C#
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Perform sorting techniques
 | * + Definition of Sorting
	+ Categories of sorting
* Stable and not stable sorting
* Adaptive and Non-Adaptive Sorting Algorithm
* In place and not in place
	+ Types of Sorting algorithms
* Bubble sort
* Insertion sort
* Selection sort
	+ Demonstration of sorting algorithms using C#
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Illustrate graph data structure
 | * + Graph Data Structure
* Vertex
* Edge
* Adjacency
* Path
	+ Graph Operations
* AddNode
* RemoveNode
* AddEdge
* DisplayNode
	+ Graph Traversals
* Breadth first
* Depth first
	+ Explanation of Shortest paths
	+ Demonstration of shortest paths using C#
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Illustrate trees data structure
 | * Trees Data Structure
* Root Node
* Path
* Parent Node
* Child Node
* Leaf Node
* Subtree
* Siblings
* Traversing
* Levels
* Visiting
	+ Tree Traversal
* In-order
* Pre-order
* Post-order
	+ Binary Search Tree
* Representation
* Operations
	+ Spanning trees
* Properties
* Applications
* Minimum spanning tree
* Kruskal spanning tree
* Prim spanning tree
* Demonstration of binary search tree operations using C#
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Perform recursion
 | * Definition of recursion
* Properties of a recursive function
* Base criteria
* Progressive approach
* Demonstration of recursion using C#
 | * Written tests
* Oral tests
* Practical tests
 |

**Suggested Methods of Instruction**

* Presentations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical assignments
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

**•** Visual Studio

**Equipment**

**•** Computers

**Materials and supplies**

**•** Instructional materials

• Stationery

# OBJECT ORIENTED CONCEPTS USING JAVA

**UNIT CODE:** ICT/CU/CP/CR/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Object Oriented Programming Concepts using Java

**Duration of Unit:** 170 hours

**Unit Description**

This unit covers the competencies required to apply object-oriented programming concepts using Java. It involves understanding the concepts of object-oriented programming, creating classes and objects, implementing inheritance and polymorphism.

**Summary of Learning Outcomes**

* + - 1. Understand concepts of Object Oriented Programming
			2. Create classes and objects
			3. Implement inheritance
			4. Implement polymorphism

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Method** |
| * 1. Understand concepts of object-oriented programming
 | * Definition of Object Oriented Programming (OOP)
* Key OOP terminologies
* Object
* Class
* Inheritance
* Polymorphism
* Abstraction
* Data Encapsulation
* Applications of object oriented programming
* Benefits of OOP
* Install JDK
* Java programming environment
* Features of JAVA
* Java syntax
* Data operations
* Control structures
* Functions
 | * Written tests
* Oral tests
* Practical tests
 |
| * 1. Create classes and objects
 | * Class components
* Attributes
* Methods
* Destructors
* Constructors
* Access modifiers
* Private
* Public
* Protected
* Class design
* Definition of a class diagram
* Designing a UML class diagram
* Creating classes
* Creation of relevant objects from classes
* Performing proposed operations using class methods
 | * Written tests
* Oral tests
* Practical tests
 |
| * 1. Implement inheritance
 | * The Inheritance concept
* Key terminologies in inheritance
* Base class
* Derived class
* Types of inheritance
* Single inheritance
* Hybrid
* Hierarchical
* Multilevel inheritance
* Designing of inheritance –based classes using a UML class diagram
* Implementation of program solution according to design
 | * Written tests
* Oral tests
* Practical tests
 |
| * 1. Implement polymorphism
 | * Polymorphism concept
* Key terminologies in polymorphism
* Polymorphic class
* Abstract class
* Virtual Method
* Method overriding
* Method overloading
* Types of polymorphism
* Run time Polymorphism
* Compile Time Polymorphism
* Demonstration of Method overriding and Method overloading
* Designing of polymorphic classes according to requirements
* Implementation of program solution according design
 | * Written tests
* Oral tests
* Practical tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical UML based design and coding assignments
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

