TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

NATIONAL COMPETENCY BASED CURRICULUM

FOR

ICT TECHNICIAN

LEVEL 5

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 to the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). 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 these Occupational Standards were developed for the purpose of developing a competency-based curriculum for ICT Technician. These Occupational Standards will also be the bases for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the ICT sector's growth and 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 and Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, 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 these Occupational Standards for ICT technicians. These standards will be the bases for development of competency based curriculum for ICT technician Level 6.

The occupational standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

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.

Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. EngTech.
CHAIRMAN, TVET CDACC

ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to Automotive Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

Dr. LAWRENCE GUANTAI M'ITONGA, PhD
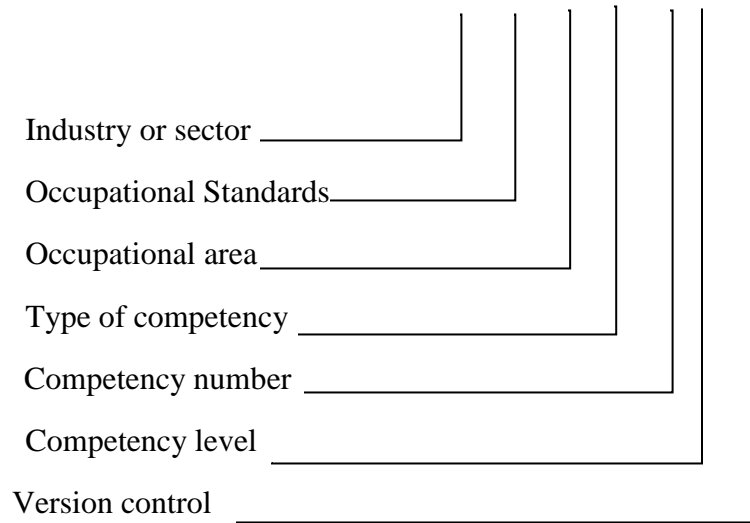**COUNCIL SECRETARY/CEO**

TABLE OF CONTENT

ACRONYMS

CDACC   Curriculum Development, Assessment and Certification Council

DSS   Decision Support System

DMA   Direct Memory Access

EMS   Environmental Management System

ERP   Enterprise Resource Planning

FIFO   First In First Out

ICT   Information and Communication Technology

KCSE   Kenya Certificate of Secondary Education

KNQA   Kenya National Qualification Authority

KNQF   Kenya National Qualification Framework

LAN   Large Area Network

OIS   Operation Information System

OSH   Occupational Safety Healthy

PAN   Personal Area Network

PPE   Personal protective equipment

RAM   Random Access Memory

SSFT   Shortest Seek Time First

TVET   Technical and Vocational Education and Training

TPS   Transaction Processing System

WAN   Wide Area Network

KEY TO UNIT CODE

$$\textbf{IT/CU/ICT/BC/01/5 \quad A}$$

Industry or sector ⎯⎯⎯⎯⎯⎯

Occupational Standards⎯⎯⎯⎯⎯

Occupational area⎯⎯⎯⎯⎯⎯

Type of competency ⎯⎯⎯⎯⎯⎯

Competency number ⎯⎯⎯⎯⎯⎯

Competency level ⎯⎯⎯⎯⎯⎯

Version control ⎯⎯⎯⎯⎯⎯⎯⎯

COURSE OVERVIEW

1.DESCRIPTION OF THE COURSE

This course is designed to equip individuals with the competences required to practice as ICT technicians in the modern Kenyan Technological sector. It reflects the employers' demand for qualified personnel, that would enable them to compete in an environment where the technology is constantly evolving, and the expectations of clients are becoming ever more demanding.

The course consists of:
- Basic units of learning to build the necessary skills and attitudes to enhance the employability of ICT technicians, enabling them to make positive contributions to the quickly technology Country;

- Core units of learning to develop high-end knowledge and skills to perform any Information communication and technological services needed in the society.

2.   Units of Learning

Basic Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factor
IT/CU/ICT/BC/1/5	Demonstrate Communication Skills	25	2.5
IT/CU/ICT/BC/2/5	Demonstrate Numeracy skills	40	4
IT/CU/ICT/BC/3/5	Demonstrate Digital Literacy	45	4.5
IT/CU/ICT/BC/4/5	Demonstrate Entrepreneurial Skills	70	7
IT/CU/ICT/BC/5/5	Demonstrate Employability Skills	50	5
IT/CU/ICT/BC/6/5	Demonstrate Environmental Literacy	25	2.5
IT/CU/ICT/BC/7/5	Demonstrate occupational Safety and Health Practices	25	3.5
Total		**210**	**21**

Core Units of Learning

Unit Code	Unit Title	Duration in Hours	Credit Factor
ICT/CU/IT/CR/1/6	Perform Networking	300	30
ICT/CU/IT/CR/2/6	Install computer software	200	20
ICT/CU/IT/CR/3/6	Perform computer repair and maintenance	280	28
ICT/CU/IT/CR/4/6	Manage Database System	310	31
ICT/CU/IT/CR/5/6	Develop Computer Program	340	34
ICT/CU/IT/CR/6/6	Manage Operating System	210	21
	Industrial Attachment	360	36
Total		**2000**	**200**
Gross total		**2280**	**228**

Total number of hours **2280** inclusive of industrial attachment. These Units of Learning are independent of each other and may be taken independently.

