REPUBLIC OF KENYA

COMPETENCY BASED CURRICULUM

FOR

COMPUTER SCIENCE

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 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 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 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 has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for the ICT Sector's growth and 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 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) in conjunction with ICT Sector Skills Advisory Committee (SSAC) and Computer Science experts has helped develop this curriculum.

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 this curriculum.

Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. Eng.Tech.
CHAIRMAN, 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 the 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.

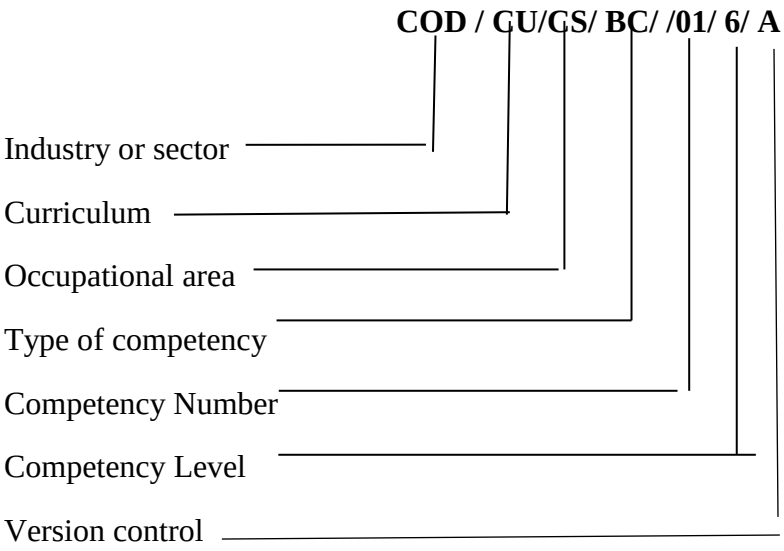
I am convinced that this curriculum will go a long way in ensuring that workers in Computer Science Sector acquire competencies that will enable them to perform their work more efficiently.

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

ACRONYMS

CDACC	Curriculum Development Assessment and Certification Council
CU	Curriculum
CS	Computer Scientist
BC	Basic Competency
CC	Core Competency
KCSE	Kenya Certificate of Secondary Education
KNQA	Kenya National Qualifications Authority
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
SSAC	Sector Skills Advisory Committee
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE



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COURSE OVERVIEW

Description of The Course

The Computer Science Level Six (6) qualification consists of competencies that a person must achieve to demonstrate understand computer organization and architecture, understand operating systems, understand mathematics for computer science, understand fundamentals of programming, demonstrate database management skills, develop an information system, understand networking and distributed systems, understand artificial intelligence, understand algorithms and data structures, demonstrate web design skills and understand graphic design.

This course consists of basic, common and core competencies as indicated below:

Basic Units of Learning

Unit of Learning Code	**Unit of Learning Title**	**Duration in Hours**	**Credit Factor**
IT/CU/CS/BC/01/6/A	Communication skills	40	4
IT/CU/CS/BC/01/6/A	Numeracy skills	60	6
IT/CU/CS/BC/01/6/A	Digital literacy	60	6
IT/CU/CS/BC/01/6/A	Entrepreneurship education	100	10
IT/CU/CS/BC/01/6/A	Employability skills	80	8
IT/CU/CS/BC/01/6/A	Environmental literacy	40	4
IT/CU/CS/BC/01/6/A	Occupational safety and health practices	40	4
Total		**420**	**42**

Common units of learning

Unit of Learning Code	**Unit of Learning Title**	**Duration in Hours**	**Credit Factor**
IT/CU/CS/CC/01/6/A	Demonstrate Basic Electronic Skills	170	17
Total		**170**	**17**

Core units of learning

Unit of Learning Code	Unit of Learning Title	Duration in Hours	Credit Factor
IT/CU/CS/CR/01/6/A	Computer organization and architecture	140	14
IT/CU/CS/CR/02/6/A	Operating systems	130	13
IT/CU/CS/CR/03/6/A	Mathematics for computer science	140	14
IT/CU/CS/CR/04/6/A	Fundamentals of programming	180	18
IT/CU/CS/CR/05/6/A	Database management skills	160	16
IT/CU/CS/CR/06/6/A	Information system	150	15
IT/CU/CS/CR/07/6/A	Networking and distributed systems	210	21
IT/CU/CS/CR/08/6/A	Artificial intelligence	180	18
IT/CU/CS/CR/09/6/A	Algorithms and data structures	170	17
IT/CU/CS/CR/10/6/A	Web design skills	200	20
IT/CU/CS/CR/11/6/A	Graphic design	170	17
	Industrial attachment	480	48
Total		**2310**	**231**
Grand Total		**2900**	**290**

The total duration of the course is **2900** hours.

Entry Requirements

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

a) Kenya Certificate of Secondary Education (KCSE C-)

Or

b) 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 an IT 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:

a) **Internal assessment**: conducted continuously by the trainer (internal assessor) who is monitored by an accredited internal verifier.
b) **External assessment:** conducted by an accredited external assessor who is monitored by an accredited external verifier.

The assessors and verifiers are registered by TVET CDACC which also coordinates external assessment.

Certification

A candidate will be issued with a Record of Achievement for each Unit of Competency. To attain the qualification National Diploma Level 6 in Computer Science, 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: IT/CU/CS/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 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. 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	• Written • Interview

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

	• Encouraging group members participation • Evaluating group communication strategies	
7. Represent the organization	• Presentation techniques • Development of a presentation • Multi-media utilization in presentation • Communication skills relevant to client groups	• Interview • Written

Suggested Delivery Methods

- Discussion
- Role playing
- Simulation
- Direct instruction
- Practice by trainee

Recommended Resources

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

NUMERACY SKILLS

UNIT CODE: IT/CU/CS/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 by a worker in order to apply a wide range of mathematical calculations for work; apply ratios, rates and proportions to solve problems; estimate, measure and calculate measurement for work; Use detailed maps to plan travel routes for work; Use geometry to draw and construct 2D and 3D shapes for work; Collect, organize and interpret statistical data; Use routine formula and algebraic expressions for work and use 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