**•** JDK

• UML software

**Equipment**

**•** Computers

**Materials and supplies**

**•** Instructional materials

• Stationery

# EVENT DRIVEN PROGRAMMING CONCEPTS USING VB.Net

**UNIT CODE:** ICT/CU/CP/CR/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Event Driven Programming Concepts using VB.Net

**Duration of Unit:** 170 hours

**Unit Description**

This unit covers the competencies required to apply event driven programming concepts using VB.Net. It involves understanding event driven programming concepts, understanding the VB.Net environment, demonstrating VB.Net Syntax elements, using VB.Net basic controls, using events, using VB.Net dialogs, using advanced forms, understanding exception handling, connecting VB.NET applications to a database and deploying VB.Net applications.

**Summary of Learning Outcomes**

1. Understand event driven programming concepts
2. Understand the VB.Net environment
3. Demonstrate VB.Net Syntax elements
4. Use VB.Net basic controls
5. Use events
6. Use VB.Net dialogs Boxes
7. Use advanced forms
8. Understand exception handling
9. Connect VB.NET applications to a database
10. DeployVB.Net applications

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + 1. Understand event driven programming concepts
 | * **Event Driven Programming (EDP)**
	+ **Definition of EDP**
	+ **Comparison of EDP with procedural programming**
* **Key terminology in event driven programming**
	+ **Application**
	+ **Event**
	+ **Method**
	+ **Object Property**
	+ **Object**
	+ **Control**
	+ **Form**
	+ **Design time**
	+ **Run time**
* **Phases of event driven programming**
* Human Computer Interaction (HCI) concepts
* Definition of HCI
* Common mistakes in design
* Interface design principals
 | * **Oral tests**
* **Written tests**
 |
| 1. Understand the VB.Net environment
 | * **The .Net framework**
	+ **Applications supported**
* **Windows applications**
* **Web applications**
* **Web services**
	+ **Components of the .Net framework**
* **Common Language Runtime**
* **.Net Framework Class Library**
* **Common Language Specification**
* **Common Type System**
* **Windows Forms**
* **ASP.Net and ASP.Net Ajax**
* **ADO.Net**
* **Metadata and Assemblies**
* **Installation of Visual Studio**
* **Features of VB.Net**
* **The Integrated Development Environment (IDE)**
	+ **Definition of IDE**
	+ **Parts of VB.Net IDE**
* **Title bar**
* **Menu bar**
* **Tool bar**
* **Layout Toolbar**
* **Initial Form window**
* **Properties Window**
* **Toolbox**
* **Solutions Explorer**
* **Form Layout Window**
* **VB.Net program structure**
	+ **Namespace declaration**
	+ **Class or module**
	+ **One or more procedures**
	+ **Variables**
	+ **The Main procedure**
	+ **Statements and Expressions**
	+ Comments
* **Creating aVB.Net project**
	+ Basic VB.Net syntax
* **Rules for identifiers**
* **Keywords**
* **Simple input and output in VB.Net**
	+ Saving Forms and Project
	+ Compiling a Project
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Demonstrate VB.Net Syntax elements
 | * **Basic VB.Net data types**
* Strings
* Floats
* Integer
* Boolean
* Date
* Byte
* Character
* **Type Conversion functions**
* CDbl()
* CDec()
* Cint()
* CDate()
* CBool()
* **Variables and Constants**
* **Declaring variables**
* **Initialising variables**
* **Declaring constants**
* **Accepting user input**
* **Displaying output from variables**
* **Operators and expressions**
* **Decision making control structures**
* If.. Then statement
* If..The..Else statement
* If.. Else If.. Else statement
* Nested If statements
* Select Case statement
* Nested Select Case statement
* **Looping control structures**
* Do..Loop
* For..Next loop
* Each..Next loop
* While..End While Loop
* With..End With loop
* Nested Loop
* Exit and Continue statement
* **Definition of a VB.NET Procedure**