3. Entry Requirements

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

a) Kenya Certificate of Secondary Education (K.C.S.E.) with a minimum mean grade of D+(Plus)
   Or
b) ICT Technician Level 4 certificate with **one** year of continuous work experience
   Or
c) Equivalent qualifications as determined by Kenya National Qualifications Authority (KNQA)

4. Provision for Industrial attachment

It is envisaged that the trainee will have undergo 360 hours industrial training and assessment with a recognised ICT industry as a prerequisite for completion of this training course.

5. 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.
As part of the continuous internal assessment process, trainees will maintain a portfolio of evidence of their achievements.

6. Certification

On successful completion of a Unit of Learning, a trainee will be issued with a Certificate that acknowledges the achievement of that competence. On successful completion of **all** units of learning, a trainee will be awarded an ICT Technician Certificate qualification. These certificates will be issued by TVET CDACC in conjunction with training provider.

BASIC UNITS OF LEARNING

COMMUNICATION SKILLS

UNIT CODE: IT/CU/ICT/BC/1/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate communication skills

Duration of Unit: 25 hours

Unit Description
This unit covers the competencies required in meeting communication needs of clients and colleagues and developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

Summary of Learning Outcomes
1. Utilize specialized communication skills processes
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. Utilize specialized communication skills processes	• 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	• Written • Oral

	(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	
2. Develop communication strategies	• Dynamics of groups • Styles of group leadership • Openness and flexibility in communication • Communication skills relevant to client groups	• Observation • Written
3. Establish and maintain communication pathways	• Types of communication pathways	• Written • Observation
4. Promote use of communication strategies	• Application of elements of communication strategies • Effective communication techniques	• Written • Observation
5. Conduct interview	• Types of interview • Establishing rapport • Facilitating resolution of issues • Developing action plans	• Written • Observation
6. 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	• Written • Observation

7. Represent the organization	• Presentation techniques • Development of a presentation • Multi-media utilization in presentation • Communication skills relevant to client groups	• Observation • Written

Suggested Delivery Methods
- Interview
- Role playing
- Observation

Recommended Resources
- Desktop computers/laptops
- Internet connection
- Projectors
- Telephone

DIGITAL LITERACY

UNIT CODE:IT/CU/ICT/BC/2/5

Relationship to Occupational Standards
This unit addresses the Unit of Competency: Demonstrate digital literacy

Duration of Unit: 45 hours

Unit Description
This unit describes competencies required to use a computer and other digital devices for the purposes of communication, work performance and management at the workplace.

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 - Observation
2. Apply security measures to data, hardware and software	- 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 - Observation - Project
3. Apply computer software in solving tasks	- Operating system - Word processing - Spread sheets - Data base design and manipulation	- Oral questioning - Observation - Project

		• Data manipulation, storage and retrieval	
4. Apply internet and email in communication at workplace	• Computer networks • Network configurations • Uses of internet • Electronic mail (e-mail) concept	• Oral questioning • Observation • Oral presentation • Written report	
5. 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 • Observation • Oral presentation • Written report • Project	
6. Prepare presentation packages	• Types of presentation packages • Procedure of creating slides • Formatting slides • Presentation of slides • Procedure for editing objects	• Oral questioning • Observation • Oral presentation • Written report • Project	

Suggested Delivery Methods
- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- Viewing of related videos
- Project
- Group discussions

Recommended Resources

- Desk top computers
- Laptop computers
- Other digital devices
- Printers
- Storage devices
- Internet access
- Computer software

ENTREPRENEURIAL SKILLS

UNIT CODE: IT/CU/ICT/BC/3/5

Relationship to occupational standards

This unit addresses the unit of competency: Demonstrate entrepreneurial skills

Duration of unit: 70 hours

Unit description

This unit describes the competencies critical to demonstration of entrepreneurial aptitudes. It involves, developing business innovation strategies, developing new markets, customer base, expanding employed capital and undertaking regional/county expansion while retaining motivated staff.