2. 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 ❑ Oral questioning ❑ Assignments ❑ Supervised exercises
3. 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
4. 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	❑ Oral ❑ Written ❑ Practical test ❑ Observation

5. 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	
6. 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.	❑ Assignments ❑ Supervised exercises ❑ Written tests

	• 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	
7. 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	❑ Oral ❑ Written ❑ Practical test ❑ Observation

Suggested Delivery Methods

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

Recommended Resources

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

DIGITAL LITERACY

UNIT CODE:IT/CU/CS/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 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 • Data manipulation, storage and retrieval	• Oral questioning • Observation • Project
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

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

ENTREPRENEURSHIP EDUCATION

UNIT CODE: IT/CU/CS/BC/04/6/A

Relationship to occupational standards

This unit addresses the unit of competency: Demonstrate understanding of entrepreneurship

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 knowledge of entrepreneurship and self-employment
2. Identify entrepreneurship opportunities
3. Create entrepreneurial awareness
4. Apply entrepreneurial motivation
5. Develop business innovative strategies
6. Develop Business plan

Learning Outcomes, Content and Suggested Assessment Methods

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	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written tests ❑ Oral questions ❑ Third party

	❑	report ❑ Interviews
2. 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	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written tests ❑ Oral questions ❑ Third party report ❑ Interviews
3. 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	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written tests ❑ Oral questions ❑ Third party report ❑ Interviews
4. Apply entrepreneurial motivation	❑ Internal and external motivation ❑ Motivational theories ❑ Self-assessment ❑ Entrepreneurial orientation ❑ Effective communications in entrepreneurship ❑ Principles of communication ❑ Entrepreneurial motivation	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written tests ❑ Oral questions ❑ Third party report ❑ Interviews

5. 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 ❑	❑ Observation ❑ 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	❑ Observation ❑ Case studies ❑ Individual/group assignments ❑ Projects ❑ Written tests ❑ Oral questions ❑ Third party report ❑ Interviews

Suggested Delivery Methods

- Direct instruction
- Project
- Case studies
- Field trips
- Discussions
- Demonstration
- Question and answer
- Problem solving
- Experiential
- Internship
- Team training
- Guest speakers

Recommended Resources

- Case studies for small businesses
- Business plan templates
- Computers
- Overhead projectors
- Internet
- Mobile phone
- Video clips
- Films
- Newspapers and handouts
- Business journals
- Writing materials

EMPLOYABILITY SKILLS

UNIT CODE: IT/CU/CS/BC/05/6/A

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Demonstrate employability skills

Duration of Unit: 80hours

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	❑ Observation ❑ Written ❑ Oral interview ❑ Third party report

	❑ 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	
2. 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	❑ Observation ❑ Written ❑ Oral interview ❑ Third party report
3. Demonstrate critical safe work habits	❑ Stress and stress management ❑ Time concept	❑ Observation ❑ Written ❑ Oral interview

	❑ Punctuality and time consciousness ❑ Leisure ❑ Integrating personal objectives into organizational objectives ❑ Resources mobilization ❑ Resources utilization ❑ Setting work priorities ❑ Developing healthy relationships ❑ HIV and AIDS ❑ Drug and substance abuse ❑ Managing emerging issues	❑ Third party report
4. 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	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report
5. Plan and organize work	❑ Functions of management ❑ Planning ❑ Organizing ❑ Time management	❑ Observation ❑ Oral interview ❑ Written

	❑ 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	❑ Third party report
6. 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	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report
7. Demonstrate workplace learning	❑ Managing own learning ❑ Mentoring ❑ Coaching ❑ Contributing to the learning community at the workplace ❑ Cultural aspects of work ❑ Networking	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report

	❑ 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	
8. 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	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report
9. 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	❑ Observation ❑ Oral interview ❑ Written ❑ Third party report

	❑ Financial responsibility/accountability ❑ Etiquette ❑ Personal and professional integrity ❑ Commitment to jurisdictional laws ❑ Emerging issues in ethics	

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/CS/BC/06/6/A

Relationship to Occupational Standards:

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

Duration of Unit: 40 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 wastes	❑ Written questions ❑ Oral questions ❑ Observation of work procedures

	❑ 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. Analyze resource use	❑ Identification of resource consuming processes ❑ Determination of quantity and nature of resource consumed	❑ Written tests ❑ Oral questions ❑ Practical test ❑ Observation

	❑ Analysis of resource flow 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/CS/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 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 is conducted by ❑ Authorized personnel or agency ❑ Gathering of OHS issues and/or concerns raised	❑ 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, including use of PPE (personal protective equipment) for specific hazards are identified and implemented ❑ Appropriate risk controls based on result of OSH	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation of implementation of control measures

	hazard evaluation is recommended ❑ Contingency measures, including emergency procedures during workplace incidents and emergencies are recognized and established in accordance with organization procedures	
3. Implement OSH programs, procedures and policies/guidelines	❑ Providing information to work team about company OHS program, procedures and policies/guidelines ❑ Participating in implementation of OSH procedures and policies/ guidelines ❑ Training of team members and advice on OSH standards and procedures ❑ Implementation of procedures for maintaining OSH-related records	❑ Oral questions ❑ Written tests ❑ Practical test ❑ Observation

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

COMMON UNITS OF LEARNING

BASIC ELECTRONICS

UNIT CODE: IT/CU/CS/CC/01/6/A

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

Duration of Unit: 170 hours

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	❑ Practical exercises ❑ Written

	✓ Capacitor ✓ Diode ✓ Inductor ❑ Characteristic of electronic components. ❑ Application of electronic components. ❑ Identification of integrated circuit characteristics	❑ Observation ❑ 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	❑ Written ❑ Observation ❑ Oral

	✓ Magnetic memories	
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

- 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

COMPUTER ORGANISATION AND ARCHITECTURE

UNIT CODE: IT/CU/CS/CR/01/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Understand Computer Organization and Architecture**

Duration of Unit: 140 hours

Unit description
This unit covers the competencies required to understand Computer Organisation and Architecture. It involves understanding principles of computer organisation and design, understanding central processing unit functions, understanding computer memory organization, understanding input-output functions and understanding computer arithmetic and logic.