* **Types of Procedures**
* Sub Procedures
* Functions
* **Demonstration of Sub Procedures**
* **Demonstration of Functions**
* **Demonstration of String properties and methods**
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Use VB.Net basic controls
 | * **Basic VB.Net Controls**
	+ Controls and their purpose
* **Form**
* **TextBox**
* **Label**
* **Button**
* **ListBox**
* **ComboBox**
* **RadioButton**
* **CheckBox**
* **PictureBox**
* **ProgressBar**
* **ScrollBar**
* **DateTimePicker**
* **TreeView**
* **ListView**
	+ **Standard naming conventions for controls**
* **Elements of a control**
	+ **Properties**
	+ **Methods**
	+ **Events**
* **Interface design principles**
* **Demonstrating Properties, Methods and Events**
	+ **VB.Net properties for basic controls**
	+ **Setting properties at design time and run time**
	+ **VB.Net methods for basic controls**
	+ **VB.Net Events for basic controls**
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Use Events
 | * **Definition of Event handler**
* **Types of events**
* VB.Net Mouse events
* VB.Net Keyboard events
* **Demonstration of mouse event handling**
* VB.Net MouseEventargs properties are explained
* Mouse Event handlers are created
* **Demonstration of keyboard event handling**
* VB.Net KeyEventargs properties are explained
* Keyboard Event handlers are created
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Use VB.Net Dialog Boxes
 | * **Uses of dialog boxes**
* **Key dialog classes, functions and methods**
* CommonDialog class
* RunDialog() function
* ShowDialog() method
* **CommonDialog Classes**
* ColorDialog
* FontDialog
* FileDialog: OpenFileDialog, SaveFileDialog
* PrintDialog
* PageSetUpDialog
* **Demonstration of Common Dialog classes’ properties and methods**
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Use Advanced Forms
 | * **Demonstration of VB.Net Menu and Sub Menu controls**
* Creating Menu and Sub Menu Controls
* **MenuStrip**
* **StripMenuItem**
* **ContextMenuStrip**
* Adding Properties and events to Menus and Sub Menus
* **Demonstration of Cutting, Copying and Pasting**
* Creating a ClipBoardclass object
* Using Clipboard Methods
* **Demonstration of modal forms**
* Purpose of modal forms
* Adding a modal form
* Calling a modal form
 | * **Practical tests**
* **Oral tests**
* **Written tests**
 |
| 1. Understand exception handling
 | * **Exception handling concept**
* **Exception handling keywords**
* Try
* Catch
* Finally
* Throw
* **Demonstration of Exception classes in the .Net framework**
* **Demonstration of user defined exceptions**
 | * Practical tests
* Oral tests
* Written tests
 |
| 1. Connect VB.NET applications to a database
 | * **ADO.Net object model**
* **Database connection using the DataProvider**
* **Creation of tables using Dataset components**
 | * Practical tests
* Oral tests
* Written tests
 |
| 1. Deploy a VB.NET application
 | * **Purpose of Deployment**
* **Deployment Steps**
* **Deployment of a VB.Net project**
 | * Practical tests
* Oral tests
* Written tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical assignments and projects;
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

• Visual Studio

**Equipment**

• Computer

**Materials and supplies**

• Instructional materials

• Stationery

# CLIENT-SIDE WEB APPLICATIONS

**UNIT CODE:** ICT/CU/CP/CR/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency**:** Develop Client-side Web Applications

**Duration of Unit:** 170 hours

**Unit Description:**

This unit specifies competencies required to develop client side web applications. It involves understanding HTML basics, using HTML elements, demonstrating web page formatting, applying styles, understanding JavaScript basics, using JavaScript datatypes, using JavaScript functions and using JavaScript libraries