Summary of Learning Outcomes

1. Develop business innovation strategies
2. Develop new products/ markets
3. Expand customers and product lines
4. Motivate all staff/workers
5. Expand employed capital base
6. Undertake regional/county business expansion

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Develop business Innovation strategies	• Innovation in business • Business innovation strategies • Creativity for business development • New technologies in entrepreneurship • Linkages with other entrepreneurs • Setting strategic directions • New ideas and approaches • Entrepreneurial skills	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written ❑ Oral

		development	
		• Market trends	
		• Monitoring and anticipating market trends	
		• Products and processes in entrepreneurship	
		• Business conventions ad exhibitions	
		• Business growth refocus	
2. Develop new products/ markets		• Feasibility study for new products • Identifying new sources of raw material and resources • New target markets/customers • Increasing products and services • Marketing improvement • Intrapreneurship and business growth	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written ❑ Oral
3. Expand customers and product lines		• Market demand • Regulatory environment • Creating product and services competitive advantages • Creating royal client base • Identifying and maintain new customers and markets • Advance product/ service promotions • Advance market expansion • Small business records management • Book keeping and auditing for small businesses • Computer application software and programmes • ICT in customer and product diversification	❑ Oral ❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written
4. Motivate staff/workers		• Motivation of workers • Communication at workplace for	❑ Observation ❑ Case studies

	motivation purpose • Problem solving • Conflict resolution at place of work • Good staff/workers relation • Team building and team work • Staff development and enhancement • Culture of continuous improvement	❑ Individual/group assignments ❑ projects ❑ Written
5. Expand employed capital base	• Employed capital in business • Business share holdings • Types of shares • Shares diversification • Role of shareholders • Entrepreneurship • Increasing products and services	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written ❑ Oral
6. Undertake county/ regional business expansion	• Region/ county identification process • Regional/ county laws and regulation • Business regional/county expansion • Regional/ County business expansion • Innovation in business • Business expansion and diversification • Resources for regional/county expansion • Small business Strategic Plan • Computer software in business development • ICT and business growth	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ projects ❑ Written ❑ Oral

Suggested Delivery Methods
- Instructor led facilitation of theory
- Demonstration by trainer

- Practice by trainee
- Role play
- Case study

Recommended Resources
- Case studies for small businesses
- Business plan templates
- Laptop/ desktop computers
- Internet
- Telephone
- Writing materials

EMPLOYABILITY SKILLS

UNIT CODE: IT/CU/ICT/BC/4/5

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate employability skills

Duration of Unit: 50 hours

Unit Description

This unit covers competencies required to demonstrate employability skills. It involves competencies for exuding self-awareness and ability to deal with everyday life challenges; demonstrating critical safe work habits and leading a workplace team; planning and organizing work activities; applying learning, creativity and innovativeness in workplace functions; pursuing professional growth and managing time effectively in the workplace.

Summary of Learning Outcomes

1. Develop self-awareness and ability to deal with life challenges
2. Demonstrate critical safe work habits for employees
3. Lead a workplace team
4. Plan and organize work
5. Maintain professional growth and development in the workplace.
6. Demonstrate learning, creativity and innovativeness in the workplace.

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Develop self-awareness and ability to deal with life challenges	- Self-awareness - Formulating personal vision, mission and goals - Strategies for overcoming life challenges - Managing emotions - Emotional intelligence - Asserting one-self - Assertiveness versus aggressiveness	- Observation - Written - Oral interview - Third party report

		• Expressing personal thoughts, feelings and beliefs • Self esteem • Developing and maintaining high self-esteem • Developing and maintaining positive self-image • Sharing personal feelings • Setting performance targets • Monitoring and evaluating performance • Articulating ideas and aspirations • Accountability and responsibility	
2.	Demonstrate critical safe work habits for employees	• 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 • Dealing with emerging issues	• Observation • Written • Oral interview • Third party report
3.	Lead a workplace team	• Leadership • Influence • Team building • Determination of team roles and objectives • Team parameters and relationships • Individual responsibilities in a team • Forms of communication • Business communication • Complementing team activities • Gender and gender mainstreaming • Human rights protocols	• Observation • Oral interview • Written • Third party report

	• Developing healthy relationships • Maintaining relationships • Conflicts and conflict resolution	
4. Plan and organize work	• Planning • Organizing • Schedules of activities • Developing work plans • Developing work goals/objectives and deliverables • Monitoring work activities • Evaluating work activities • Resource mobilization • Resource allocation • Resource utilization • Decision making • Problem solving • Negotiation	• Observation • Oral interview • Written • Third party report
5. Maintain professional growth and development in the workplace	• 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	• Observation • Oral interview • Written • Third party report
6. Demonstrate learning, creativity and innovativeness in the workplace	• Managing own learning • Mentoring • Coaching • Networking • Variety of learning context • Application of learning • Safe use of technology • Taking initiative/proactivity • Flexibility	• Observation • Oral interview • Written • Third party report

	• Identifying opportunities • Generating new ideas • Workplace innovation • Performance improvement	

Suggested Methods of Delivery

- Instructor lead facilitation of theory
- Demonstrations
- Simulation/Role play
- Group Discussion
- Presentations
- Projects
- Case studies
- Assignments