Summary of Learning Outcomes

1. Understand principles of Computer Organisation and Design
2. Understand Central Processing Unit functions
3. Understand computer memory organization
4. Understand Input-Output functions
5. Understand computer arithmetic and logic

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand principles of computer organisation and design	❑ Definition of Computer Organisation ❑ Description of Computer Architecture ❑ Computer Memory Organization ❑ Structure and function of computer components ✓ Basic components	❑ Practical tests ❑ Observation ❑ Oral tests ❑ Written tests

	✓ Functions of components ❑ Identification of computer hardware components ❑ Input – Output Organization	
2. Understand Input-Output organization	❑ Peripheral devices ✓ Categories of peripheral devices ✓ Standard I/O devices specification factors ❑ Input-output processing ❑ Role of Bus interface in I/O ❑ Modes of data transfer ✓ Programmed I/O ✓ Interrupt initiated I/O ✓ Direct memory access(DMA) ❑ I/O devices' specifications as per user needs ❑ Verification of computer I/O devices' specifications	❑ Practical tests ❑ Observation ❑ Oral tests ❑ Written tests
3. Understand computer memory organization	❑ Computer Memory Organization ✓ Functions ✓ Categories of internal memory ✓ Standard memory specification factors ❑ Storage technologies ✓ Solid state storage devices ✓ Optical storage devices ✓ Magnetic storage devices ❑ Cache and Virtual memory ✓ Definitions ✓ Operations of cache and virtual memory ❑ Prescription of memory specifications as per user needs	❑ Practical tests ❑ Observation ❑ Oral tests ❑ Written tests

	❑ Verification of memory specifications for a given computer	
4. Understand Central Processing Unit functions	❑ Central Processing Unit ✓ Types of processors ✓ Processor generations ✓ Standard CPU specification factors ❑ CPU architecture ✓ Arithmetic and Logic Unit ✓ Control Unit ✓ Buses ❑ Register ✓ Definition ✓ Types of registers ❑ Instruction representation and execution ✓ Instruction set ✓ Fetch Execute Cycle ❑ Prescription of CPU specifications as per user needs ❑ Verification of computer CPU specifications	❑ Practical tests ❑ Observation ❑ Oral tests ❑ Written tests
5. Understand computer arithmetic and logic	❑ Number systems ✓ Types ✓ Operations ✓ Conversion ❑ IEEE-based Integer and Floating point representations ❑ Integer and Floating point arithmetic ✓ Addition ✓ Subtraction ✓ Multiplication ❑ Logic operators ✓ OR ✓ AND ✓ NAND ✓ NOR	❑ Practical tests ❑ Observation ❑ Oral tests ❑ Written tests

	✓ NOT ❑ Logic operations ✓ Addition ✓ Multiplication ✓ Subtraction ✓ Division ❑ Demonstrating methods of representing logic operations ✓ Truth table ✓ Karnaugh maps ✓ Logic gates	

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
- Simulation

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

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

Recommended Resources

Tools

Internet

Equipment

- Computer
- Separate/disassembled hardware components, including
  - ✓CPUs
  - ✓Memory modules
  - ✓Disks
- Peripheral device

Materials and supplies

- Instructional material
- Stationery

Reference materials

- Hardware vendor specifications
- Trainer – recommended resources including web resources

OPERATING SYSTEMS

UNIT CODE: IT/CU/CS/CR/02/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Understand Operating Systems**

Duration of Unit: 130 hours

Unit Description:
This unit covers the competencies required to understand operating systems. It involves understanding fundamentals of operating systems, understanding process management, understanding memory management, understanding input-output management and understanding file management.

Summary of Learning Outcomes:

1. Understand fundamentals of operating systems
2. Understand process management
3. Understand memory management
4. Understand Input and Output management
5. Understand file management

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand fundamentals of operating systems	❑ Computer software ✓ Definition ✓ Classification ❑ Operating system ✓ Definition ✓ Concepts ✓ Functions of operating system are identified. ❑ Operating system structures ✓ Monolithic ✓ Layered ✓ Virtual ✓ Client-server model ❑ Types of operating systems	❑ Practical exercises ❑ Oral tests ❑ Written tests ❑ Observation

	❑ Requirements for Windows OS installation ❑ Demonstration of Windows installation ✓ Specify hardware requirements ✓ Back up data in target machine ✓ Partition creation and/or formatting ✓ Installation as per vendor instructions ✓ Testing installation	
2. Understand Process Management	❑ Process management ✓ Definitions: Process, Thread, Process Control Block ✓ Functions of the Process Manager ❑ Computer Resources ❑ Process states and their transition ✓ States: Ready, Waiting, Complete, Running ✓ Transitions: Dispatch, Suspend, Exit, Resume ❑ Process scheduling ✓ Features of scheduling algorithms ✓ Types of schedulers ✓ Scheduling algorithms ❑ Demonstration of Task Manager ✓ Observing CPU queue ✓ Stopping CPU intensive processes. ❑ Performance monitor tools in process management	❑ Practical exercises ❑ Oral tests ❑ Written tests ❑ Observation

3. Understand Memory Management	❑ Memory Management ✓ Definition ✓ Objectives of Memory management ✓ Components of the Memory Management unit ❑ Memory management techniques ✓ Partitioning ✓ Virtual memory: ❑ Paging, Segmentation ❑ Demonstration of virtual memory settings – Increasing the Windows page file size	❑ Practical exercises ❑ Oral tests ❑ Written tests ❑ Observation
4. Understand Input and Output Management	❑ Input - output management ✓ Definition ✓ Objectives of I/O management ✓ I/O hardware ✓ I/O software ✓ Polling Vs Interrupt drive I/O ❑ Disk operations ✓ Access time factors ✓ Techniques for resolving slow disk I/O ❑ Computer clock system ✓ Virtual Input Output ✓ Definition of Virtual I/O ✓ Types of virtual I/O: Buffering, Spooling, Caching ❑ Disk selection criteria ✓ Size ✓ Speed ❑ Disk properties in Windows ❑ Demonstration of disk storage management operations ✓ Formatting volume	❑ Practical exercises ❑ Oral tests ❑ Written tests ❑ Observation