**Summary of Learning Outcomes:**

* + - 1. Understand HTML basics
			2. Use HTML elements
			3. Demonstrate web page formatting
			4. Apply styles
			5. Understand JavaScript basics
			6. Use JavaScript datatypes
			7. Use JavaScript functions
			8. Use JavaScript libraries

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Method** |
| 1. Understand HTML basics
 | * Definition of HTML
* HTML terminologies
* Document
* Stylesheet
* Element
* Attribute
* Creation of HTML file
* Document type declaration
* Saving as .html file
* HTML core elements
* <head>
* <title>
* <body>
* <html>
* Addition of HTML core elements to file
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Use HTML elements
 | * Basic HTML elements
* <p>
* <br>
* <h1>
* Addition of basic HTML elements to HTML document
* Definition of attributes
* src
* alt
* href
* Addition of attributes to elements
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Demonstrate web page formatting
 | * Layout elements
* <header>
* <nav>
* <section>
* <footer>
* Addition of layout elements to HTML document
* Addition of layout element attributes to HTML document
* class
* id
* name
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Apply Styles
 | * Style concepts
* background
* padding
* alignment
* border
* Application of internal styles
* Creation of external CSS file
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Understand JavaScript basics
 | * Purpose of JavaScript
* JavaScript syntax
* Accessing HTML element attributes using the JavaScript Document Object Model (DOM)
* Changing HTML element attributes using JavaScript DOM model
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Use JavaScript datatypes
 | * JavaScript datatypes
* Strings
* Numbers
* Booleans
* Demonstration of data type operations
* Variables declarations and scope
* Expressions
* Arithmetic
* Boolean
* String concatenation
* Demonstration on arrays operations
* count()
* pop()
* push()
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Use JavaScript functions
 | * JavaScript function structure
* Creation of JavaScript function
* Invoking of JavaScript function
* Returning values from functions
 | * Practical tests
* Written tests
* Oral tests
 |
| 1. Use JavaScript libraries
 | * Libraries concept
* JQuery framework
* Referencing JQuery
* JQuery syntax
* JQuery events
* Keyboard
* Mouse
* Form
* Document Window
 | * Practical tests
* Written tests
* Oral tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical assignments and projects

**Recommended Resources**

**Tools**

• Text Editor

• Browser

**Equipment**

• Computer

**Materials and supplies**

• Instructional materials

• Stationery

# DEVELOP SERVER-SIDE WEB APPLICATIONS USING PHP

**UNIT CODE:** ICT/CU/CP/CR/09/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Develop Server-side Web Applications

**Duration of Unit:** 170 hours

**Unit Description:**

This unit specifies competencies required to develop serve side web applications. It involves understanding server-side development concepts, understanding PHP basics, using PHP datatypes and their operators, using control statements, using arrays, using PHP Superglobals, developing forms, testing and debugging applications

**Summary of Learning Outcomes:**

1. Understand server side development concepts
2. Understand PHP basics
3. Use PHP datatypes and their operators
4. Use control statements
5. Use arrays
6. Use PHP Superglobals
7. Develop forms
8. Test and debug applications