Recommended Resources

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

ENVIRONMENTAL LITERACY

UNIT CODE: IT/CU/ICT/BC/5/5

Relationship to Occupational Standards:

This unit addresses the unit standard: **Demonstrate environmental literacy**

Duration of Unit: 25 hours

Unit Description

This unit describes the competencies required to control environmental hazard, control environmental pollution, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, identify environmental legislations/conventions for environmental concerns, implement specific environmental programs, monitor activities on environmental protection/programs, analyze resource use and develop 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	• Written questions • Oral questions • Observation of work procedures

	wastes • Types and uses of PPE in line with environmental regulations • Occupational Safety and Health Standards (OSHS)	
2. 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 • Observation of work procedures • Role play
3. 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 • Observation of work procedures • Role play
4. 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 • Observation of work procedures • Role play

5.	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 • Observation of work procedures
6.	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 • Observation of work procedures • Role play
7.	Monitor activities on Environmental protection/Programs	• Periodic monitoring and Evaluation of activities • Gathering feedback from stakeholders • Analysing 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 • Observation
8.	Analyse resource use	• Identification of resource consuming processes • Determination of quantity and nature of resource consumed • Analysis of resource flow	• Written tests • Oral questions • Practical test • Observation

	through different parts of the process. • Classification of wastes for possible source of resources.	
9. 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 • Observation

Suggested Delivery Methods
- 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:IT/CU/ICT/BC/6/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstrate occupational safety and health practices

Duration of Unit: 25 hours

Unit Description
This unit describes the competencies required to comply with regulatory and organizational requirements for occupational safety and health.

Summary of Learning Outcomes
1. Identify workplace hazards and risk
2. Identify and implement appropriate control measures to hazards and risks
3. Implement OSH programs, procedures and policies/guidelines

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 • Observation of trainees identify hazards and risks
2. Identify and implement appropriate control measure to hazards and risks	• Prevention and control measures e.g. use of PPE • Contingency measures	• Oral questions • Written tests • Practical tests • Observation of implementation of control measures
3. Implement OSH programs, procedures and policies/guidelines	• Company OSH program, procedures and policies/guidelines • Implementation of OSH	• Oral questions • Written tests • Practical test

	procedures and policies/ guidelines	• Observation
	• Training of team members and advice on OSH standards and procedures	
	• Implementation of procedures for maintaining OSH-related records	

Suggested Delivery Methods
- Instructor led facilitation of theory
- Demonstration by trainer
- Practical work by trainee
- 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

DEMONSTRATE BASIC ELECTRONIC SKILLS

UNIT CODE:IT/CU/ICT/BC/7/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstration of basic electronic skills

Duration of Unit:

Unit description
This unit specifies the competencies required to demonstrate basic skills of electronics. It involves identification of electric circuits, electronic components, understand semi-conductor theory, identify and classify memories, apply number systems and identify 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
6. 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

2. Identify Electronic components	❑ Identification of electronic components
	   ✓ Resistor
	   ✓ Capacitor
		• Practical exercises
		• Written
		• Observation

		✓ Diode ✓ Inductor ❑ Characteristic of electronic components. ❑ Application of electronic components. ❑ Identification of integrated circuit characteristics	• Oral
3.	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
4.	Identify and classify memory	❑ Definition of memory ❑ Classification of memories ✓ RAM ✓ ROM ✓ DAM ❑ Types of memories ✓ Semiconductor memories ✓ Magnetic memories	• Written • Observation • Oral

5. 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

6. 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 Delivery
• Presentations and practical demonstrations by trainer;
• Guided learner activities and research to develop underpinning knowledge;
• Supervised activities and projects in a workshop;
The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
• Visiting lecturer/trainer from the ICT sector;
• Industrial visits.

Recommended Resources

Tools   1. Screw Drivers   2. Pliers   3. Wire cutters   4. Wire Strippers   5. Clamps   6. 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

COMPUTER NETWORKING

UNIT CODE: IT/CU/ICT/CR/1/5

Relationship to Occupational Standards
This unit addresses the unit of competency: **Performing Computer Networking**

Duration of Unit: 300 hours

Unit description
This unit specifies the competencies required to perform computer Networking. It involves Identification of network types, Connection of networking devices, configuration of network devices, network testing, configuration of LAN network type and monitor network connectivity.