	✓ Partitioning volume ✓ Shrinking volume ✓ Extending volume ✓ Optimising and defragmenting disk ✓ Changing drive security permissions ✓ Backing up ✓ Copying data to optical disks ✓ Handling removable media ❑ Demonstration of device management operations using Windows Device Manager ✓ Verifying installed drivers ✓ Resolving driver conflicts	
5. Understand File Management	❑ File management ✓ Definition ✓ Objectives of file manager ✓ File naming concepts ❑ File access methods ✓ Sequential access ✓ Direct/Random access ✓ Indexed sequential access ❑ File allocation techniques ✓ Contiguous ✓ File Allocation ✓ Indexed ❑ File protection and security ✓ Importance ✓ Access control ✓ Audit trial ❑ Demonstration of file and directory operations ✓ Creating folders and files ✓ Renaming folders and files ✓ Deleting folders and files ✓ Copying and Moving folders and files ✓ Setting file attributes	❑ Practical exercises ❑ Oral tests ❑ Written tests ❑ Observation

	❑ Local security policy settings ✓ Password policy ✓ Account lockout policy ✓ Audit policy ✓ Security options	

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

- Windows Operating system

Equipment

- Computers

Materials and supplies

- Instructional materials
- Stationery

Reference materials

- Trainer-recommended resources including web resources

MATHEMATICS FOR COMPUTER SCIENCE

UNIT CODE: IT/CU/CS/CR/03/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: **Understand Mathematics for Computer Science**

Duration of Unit: 140 hours

Unit description

This unit specifies the competencies required to understanding linear algebra, understanding Boolean algebra, understanding set theory, understanding calculus and understanding probability and statistics.

Summary of Learning Outcomes

1. Understand Linear Algebra
2. Understand Boolean Algebra
3. Understand Set Theory
4. Understand Calculus
5. Understand Probability and Statistics

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand Linear Algebra	❑ Linear Equations ❑ ✓ Definition ✓ Types ❑ Solving linear equations ✓ Methods of solving ✓ Formation ❑ Vectors ✓ Definition ✓ Types ❑ Vector operations ✓ Addition ✓ Subtraction ✓ Multiplication ✓ Scalar	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Dot product ❑ Matrices ✓ Definition ✓ Types ✓ Determinant ✓ Application ❑ Matrix operations ✓ Addition ✓ Scalar multiplication ✓ Transposition ❑ Inverse of square matrix	
2. Understand Boolean Algebra	❑ Boolean algebra ✓ Definition of Boolean algebra ✓ Uses of Boolean algebra ❑ Key Terminology ✓ Boolean value ✓ Boolean function ✓ Digital logic ❑ Basic Boolean operations ✓ AND ✓ OR ✓ NOT ❑ Secondary operations ✓ NAND ✓ NOR ✓ EX-OR ✓ EX-NOR ❑ Writing Boolean Expressions ✓ Order of basic operations ✓ Symbols ❑ Simplification of Boolean expressions ✓ Using algebraic functions ✓ Using Truth tables	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ 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	
3. Understand Set Theory	❑ Sets Theory ✓ Definition of a Set ✓ Characteristics of sets ❑ Methods of Set representation ✓ Statement form ✓ Tabular form ✓ Set builder notation ❑ Cardinality of a set ❑ Types of sets ✓ Finite ✓ Infinite ✓ Subset ✓ Universal ✓ Proper ✓ Singleton set ❑ Venn Diagrams ❑ Set Operations ✓ Set Union ✓ Set Intersection ✓ Set Difference ✓ Complement of Set ✓ Cartesian Product	❑ Practical tests ❑ Oral tests ❑ Written tests

4. Understand Calculus	❑ Functions ✓ Definition of function ✓ Domain ✓ Range ✓ Linear functions ✓ Power functions ✓ Evaluation ❑ Graphing of functions ✓ Intercepts ✓ Limits ❑ Differential calculus ✓ Rate of change ✓ Rules of derivatives ✓ Optimization ❑ First and second order differential equations ❑ Integral calculus ✓ Definite ✓ Indefinite ❑ Techniques of integration ✓ By parts ✓ Reserve chain rule ✓ u-substitution	❑ Oral ❑ Observation ❑ Written
5. Understand Probability and Statistics	❑ Key terminologies in probability ✓ Samples spaces ✓ events ✓ sets ✓ outcomes ❑ Probability axioms and counting problems ❑ Permutations and combinations ❑ Conditional probability and multiplication rule ❑ Data representation techniques ✓ Histogram ✓ Pie charts	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Scatter plot ✓ Bar graph ❑ Measures of central tendency ✓ Mean ✓ Mode ✓ Median ❑ Measures of spread ✓ Variance ✓ Standard deviation ❑ Measure of Location ✓ Quartile ✓ Percentile	

Suggested Methods of Delivery

- Presentations by trainer;
- Guided learner activities and research to develop underpinning knowledge;

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

- Visiting lecturer/trainer from the Mathematics field.
- Industrial visits

Recommended Resources

Tools

- Internet

Equipment

- Calculator
- Computer

Materials and supplies

- Instructional material
- Stationery

Reference materials

Trainer-recommended reference material including text books and web resources

FUNDAMENTALS OF PROGRAMMING

UNIT CODE: IT/CU/CS/CR/04/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Understand Fundamentals of Programming**

Duration of Unit: 180 hours
Unit Description:
This unit covers the competencies required to understand fundamentals of programming. It involves understanding programming concepts, understanding the Java environment, performing data operations, using control structures, using methods and understanding Object Oriented programming.
Summary of Learning Outcomes:

1. Understand Programming Concepts
2. Understand the Java environment
3. Perform Data Operations
4. Use Control Structures
5. Use Methods
6. Understand Object Oriented Programming

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand Programming Concepts	❑ Definition of programming ❑ Phases of program development ✓ Establish program requirements ✓ Design a program ✓ Coding ✓ Code test and debug ✓ Document ✓ Maintain ❑ Key terms used in programming ✓ Algorithm ✓ Source code ✓ Executable ✓ Compiling ✓ Debugging	❑ Practical tests ❑ Oral tests ❑ Written tests