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Method** |
| 1. Understand server side development concepts
 | * Server Side Development Concept
* Key terminologies in server side development
* Server side development languages
 | * Written tests
* Oral tests
 |
| 1. Understand PHP basics
 | * Definition of PHP
* Purpose of PHP
* Installation of Apache distribution
* PHP syntax
* PHP main tags
* Case sensitivity
* Comments
* Creation of a PHP file
* Using PHP tag
* Displaying simple output
* Saving in the appropriate directory
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Use PHP data types and their operators
 | * PHP data types
* String
* Integer
* Float
* Boolean
* Array
* Object
* Null
* Resource
* Variable declaration
* Using Operators
* Arithmetic
* Assignment
* Comparison
* Increment/Decrement
* Logical
* String
* Array
* Conditional assignment
* Creation of PHP application using data types
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Use control statements
 | * Types of Control Statements
* Decision
	+ If..else
	+ If..else..If
	+ Switch statement
* Looping
	+ While loop
	+ For loop
* Demonstration of different control statements
* Creation of PHP application using control statements
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Use arrays
 | * Definition of Arrays
* Types of arrays
* Indexed
* Associative
* Multidimensional
* Array functions
* Adding elements (push)
* Removing elements (pop)
* Rearranging elements (shift)
* Sorting elements
* Array data processing operations
* Arithmetic
* Calculation of array totals
* Calculation of array average
* Finding a value
* Finding largest and smallest values
* Creation of PHP applications using arrays
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Use PHP Superglobals
 | * Definition of PHP Superglobals
* Uses of Superglobals
* $\_GET
* $\_POST
* $\_SERVER
* $\_ENV
* $\_COOKIE
* GLOBALS
* $\_REQUEST
* $\_FILES
* Demonstration of the $\_SESSION variable
* Creation of PHP applications using superglobals
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Develop forms
 | * Definition of PHP forms
* Requirements of form creation
* Method
* Action
* Using form methods
* POST
* GET
* Define form validation
* Form validation functions
* stripslashes()
* htmlspecialchars()
* isset()
* isempty()
* preg\_match()
* filter\_var()
* Creation of a contact form with attachment
* Database storage
* Connecting to a database
* Saving to a database
* Retrieving, parsing and displaying data
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Test and debug applications
 | * Identification of test parameters
* Acquisition of test data
* Types of errors
* Syntax
* Logic
* Semantic
* Demonstration of error handling methods
* Simple “die()” statements
* Custom errors and error triggers
* Error reporting
* Code profilers
* Standard profilers
* Tracing profiles
* Application Performance Monitoring (APM) tools
 | * Written tests
* Oral tests
* Practical tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised practical assignments and projects
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

• Apache Distribution

• Browser

• Text Editor

**Equipment**

• Computers

**Materials and supplies**

• Instructional materials

• Stationery

# MOBILE APPLICATIONS DEVELOPMENT

**UNIT CODE:** ICT/CU/CP/CR/10/6/A

**Relationship to Occupational Standards**

This unit addresses the competency: Develop Mobile Applications

**Duration of Unit:** 170 hours

**Unit Description:**

This unit specifies competencies required to develop mobile applications. It involves understanding mobile application concepts, understanding the mobile application development environment, identify application design issues, developing a mobile application, testing the developed mobile applications, publishing and commercializing the developed application.

**Summary of Learning Outcomes:**

1. Understand mobile application concepts
2. Understand mobile application development environment
3. Identify Application Design Issues
4. Develop mobile application
5. Test the developed mobile application
6. Publish and Commercialize the developed Application

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Understand mobile application concepts
 | * Definition of Mobile application
* Mobile application development platforms
* iOS
* Android
* Mobile application development approaches
* Native
* Hybrid Native
* Hybrid web
* Progressive web
* Reasons for development of mobile applications
 | * Written tests
* Oral tests
 |
| 1. Understand mobile application development environment
 | * Mobile application architecture and design
* Mobile application development frameworks and tools
* Xamarin
* Flutter
* Nativescript
* Mobile application development Techniques and methodologies
* Waterfall
* Agile
 | * Written tests
* Oral tests
 |
| 1. Identify application design issues
 | * Mobile development lifecycle
* Setup
* Develop
* Test and Debug
* Publish
* Key design principles and guidelines
* Mobile application navigation patterns
* Tabbed
* Carousel
* Modal
* MasterDetail
* User interface design principles
 | * Written tests
* Oral tests
 |
| 1. Develop mobile application
 | * Creating design specification according to client needs
* Installation of appropriate mobile development software
* Configuration of Google play SDK
* Creation of project structure according to design specification
* Configuration of the AndroidManifest.XML file
* Definition of Resources in XML.
* Images
* Audio files
* Video
* Definition of Framework components
* Activity
* Services
* Broadcast receiver
* Content provider
* Creation of project prototype according to design specification.
* Building project prototype into a debug APK
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Test the developed mobile application
 | * Testing techniques and procedures
* Installation testing
* Usability testing
* Debugging techniques
* Logging
* Breakpoints
* Memory profiling
* Testing and debugging of mobile application according to design specification
 | * Written tests
* Oral tests
* Practical tests
 |
| 1. Publish and commercialize the developed application
 | * Application distribution through application stores
* Monetizing applications according to store terms
* Routine upgrading and patching of the application
 | * Written tests
* Oral tests
* Practical tests
 |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer;
* Guided learner activities and research to develop underpinning knowledge;
* Supervised activities and mobile application development projects;
* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