Summary of Learning Outcomes
1. Identify network type and components
2. Connect network devices
3. Configure network devices
4. Configure LAN Network type
5. Perform Network testing
6. Monitor Network connectivity

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Identify network type and components	❑ Definition of Network
	 ❑ Definition of Network terms
	 ❑ Network topologies
	     ✓ Star
	     ✓ Ring
	     ✓ Mesh
	     ✓ Hybrid
	     ✓ Point to Point
	 ❑ Network types
	     ✓ LAN
	     ✓ WAN
	     ✓ PAN
		• Practical exercises
		 • Observation
		 • Oral

		✓ MAN	
		❑ components of a network	
		✓ switches/hubs	
		✓ routers	
		✓ ports	
		✓ media	
		✓ computers	
		❑	

2.	Connect network devices	❑ Definition of network devices
		❑ Identification of Network connection Media
		    ✓ Wired
		    ✓ Wireless
		❑ Characteristics of connection medium
		❑ Network devices
		    ✓ switches/hubs
		    ✓ routers
		    ✓ ports
		    ✓ computers
		❑ connect network devices
			• Practical
			• Oral
			• Observation
			• Written

3	Configure network devices	❑ Definition of configuration
		❑ Network Architecture
		    ✓ TCP/IP Protocol Suite
		    ✓ Ethernet
		❑ Network protocols
		    ✓ TCP/IP
		❑ Network Operating system
		❑ Connect and configure network devices
			• Practical
			• Oral
			• Observation
			• Written

4	Configure LAN network types	✓ Assemble prerequisite components and medium ✓ Connect to establish the network ✓ Configure individual network components ✓ Configure network protocols	• Practical • Oral • Observation • Written

5 Perform Network testing	✓Outline network test plan
	✓Network testing tools
	    • Clamp meter
	    • Voltmeter
	    • Cable tester
	    • Signal tester
	✓Test network components
	✓Test the network
	✓Test report
		• Practical exercises with observation checklists conducted by trainer.
		
		• Oral questioning with checklist conducted by trainer to assess underpinning knowledge.
		
		• Short tests to assess underpinning knowledge.
		
		• Learner to perform project

Suggested Methods of Delivery
- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a workshop;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools
1. Network tool kit
2. Signal testers
3. URL Encode
4. Header checker
5. Crimping tools
6. Cable tester
7. Punch Downs

Equipment
- Computer
- Cables
- Switches
- Routers/modem
- Bridges
- Repeaters
- Fibre modules
- Antistatic gloves
- Ports
- RJ45
- NIC
- Gateways
- Microwave dishes

Materials and supplies

Consumables for maintaining Network including:
- RJ45
- Fibre Modules
- Cables

Replacement parts including:
- Points
- Switches
- Routers
- NIC
- Modem
- Cables

Cleaning materials;

Hand cleaner.

INSTALL COMPUTER SOFTWARE

UNIT CODE: IT/CU/ICT/CR/2/5

Relationship to Occupational Standards
This unit addresses the unit of competency: Installation of Computer Software

Duration of Unit: 260 hours

Unit Description:
This unit describes the competencies required in installing computer software. It involves Identification of software to be installed, installation of the software, and configuration of the software, software testing, user training and software maintenance.

Summary of Learning Outcomes:

1. Identification of software to be installed
2. Install the software
3. Configure the software
4. Test software functionality
5. Perform user training

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods

1. Identify software to be installed	❑ Definition of software
	❑ Classification of software
	  ✓ System
	  ✓ Application
	❑ Criteria for selection
	❑ Software Acquisition Methods
	  ✓ Off the shelf
	  ✓ Open source
	❑ Operating systems
	❑ Types of operating systems
	  ✓ Single and multi-user
		• Practical
		• Oral questioning
		• Written test

	✓ Single and multitasking
	✓ Real time
	✓ Distributed
	✓ Batch
	
	❑ Functions of operating systems
	   ✓ Device management
	   ✓ Memory management
	   ✓ Storage management
	   ✓ Process control
	   ✓ Security Management
	
	❑ Types of operating system interfaces
	   ✓ Command-line/character user
	   ✓ Menu driven
	   ✓ Graphical user Interface	

2. Install the software	❑ Define software installation
	❑ Installation media
	❑ Software installation legal requirements
	❑ Existing data protection
	❑ Types of software installation
	   ✓ Attended
	   ✓ Unattended
	   ✓ Headless
	   ✓ Schedule/Automated
	   ✓ Clean/Updating
	   ✓ Network
	❑ Software installation and registration
	❑ Software configuration
	❑ Importance of registration
		• Practical
		• Observation
		• Written tests
		• Writing reports

3. Software configuration management	❑ Software configuration components
	   ✓ software configuration identification
	   ✓ software configuration control
	   ✓ software configuration status accounting and auditing
	❑ Reasons for software configuration
	   ✓ Tracking
	   ✓ Controlling
		• Practical
		• Observation
		• Written tests
		• Writing reports
		•

	❑ Importance of software configuration management
	    ✓ Identification
	    ✓ Management
	    ✓ Auditing and accounting	

4. Test software functionality	❑ Define software installation testing
	❑ Techniques Of Software Testing
	    ✓ Boundary value analysis
	    ✓ Equivalence class partitioning
	    ✓ Error Guessing
	❑ Installation checklist
	❑ Functional Testing
	    ✓ Mainline functions
	    ✓ Basic Usability
	    ✓ Accessibility
	    ✓ Error Conditions
	❑ Generate test report
		• Practical
		• Oral
		• Short tests
		• Learner portfolio of evidence.