	❑ Types of code ✓ Source code ✓ Object code ✓ Machine code ❑ Translators used in programming ✓ Compiler ✓ Interpreter ✓ Assembler ❑ OOP fundamental concepts	
2. Understand the Java Environment	❑ Installation of Java ✓ Download Java for Windows ✓ Install JDK ✓ Set the Environment variables ❑ Java Programming environment ✓ Downloading Eclipse IDE ✓ Setting up Eclipse IDE ✓ Launching Eclipse IDE ❑ Features of Java ❑ Java syntax ✓ Case Sensitivity ✓ Class names ✓ Method names ✓ Program file name ✓ Public static void main ✓ Identifiers ✓ Modifiers ✓ Variables ✓ Java Arrays ✓ Java Enums ✓ Java Keywords	❑ Practical tests ❑ Oral tests ❑ Written tests
3. Perform Data Operations	❑ Java Data Types ✓ Integer ✓ Float ✓ Strings ✓ Boolean ❑ Java statements	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Expression Statements ✓ Declaration Statements ✓ Control-flow statements ❑ Variables and Constants ✓ Local Variables ✓ Class Variables ✓ Instance Variables ✓ Integer constants ✓ Real Constants ✓ Single character constants ✓ String constants ❑ Java Data operations ✓ Variable assignment ✓ Variable reading ✓ Variable arithmetic ✓ Object Instantiation ❑ Java Program to perform an operation ✓ Area of a circle ✓ Solve Quadratic equations ✓ Calculate compound interest	
4. Use Control Statements	❑ Java Control Statements ✓ Decision making statements ✓ Looping statements ✓ Branching statements ❑ Uses of different control statements in Java Decision making statements ✓ If then ✓ If then else ✓ Switch Looping statements ✓ for ✓ while ✓ do while Branching statements ✓ break	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Continue ❑ Creation of programs using control statements	
5. Use Methods	❑ Java Methods ✓ Definition ✓ Structure ❑ Demonstration of methods ✓ Creating Methods ✓ Method calling ✓ Void keyword ✓ Passing parameters by value ✓ Method overloading ✓ Using command line arguments ✓ The this keyword ✓ Variable arguments ✓ The finalize () method ❑ Creation programs to implement methods	❑ Practical tests ❑ Oral tests ❑ Written tests
6. Understand Object Oriented Programming	❑ Object oriented programming concepts ✓ Inheritance ✓ Encapsulation ✓ Abstraction ✓ Polymorphism ❑ Classes ✓ Declaring attributes ✓ Creating Methods ❑ Objects ✓ Creating objects ✓ Calling methods ❑ Creation of programs to implement inheritance	❑ Practical tests ❑ Oral tests ❑ Written tests

Suggested Methods of Delivery

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

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

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

Recommended Resources

Tools

- JDK

Equipment

- Computers

Materials and supplies

- Instructional materials
- Stationery

Reference materials

- Trainer-recommended resources including web resources

DATABASE MANAGEMENT SKILLS

UNIT CODE: IT/CU/CS/CR/05/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Understand Database Management Skills**

Duration of Unit: 160 hours

Unit Description:
This unit covers the competencies required to demonstrate database management skills. It involves understanding database fundamentals, designing a database, using Structured Query Language, understanding the design of object oriented databases, understanding indexing and hashing and understanding database applications.

Summary of Learning Outcomes:
By the end of the unit, the trainee should be able to:

1. Understand Database fundamentals
2. Design a database
3. Use Structured Query Language
4. Understand the design of object oriented databases
5. Understand indexing and hashing
6. Understand database applications

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand database fundamentals	❑ Definition of database ❑ 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	❑ Oral tests ❑ Written tests ❑ Practical tests

	✓ 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 ❑ Prescribe RDBMS product for a simulated environment ❑ Database security ✓ Definition ✓ Access control ✓ Authentication ✓ Integrity control ✓ Backup	
2. Design a database	❑ Phases of database Design ✓ Conceptual database design (ERM Modeling) ✓ Logical database design ✓ Physical database design ❑ Entity modelling ✓ Components ✓ Designing Entity Model using UML (Unified Modelling Language) ❑ Normalisation ✓ Definition ✓ Demonstration of normalisation ❑ Validating model according to the requirements / specified transactions (CRUD matrix)	❑ Oral tests ❑ Written tests ❑ Practical tests

3. Use Structured Query Language (SQL)	❑ SQL ✓ Definition ✓ Characteristics ✓ Components ❑ 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 SQL ALTER statement ✓ Adding an attribute ✓ Dropping an attribute ✓ Modifying attribute domain ❑ Dropping table using SQL DROP TABLE statement ❑ Data manipulation query statements ✓ INSERT ✓ SELECT ✓ UPDATE ✓ DELETE ❑ Data Manipulation Query Statements ✓ Retrieving records using SELECT statement ✓ Insertion of records using INSERT INTO statements	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Deleting records using DELETE statement ✓ Updating records using UPDATE. SET statement ❑ SQL Joins ✓ Definition of a join ❑ Types of joins ❑ Create and query a database from a validated ER model. ❑ Creating a simple join	
4. Understanding the design of object oriented databases	❑ Object oriented database ✓ Definition ✓ Comparison with other types of databases ❑ Object oriented database concepts ✓ Classes ✓ Objects ✓ Attributes ✓ Inheritance ❑ Implementation of Object Oriented Database Concepts from a set of requirements ❑ Creation of views and triggers.	❑ Practical tests ❑ Oral ❑ Written tests
5. Understanding indexing and hashing	❑ Indexing and hashing ✓Definition of indexing and hashing ✓Types of indexing ✓Types of hashing ❑ Demonstration of indexing ✓ Dense index ✓ Sparse index ❑ Demonstration of hashing ✓ Static hashing ✓ Dynamic hashing ❑ Implementation of indexing and hashing in an existing database	❑ Practical tests ❑ Oral ❑ Written tests
6. Understanding database applications	❑ Decision support system ❑ Data mining	❑ Practical tests ❑ Oral ❑ Written tests

	❑ Features of Distributed Databases ❑ Features of Data warehouses ❑ Features of Spatial and geographical databases ❑ Features of Multi-media databases ❑ Mobility and personal databases ❑ Design and implementation of data warehouses	