* Integrated Development Environment (IDE)
* Graphic User Interface (GUI)
* Android SDK

**Equipment**

* Computer
* Mobile device

**Materials and supplies**

* Instructional materials

Stationery

# AGILE DEVELOPMENT CONCEPTS

**UNIT CODE:** ICT/CU/CP/CR/11/6/A

**Relationship to Occupational Standards**

This unit addresses the competency: Understand Agile Development Concepts

**Duration of Unit:** 150 hours

**Unit Description:**

This unit specifies competencies required to understand agile development concepts**.** It involves outlining agile concepts, outlining DSDM Atern concepts, identifying team roles and responsibilities and exploring risk and quality control techniques.

**Summary of Learning Outcomes:**

1. Outline agile concepts
2. Outline DSDM Atern concepts
3. Identify team roles and responsibilities
4. Explore risk and quality control techniques

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Outline agile concepts
 | * Definition of Agile Software Development
* Underpinning themes of Agile Development
* User involvement
* Iterative Development
* Incremental Development
* Flexibility to embrace change
* Prioritisation of requirements
* Collaborative working
* The Agile Manifesto
* Agile Development benefits
* Agile methodologies
* Dynamic Systems Development Methodology (DSDM)
* eXtreme Programming (XP)
* SCRUM
* Feature Driven Development (FDD)
* Lean Development
 | * Oral tests
* Written tests (Case Studies)
 |
| * 1. Outline DSDM Atern concepts
 | * Definition of DSDM
* DSDM Eight Principles
* Focus on business need
* Deliver on time
* Collaborate
* Never Compromise Quality
* Build incrementally firm foundations
* Develop iteratively
* Communicate continuously and clearly
* Demonstrate control
* Benefits of using DSDM
* DSDM key Techniques
* MoSCoW Prioritisation (of Requirements)
* Modeling
* Facilitated Workshops
* Time Boxing
* Iterative Development
 | * Oral tests
* Written tests (Case Studies)
 |
| * 1. Identify team roles and responsibilities
 | * Characteristics of agile teams
* Self-directed and motivated
* Small
* Composed of users and client
* Structure flexibility
* Team oriented success
* Team role types
* Business
* Management
* Solution (Technical)
* Roles and their responsibilities
* Business Sponsor
* Business Ambassador
* Business Analyst
* Project Manager
* Technical Coordinator
* Solution Developer
* Solution Tester
* Workshop Facilitator
 | * Oral tests
* Written tests (Case Studies)
 |
| * 1. Explore risk and quality control techniques
 | * Definition of Risk
* DSDM’s risk management approach
* Definition of Quality
* Role of testing in quality assurance
* DSDM’s testing concepts
* Fail fast
* Collaborative testing
* Independent testing
* Prioritized testing
* Test driven testing
* Risk based testing
 | * Oral tests
* Written tests (Case Studies)
 |

**Suggested Methods of Instruction**

* Guided learner activities and research to develop underpinning knowledge;
* Presentations and practical demonstrations by trainer;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:

* Visiting expert from the ICT sector;
* Industrial visits

**Recommended Resources**

**Tools**

• MS Office, Internet

**Equipment**

• Computer

**Materials and supplies**

• Instructional materials

• Stationery