Perform user training	❑ Keys to Developing an End User Training Plan
	    ✓ Determine user skill set
	    ✓ Creating a training program
	    ✓ Setting training goals
	    ✓ Training delivery methods
	    ✓ Assessing end-user needs
	❑ Training feedback
		• Practical
		• Oral
		• Short tests
		• Learner portfolio of evidence.

Suggested Methods of Delivery
- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a workshop;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools
Diagnostic tools
Utility programs
Processor and memory optimizers
Wise Installer
CruiseControl.Net
Install Aware

Equipment
Computer
Software
External Hard disk
Flash disk
CD/DVD

Materials and supplies
- Digital instructional material including DVDs and CDs;   - Operating system   - Machines   - Power   - Application software

Reference materials
Manufacturers manuals

PERFORM COMPUTER REPAIR AND MAINTENANCE

UNIT CODE: IT/CU/ICT/CR/3/5

Relationship to Occupational Standards

This unit addresses the unit of competency**: Perform Computer Repair And Maintenance**

Duration of Unit:280hours

Unit Description:

This unit specifies competencies required to perform computer repair and Maintenance. It includes performing troubleshooting, disassembling faulty components, repair/replace and reassembling components, testing computer, component functionality and upgrading computer software/hardware.

Summary of Learning Outcomes:
1. Perform troubleshooting
2. Disassemble faulty components
3. Repair/Replace and reassemble components
4. Test computer/component functionality
5. Upgrade computer software/hardware

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Method
1. Perform troubleshooting	❑ Identification of Computer parts 　✓ Hardware 　✓ Software ❑ Assembling of computer maintenance tools ❑ Theory of probable cause ❑ Assembling and disassembling process ❑ Test of theory of probable cause ❑ Problem identification ❑ Appropriate solutions	• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence.
2. Disassemble faulty components	❑ Tools for disassembling ❑ Procedures and techniques for disassembling ❑ Repair or replace and	• Practical exercises • Oral questioning • Written test

		reassemble components	• Learner portfolio of evidence.
3. Repair/Replace and reassemble components	❑ Determine components to replace or repair ❑ Procedures and Techniques for reassembling ❑ Component testing ❑ Repair/replace report		• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence.
4. Test computer functionality	❑ Identify computer testing tools ❑ Testing techniques are identified ❑ Perform computer test functionality ❑ Generate status report		• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence.
5. Upgrade computer software/hardware	❑ Determine Reasons of upgrading ❑ Identify procedures and techniques for upgrading ❑ Test functionality of the upgraded software/hardware		• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a workshop;

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

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools
- ☐ Straight-head screwdriver, large and small.
- ☐ Phillips-head screwdriver, large and small.
- ☐ Tweezers or part retriever.
- ☐ Needle-nosed pliers.
- ☐ Wire cutters.

☐   Chip extractor.
☐   Hex wrench set.
☐   Torx screwdriver
Equipment   • Computer   • Tool box
Materials and supplies   Digital instructional material including DVDs and CDs   Consumables for service and repair of suspension and steering systems including: • Cleaning materials   • Hand cleaner   • Dusters
Reference materials   Manufacturers manuals

MANAGE DATABASE SYSTEM

UNIT CODE: IT/CU/ICT/CR/4/5

Relationship to Occupational Standards

This unit addresses the unit of competency: Manage database system

Duration of Unit: 310 hours

Unit Description:
This unit specifies competencies required to manage database system. Which involve identifying database concepts, designing a basic database, creation and manipulation of database objects, database testing and printing of database objects.

Summary of Learning Outcomes:
1. Identify database concepts
2. Design basic database
3. Create and manipulate database objects
4. Perform database testing
5. Print database objects

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Method

7. Identify database concepts	❑ Define database
	❑ Database models are identified
	   ✓ ER- Models
	   ✓ Relational Models
	   ✓ Hierarchical models
	   ✓ Network Models
	
	❑ Merits and demerits of database are defined
		• Practical exercises
		• Oral questioning
		• Written test
		• Learner portfolio of evidence.

8. Design basic database	❑ Database design concepts are identified
	   ✓ Entry integrity
	   ✓ Referential integrity
		• Practical exercises
		• Oral questioning
		• Written test

	✓ Relationships	• Learner portfolio of evidence.

3. Create and manipulate database objects	❑ Database objects are identified
	  ✓ Tables
	  ✓ Queries
	  ✓ Reports
	  ✓ Forms
	❑ Creation of tables
	  • Primary and secondary key
	❑ Linking of tables
	❑ Data variables
	❑ Database integration
	❑ Database Querying
		• Practical exercises
		• Oral questioning
		• Written test
		• Learner portfolio of evidence.