Suggested Methods of Delivery

- Presentations and practical demonstrations by trainer;
- Guided learner activities and research to develop underpinning knowledge;
- Supervised practical database design and SQL projects

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

- Microsoft Office with MS Visio Modelling tool

MS SQL server software

Equipment

- Computers

Materials and supplies

- Instructional material
- Stationery

Reference materials

- Trainer – recommended resources including web resources
- SQL Server technical documentation

INFORMATION SYSTEMS

UNIT CODE: IT/CU/CS/CR/06/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Develop an Information System**

Duration of Unit:150 hours

Unit Description
This unit covers the competencies required to develop an information system. It involves understanding fundamentals of information systems, understanding the software development process, demonstrating human computer interaction principles, understanding the VB.net programming environment and developing and testing a VB.NET application

Summary of Learning Outcomes

1. Understand fundamentals of Information Systems
2. Understand the Software Development Process
3. Demonstrate Human Computer Interaction Principles
4. Understand the VB.NET programming environment
5. Develop and test a VB.NET application

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand fundamentals of Information Systems	❑ Information systems ✓ Definition ✓ Components ❑ Types of information systems ✓ Transaction Processing Systems ✓ Management Information Systems ✓ Decision Support Systems ✓ Executive Information Systems ✓ Office Automation Systems	❑ Oral questioning ❑ Written tests ❑ Practical tests

	❑ Emerging trends in information systems ❑ Recommendation of information systems for different scenarios ❑ Information system security ✓ Definition ✓ Information security management system ✓ Tools for information system security ✓ Firewalls ✓ Virtual private networks ❑ Mobile security ✓ Geolocation software ✓ Remote data removal software ❑ Web security ✓ Cyber security ✓ Technologies ✓ Web threats ✓ Defence strategies	
2. Understand the Software Development Process	❑Software Development Life Cycle ❑Software Development Methodologies ✓ Waterfall ✓ Spiral ✓ Rapid Application Development ✓ Agile Development ❑Modeling techniques ✓ Data Flow Diagrams ✓ Entity Relation Diagrams ✓ UML diagrams ❑ Creation of models for given scenarios	❑ Written tests ❑ Oral questioning ❑ Practical tests
3. Demonstrate Human Computer	❑ Human Computer Interaction ✓ Definition ✓ Role of interaction design	❑ Practical ❑ Oral questioning ❑ Observation

Interaction Principles	✓ Interaction styles ✓ Interaction elements ✓ Mistakes in interaction design ❑ Interface design principles ❑ Prescribing interaction choices and recognition of interaction flaws	❑ Written tests
4. Understand the VB.NET programming environment	❑ The .Net framework ✓ Applications supported ✓ Components of the .Net framework ❑ Installation of Visual Studio ❑ Features of VB.Net ❑ The Integrated Development Environment (IDE) ✓ Definition of IDE ✓ Parts of VB.Net IDE ❑ VB.Net program structure ✓ VB.NET syntax ✓ Namespace declaration ✓ Class or module ✓ Procedures ✓ Data types, variables, constants ✓ The Main procedure ✓ Statements and Expressions (Variable declarations, operations, control statements) ✓ Comments ❑ Creating aVB.Net project ✓ Saving Forms and Project ✓ Compiling a Project	❑ Practical tests ❑ Oral tests ❑ Written tests
5. Develop and test a VB.NET application	❑ Basic VB.Net Controls ✓ Controls and their purpose ✓ Standard naming conventions for controls ❑ Elements of a control ✓ Properties	❑ Practical tests ❑ Oral tests ❑ Written tests

	✓ Methods ✓ Events ❑ Demonstrating Properties, Methods and Events ✓ Properties for basic controls ✓ Setting properties at design time and run time ✓ Methods for basic controls ✓ Events for basic controls ❑ Demonstrating event handling ✓ Mouse events ✓ Keyboard events ❑ Designing VB.NET form using HCI principles ❑ Connection of VB.Net applications to a database ✓ ADO.Net object model ✓ Demonstrating Database connection using the Data Provider ✓ Demonstrating creation of tables using Dataset components ❑ Deployment of VB.NET VB.Net applications ✓ Purpose deployment ✓ Demonstrating deployment steps	

Suggested Methods of Delivery

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

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

- Visual Studio, CASE software, UX/UI software

Equipment

- Computer

Materials and supplies

- Instructional materials
- Stationery

Reference materials

- Trainer-recommended resources including web resources
- Visual Studio Documentation

NETWORKING AND DISTRIBUTED SYSTEMS

UNIT CODE:IT/CU/CS/CR/07/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: understand Networking and Distributed Systems

Duration of Unit: 210 hours

Unit description:

This unit specifies the competencies required to understanding networking and distributed systems concept, understanding distributed systems architectures, understanding distributed processing and file management, setting up a network in a distributed environment and troubleshooting a network

Summary of Learning Outcomes

1. Understand networking and distributed systems
2. Understand distributed systems architectures
3. Understand file management distributed processing
4. Set up a network in a distributed environment
5. Troubleshoot a network

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Fundamentals of networking and distributed systems	❑ Fundamentals of networking ✓ Definition of network ✓ Definition of network terminologies ✓ Identified network components ✓ Application and benefits of networking ❑ Types of networks ✓ LAN ✓ MAN ✓ WAN ✓ PAN	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

	❑ Network topologies ✓ Star ✓ Ring ✓ Mesh ✓ Bus ❑ Transmission media ✓ Wired media ✓ Wireless media ❑ Distributed system ✓ Definition ✓ Application ❑ Types of distributed systems ✓ Computing ✓ Information ✓ Pervasive ✓ Client server ✓ Peer to peer ❑ Distributed systems models ✓ Architectural ✓ Interaction ✓ Fault ❑ Specifying network requirements for a site ✓ Type of network ✓ Type of topology ✓ Devices ❑ Network security ✓ Definition ✓ Types of network attacks o Active o Passive ❑ Components of network security ✓ Network access control ✓ Firewall ✓ Intrusion prevention ✓ Security information and event management ❑ Wireless security	