4. Perform database testing	❑ Integration testing ❑ DB Query testing ❑ Perform database testing ❑ Generate test report	• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence.

5. Print database objects	❑ Procedure of printing database objects is identified
	❑ Print
	  ✓ Tables
	  ✓ Queries
	  ✓ Reports
	  ✓ Forms
		• Practical exercises
		• Oral questioning
		• Written test
		• Learner portfolio of evidence

Suggested Methods of Delivery
- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a workshop;

The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
- Visiting lecturer/trainer from the ICT sector;

- Industrial visits.

Recommended Resources

Tools
✓ Microsoft Access ✓ MYSQL ✓ SQL Server
Equipment
• Computer • Printer • Stationery
Materials and supplies Digital instructional material including DVDs and CDs •
Reference materials Manuals

COMPUTER PROGRAM DEVELOPMENT

UNIT CODE: IT/CU/ICT/CR/5/5

Relationship to Occupational Standards
This unit addresses the competency: **Develop computer program**

Duration of Unit: 340 hours

Unit Description:
This unit specifies competencies required to develop computer program. It involves identifying of programming concepts and approaches, identifying program development methodologies, identifying program design, identifying of programming languages, performing of basic structured programming and performing basic internet programming.

Summary of Learning Outcomes:

1.   Identify Programming concepts and approaches

2.   Identify program development methodologies

3.   Identify Program design

4.   Identify computer programming languages

5.   Perform Basic structured Programming using C language

6.   Perform Basic Internet programming

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Identify Programming concepts and approaches	❑ Definition of program and programming ❑ Language translators ✓ Compiler ✓ Interpreter ✓ Editors ✓ Linker ✓ Loader	• Oral questioning • Written test • Learner portfolio of evidence.

	❑ Types of programming approaches	

2. Identify program Development methodologies	❑ Description of program specifications
	❑ Types of development methodologies
	  ✓ Agile
	  ✓ Cystal
	  ✓ Rapid Application Development
	❑ Program development cycle
	❑ Styles of programming
	  ✓ Functional
	  ✓ Modular
	  ✓ Object oriented
		• Observation
		• Written test

3. Identify Program design	❑ Define program design
	❑ Program Design Approaches
	  ✓ Top – Down
	  ✓ Bottom – Up
	  ✓ Data-Driven
	❑ Program Design Tools
	  ✓ Pseudo code
	  ✓ Decision Tree and tables
	  ✓ flow charts
		• Oral questioning
		• Written test

4. Identify computer programming languages	Define computer programming language
	Computer programming languages
	  ✓ High level
	  ✓ Low level
	  ✓ 4GL
	  ✓ Object Oriented
	  ✓ Visual
	
	Factors to consider when choosing a programming language
	  ✓ Language domain match
	  ✓ Popularity
	  ✓ Project size
		• Oral questioning

		✓ Tool support
		✓ Efficiency
		Tools for program development
		    ✓ Pseudo code
		    ✓ flow charts
		    ✓ Data flow Diagrams	

5.	Perform Basic structured Programming using C language	❑ C Concepts
		    ✓ Characteristics
		    ✓ Pre-processor directives
		    ✓ C headers
		❑ Fundamentals of C programming language
		    ✓ Input and output statements
		    ✓ C key words
		    ✓ Variables
		    ✓ C operators
		    ✓ C Expressions
		❑ Control Structures
		    ✓ Sequence
		    ✓ Selection
		    ✓ Iteration
		❑ Sub-programs
		    ✓ Types
		    ✓ Scope of variables
		    ✓ Parameter passing
		❑ C program format
			• Oral questioning
			• Written test

6.	Perform Basic Internet programming	❑ Concepts of Internet programming
		❑ Web programming approaches
		    ✓ Server side
		    ✓ Client side
		❑ Web programming languages
		    ✓ HTML
		❑ Web Programming Interfaces
		    ✓ Common client interface
		    ✓ Common gateway interface
		❑ HTML
		    ✓Tags
			•

	✓ parcelling ✓ Coding	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised activities and projects in a workshop;

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

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools
Comprehensive set of tools.
❑ Flow charts
❑ Data flow diagram
❑ Decision table
❑ Decision tree
❑ Web Authoring tools
❑ Notepad
Equipment
• Computer
• Software
Materials and supplies
Digital instructional material including DVDs and CDs

MANAGE OPERATING SYSTEM

UNIT CODE: IT/CU/ICT/CR/6/5

Relationship to Occupational Standards

This unit addresses the unit of competency: **manage operating system**

Duration of Unit: 210 hours

Unit Description:
This unit specifies competencies required to Manage operating system. It involves Identifying fundamentals of operating system**,** identifying concepts of Process management concepts**,** **i**dentifying concepts of Memory management**,** **i**dentifying concepts of Input and Output devices**,** **i**dentifying concepts of file management**,** **i**dentifying Emerging trends in Operating system