2. Understand distributed systems architectures	❑ Distributed architecture ✓ Definition ✓ Application ❑ Architecture styles ✓ Layered Architecture ✓ Object Based Architecture ✓ Data-centred Architecture ❑ Types of distributed system architectures ✓ Centralized ✓ Decentralized ✓ Hybrid ❑ Specifying distributed system architecture requirements for a simulated site ✓ Architecture style ✓ Type of distributed system architectures	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests
3. Understand distributed processing and file management	❑ Types of distributed processing ✓ Distributed processing ✓ Parallel processing ❑ Types of file systems ❑ File sharing and accessing methods ✓ Remote access ✓ Data caching ❑ Demonstration of distributed file sharing and access	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests
4. Set up a network in a distributed environment	❑ Selection of tools, materials and devices ❑ Connection and configuration of network devices ❑ Installation and configuration of network software ❑ Testing the network	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

5. Understand Data Communication standards and IP addressing	❑ OSI model ✓ Definition ✓ Functions of different OSI model layers ✓ OSI layer Protocols are illustrated ❑ Data communication components ✓ Message ✓ Sender ✓ Receiver ✓ Medium ✓ Protocol ❑ Network IP Address classes ✓ Class A, B, C ✓ Public and Private IP Address ✓ Automatic Private IP Address	
6. Troubleshoot a network	❑ Troubleshooting ✓ Definition ✓ Techniques ✓ Procedures ❑ Troubleshooting tools ✓ Ping ✓ Tracert/traceroute ✓ Nslookup ✓ Netstat ✓ Pathping/mtr ❑ Demonstration of network troubleshooting as per IEEE standard	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

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 site;

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

- Network tool kit
- Signal testers
- Spam Blacklists
- URL Encode
- Header checker
- LanTEK III cable certifier
- Crimpers (RJ45, Hex Coax)
- Punch Down Tools.
- Wire Strippers & Cutters.
- Network Testers.
- Tone & Probes.
- Cable Installation Tools.
- Coaxial & RG6 Tools.

Equipment

- Computer
- Switches
- Routers
- Modem
- Bridges
- Repeaters
- Fibre modules
- Gateways

Materials and supplies

- Hand cleaner.

Reference materials

- Manufacturers service manuals for Network equipment
- Trainer-recommended resources including web resources

ARTIFICIAL INTELLIGENCE

UNIT CODE: IT/CU/CS/CR/08/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: **Understand Artificial Intelligence**

Duration of Unit: 180 hours

Unit Description
This unit covers the competencies required to understand artificial intelligence fundamentals. It involves understanding concepts of Artificial Intelligence, understanding problem solving techniques, understanding Python programming environment and developing Artificial Intelligence programs using Python.

Summary of Learning Outcomes
1. Understand Artificial Intelligence fundamentals.
2. Understand problem solving techniques.
3. Understand Python programming environment.
4. Develop Artificial Intelligence programs using Python.

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand concepts of Artificial Intelligence	❑ Definition of Artificial Intelligence ❑ History of Artificial Intelligence ❑ Foundations of Artificial Intelligence ✓ Mathematics ✓ Economics ✓ Decision Theory ✓ Neurology ✓ Engineering ✓ Psychology ✓ Computer Networking ❑ Applications of Artificial Intelligence	❑ Oral tests ❑ Written tests ❑ Practical tests

	✓ Expert systems ✓ Machine Learning ✓ Natural Language Processing ✓ Gaming ✓ Artificial Neural Networks ✓ Computer Vison ❑ Intelligence agents ❑ Recognising Artificial Intelligence applications in real life	
2. Understand problem solving techniques	❑ Logical operators ✓ AND ✓ OR ✓ NOT ❑ Prepositional Logic and Predicate logic ❑ Types of inferencing ✓ Single Inferencing ✓ Multiple inferencing ✓ Case based reasoning ❑ Definition of Machine Learning ❑ Types of Machine Learning ✓ Supervised Machine Learning ✓ Unsupervised Machine Learning ❑ Recognising applications of different types of inferencing	❑ Oral tests ❑ Written tests ❑ Practical tests
3. Understand Python programming environment	❑ Installation of Python ✓ Downloading Python Set Up ✓ Running Python Set Up ❑ Python syntax ✓ The Zen of Python ✓ Python Enhancement Proposals 8 (PEP 8) ✓ Variable declaration. ✓ Commenting	❑ Oral tests ❑ Written tests ❑ Practical tests

	❑ Python data types ✓ Integer ✓ Float ✓ Boolean ✓ Set ✓ Dictionary ✓ Tuple ✓ List ✓ String ❑ Control structures in Python ✓ Selection ✓ Looping ❑ Functions in Python ✓ Built-in functions ✓ User defined functions ✓ Lambda functions ❑ Object Oriented Python ✓ Creation of classes ✓ Class variables ✓ Class methods ❑ Scientific Modules in Python ✓ Pandas ✓ Numpy ✓ Matplotlib ❑ Creation of programs using Scientific Modules	
4. Develop Artificial Intelligence programs using python	❑ Sci-Kit Learn ❑ Machine Learning with K-Nearest Neighbours ✓ Mathematics behind K-Nearest Neighbours ✓ Making Predictions with K-Nearest Neighbours ❑ Machine Learning with Naïve Bayes Algorithm ✓ Mathematics behind Naïve Bayes Algorithm ✓ Making predictions with Naïve Bayes Algorithm	❑ Oral tests ❑ Written tests ❑ Practical tests

	❑ Creation of AI programs using Machine learning	

Suggested Methods of Delivery

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

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

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

Recommended Resources

Tools

- Python IDE

Equipment

- Computer

Materials and supplies

- Video tutorials
- Instructional materials
- Stationery

Reference materials

- Python Programming text books
- Official Python website

ALGORITHMS AND DATA STRUCTURES

UNIT CODE:IT/CU/CS/CR/09/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: **Understand Algorithms and Data Structures**

Duration of Unit: 140 hours

Unit Description

This unit covers the competencies required to cover the key ideas involved in designing algorithms. The unit explains how algorithms depend on the design of suitable data structures, and how some structures and algorithms are more efficient than others. It involves studying some key data structures, such as arrays, lists, queues and stacks, and their use in a range of different searching and sorting algorithms.