Summary of Learning Outcomes:

1. Identifying Fundamentals of operating system
2. Identifying concepts of Process management concepts
3. Identifying concepts of Memory management
4. Identifying concepts of Input and Output devices
5. Identifying concepts of file management
6. Identifying Emerging trends in Operating system

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
Identify fundamentals of Operating system	❑ Definition of operating system ❑ Concepts of operating system ✓ Characteristics ✓ Objectives/goals ✓ Kernel ✓ System call ✓ Shell ❑ Evolution of operating systems ❑ Operating system structures ✓ Monolithic ✓ Layered ✓ Virtual ✓ Client-server model ❑ Types of operating systems ❑ Functions of operating systems ❑ Installation of operating systems	• Practical exercises with observation checklist • Oral questioning • Written test • Learner portfolio of evidence.

Identify process management concepts	❑ Concepts of processing are identified
	   ✓ Process
	   ✓ Threads
	   ✓ Process control block
	❑ Description of process states
	❑ Definition of concurrency control
	❑ Types of concurrency control
	   ✓ Inter-process communication
	   ✓ Synchronisation
	      • Semaphores
	      • Monitors
	      • Message passing
	❑ Explanation of process scheduling
	   ✓ Features of scheduling algorithms
	   ✓ Types of schedulers
	   ✓ Scheduling algorithms
	      • Non-pre-emptive
	      • Pre-emptive
	      • Priority
	❑ Definition of Deadlocks
	   ✓ Conditions for deadlock
	   ✓ Detection and recovery of deadlock
	   ✓ Avoidance and prevention of deadlocks
	   ✓ Resource allocation graphs.
		• Practical
		• Project
		• Observation
		• Written test

Identify concepts of memory management	❑ Definition of memory management
	❑ Objectives of memory management
	❑ Memory management techniques
	   ✓ Partitions
	      • Fixed partitioning
	      • Dynamic partitioning
	   ✓ Virtual memory
	      • Thrashing
	      • Overlays
	      • Paging
		• Practical exercises
		• Oral questioning
		• Written test

	• Segmentation
	❑ Memory management policies
	    ✓ Fetch
	    ✓ Placement
	    ✓ Replacement
	    ✓ Cleaning	

Identify concepts of Input and Output devices management	❑ Definition of input and output devices
	    ✓ Input
	    ✓ Output
	❑ Objective of input and output device management
	❑ Input and output concepts
	    ✓ Input and output categories
	    ✓ Device controllers
	    ✓ Interrupt-driven input/output
	    ✓ Direct Memory Access(DMA input/output)
	❑ Explanation of input and output software
	    ✓ Principles of input and output software
	    ✓ Input and output software layers
	❑ Description of disks
	    ✓ Structure
	    ✓ Operations
	    ✓ Disk arm scheduling algorithms
	        • First In First Out (FIFO)
	        • Shortest Seek Time First (SSFT)
	        • SCAN
	        • Circular-SCAN (C-SCAN)
	        • LOOK
	        • Circular LOOK (C-
		• Practical exercises
		• Oral questioning
		• Learner portfolio of evidence.

	LOOK)	

	• RAM disk
	• RAID
	❑ Computer clock system
	   ✓ Hardware
	   ✓ Software
	❑ Computer terminals
	   ✓ Terminal hardware
	   ✓ Terminal software
	❑ Definition of virtual device
	   ✓ Objectives of virtual device
	   ✓ Spooling
	   ✓ Buffering
	   ✓ Caching	

Identify concepts of file management	❑ Definition of file system management
	❑ File system concepts
	   ✓ Naming
	   ✓ Structure
	   ✓ Types
	   ✓ Attributes
	   ✓ Operations
	❑ File access methods
	❑ Directory implementation
	❑ File allocation techniques
	❑ File protection and security
	   ✓ Importance
	   ✓ Access control
	   ✓ Audit trial
		• Practical exercises
		• Oral questioning
		• Written test
		• Learner portfolio of evidence.

Identify Emerging trends in Operating system	❑ Explain the emerging trends in operating systems ❑ Challenges of emerging trends ❑ Coping with the emerging trends	• Practical exercises • Oral questioning • Written test • Learner portfolio of evidence.

Suggested Methods of Delivery
- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;

- Supervised activities and projects in a workshop;

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

- Visiting lecturer/trainer from the ICT sector;
- Industrial visits.

Recommended Resources

Tools
Transaction Processing Systems (TPS)
Operation Information System (OIS
Decision Support Systems (DSS)
Enterprise resource planning (ERP)
Equipment
• Computers
Materials and supplies
Digital instructional material including DVDs and CDs