Summary of Learning Outcomes

1. Understand fundamental principles of algorithms
2. Understand fundamental concepts of data structures
3. Understand linked lists
4. Understand stacks and queues
5. Understand search techniques
6. Understand sorting techniques

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	❑ Written tests ❑ Oral tests ❑ Practical tests

	✓ Conquer/solve ✓ Merge/combine	
2. 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
3. Understand Linked lists	❑ Linked lists ✓ Linked lists representation ✓ Types of linked lists ❑ Doubly linked lists ✓ Representation ✓ Basic operations ❑ Circular linked lists ✓ Representation ✓ Basic operations ❑ Demonstration of basic operations for the various linked lists using Java ✓ Insertion ✓ Deletion ✓ Reverse ✓ Display	❑ Written tests ❑ Oral tests ❑ Practical tests
4. Understand Stacks and Queues	❑ Definition of Stacks ❑ Representation of stacks ❑ Basic operations ✓ Pop ✓ Push ❑ Definition of queues ❑ Representation of queues ❑ Basic operations ✓ Enqueue	❑ Written tests ❑ Oral tests ❑ Practical tests

	✓ Dequeue ❑ Demonstration of stack and queues using Java	
5. Understand Search Techniques	❑ Definition of search ❑ Explanation of Linear Search ❑ Explanation of Binary Search ❑ Demonstration of linear search and binary search using Java	❑ Written tests ❑ Oral tests ❑ Practical tests
6. Understand 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 Java	❑ Written tests ❑ Oral tests ❑ Practical tests

Suggested Methods of Delivery

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

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

- JDK

Equipment

- Computers

Materials and supplies

- Instructional materials
- Stationery

Reference materials

- Trainer recommended resources including web resources

WEB DESIGN SKILLS

UNIT CODE:IT/CU/CS/CR/10/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency**: Demonstrate Web Design Skills**

Duration of Unit: 200 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 data types, 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 data types
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	❑ Practical tests ❑ Written tests ❑ Oral tests

	✓ <head> ✓ <title> ✓ <body> ✓ <html> ❑ Addition of HTML core elements to file	
2. Use HTML elements	❑ Basic HTML elements ✓ <p> ✓ ✓ <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
3. 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
4. Apply Styles	❑ Style concepts ✓ background ✓ padding ✓ alignment ✓ border ❑ Application of internal styles ❑ Creation of external CSS file	❑ Practical tests ❑ Written tests ❑ Oral tests
5. Understand JavaScript basics	❑ Purpose of JavaScript ❑ JavaScript syntax	❑ Practical tests ❑ Written tests ❑ Oral tests

	❑ Accessing HTML element attributes using the JavaScript Document Object Model (DOM) ❑ Changing HTML element attributes using JavaScript DOM model	
6. Use JavaScript data types	❑ JavaScript data types ✓ 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
7. Use JavaScript functions	❑ JavaScript function structure ❑ Creation of JavaScript function ❑ Invoking of JavaScript function ❑ Returning values from functions	❑ Practical tests ❑ Written tests ❑ Oral tests
8. Use JavaScript libraries	❑ Libraries concept ❑ JQuery framework ❑ Installation of JQuery ❑ Referencing JQuery ❑ JQuery syntax ❑ JQuery events ✓ Keyboard ✓ Mouse ✓ Form ✓ Document Window	❑ Practical tests ❑ Written tests ❑ Oral tests

	❑ DOM manipulation with JQuery	

Suggested Methods of Delivery

- 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

Reference materials

- Trainer-recommended resources including web resources

GRAPHIC DESIGN

UNIT CODE:IT/CU/CS/CR/11/6/A

Relationship to Occupational Standards

This unit addresses the unit of competency: **Understand Graphic Design**

Duration of Unit: 170 hours

Unit description:

This unit specifies the competencies required to understanding graphic design fundamentals, understanding elements and principles of graphic design, applying typography techniques, creating and editing images, performing layout design and printing the design.

Summary of Learning Outcomes

1. Understand graphic design fundamentals
2. Understand elements and principles of graphic design
3. Apply typography techniques
4. Create and edit images
5. Perform layout design
6. Print design.

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Understand graphic design fundamentals	❑ Graphic Design ✓ Definition ✓ Types of elements ✓ Principles ✓ Application areas ❑ Graphic design equipment ✓ Computer ✓ Scanner ✓ Printer ✓ Camera ✓ Digital Tablet ❑ Uses of graphic design ❑ Specified requirements as per user requirements	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

2. Understand elements and principles of graphic design	❑ Demonstration of elements ✓ Colour ✓ Line ✓ Space ✓ Shape ✓ Texture ✓ Value ❑ Principles of graphic design ✓ Balance ✓ Contrast ✓ Emphasis ✓ Harmony ✓ Pattern ✓ Proportion ✓ Unity ❑ Selected appropriate elements for graphic design project	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests
3. Apply typography techniques	❑ Typography techniques ✓ Definition ✓ Types of techniques ❑ Typography guidelines ❑ Measurements and standards ❑ Selecting an appropriate typography techniques for graphic design project	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests
4. Create and edit images	❑ Identification of graphic design and photography Software and tools ❑ Image file types ✓ Raster ✓ Vector ❑ Creation of letter forms, lines of type and body copy ❑ Creation and manipulation of images	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests
5. Perform layout design	❑ Proportion on layout design ❑ Creation of unified systems out of dissimilar elements ❑ Creation of dynamic layouts using typographic tools	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

	❑ Creation of Type and image project ❑ Multi-page layout planning	
6. Print design	❑ Printing tools and Equipment ❑ Types of printing ❑ Paper classification ✓ Types ✓ Size ✓ Weight ❑ Selection of printing chemicals ❑ Demonstration of actual design printing	❑ Written tests ❑ Observation ❑ Oral tests ❑ Practical tests

Suggested Methods of Delivery

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

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

- Illustrator
- Adobe InDesign
- Adobe Photoshop
- Paint.net
- Corel Draw

Equipment

- Computers
- Printers
- Scanners
- Camera
- Digital Tablet

Reference materials

- Digital instructional material including DVDs and CDs