

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**DATA ENGINEER**

**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 these occupational standards have been developed for developing a competency-based curriculum for Data Engineer level 6. These Occupational Standards will also be the basis 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 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.

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 Data Engineer level 6. These standards will be the bases for development of a competency-based curriculum for Data management and analytics level 6. These Standards will also be the basis for assessment of an individual for competence certification.

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.

These occupational standards have 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.

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

**CHAIRPERSON**

**TVET CDACC**

# ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely 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 the ICT 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.

**CHAIRPERSON**

**ICT SECTOR SKILLS ADVISORY COMMITTEE**

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# ABBREVIATIONS AND ACRONYMS

CDACC Curriculum Development, Assessment and Certification Council

DE Data Engineer

IT Information Technology

EMS Environmental Management Systems

ICT Information Communication Technology

IEEE Institute of Electrical and Electronics Engineers

IT Information Technology

LAN Local Area Network

MAN Metropolitan Area Network

OSH Occupational Health and Safety

PAN Personal Area Network

RAM Random Access Memory

NLP Natural Language Processing

ROM Read Only Memory

SQL Structured Query Language

TVET Technical and Vocational Education and Training

UML Unified Modeling Language

WAN Wide Area Network

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

# KEY TO UNIT CODE

**IT/OS/DE/BC/01/6/A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Version control

# COURSE OVERVIEW

Data Management and Analytics Level 6 qualification consists of competencies that a person must achieve to enable him/her to be certified as a Data Engineer.

A Data Engineer is a person who will carry out data management and analytics duties as elaborated in various units of competency in this occupational standard. Thus, the units of competency comprising Data Management and Analytics level 6 qualifications include the following basic, common and core competencies:

**BASIC UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| IT/OS/DE/BC/01/6/A | Demonstrate Communication Skills |
| IT/OS/DE/BC/02/6/A | Demonstrate Numeracy Skills |
| IT/OS/DE/BC/03/6/A | Demonstrate Digital Literacy |
| IT/OS/DE/BC/04/6/A | Demonstrate Understanding of Entrepreneurship |
| IT/OS/DE/BC/05/6/A | Demonstrate Employability Skills |
| IT/OS/DE/BC/06/6/A | Demonstrate Environmental Literacy |
| IT/OS/DE/BC/07/6/A | Demonstrate Occupational Safety and Health Practices |

**COMMON UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| IT/OS/DE/CC/01/6/A | Apply Basic Electronic Skills |

**CORE UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| IT/OS/DE/CR/01/6/A | Demonstrate Foundational Computer Science Skills |
| IT/OS/DE/CR/02/6/A | Demonstrate Mathematical Skills for Data Science |
| IT/OS/DE/CR/03/6/A | Demonstrate Programming Skills Using Python |
| IT/OS/DE/CR/04/6/A | Apply Quantitative Modelling Skills |
| IT/OS/DE/CR/05/6/A | Apply Python in Data Science |
| IT/OS/DE/CR/06/6/A | Design and Develop Databases and Data Warehouses |
| IT/OS/DE/CR/07/6/A | Develop Machine Learning Applications Using Python |
| IT/OS/DE/CR/08/6/A | Demonstrate Data Mining and Analytics Skills in Big Data Management |
| IT/OS/DE/CR/09/6/A | Demonstrate Project Management Skills for Data Science |
| IT/OS/DE/CR/10/6/A | Demonstrate Research Skills for Data Science |
| IT/OS/DE/CR/11/6/A | Design and Implement Cloud Data Base Solutions |

# BASIC UNITS OF COMPETENCY

# 

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** IT/OS/DE/BC/01/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Meet communication needs of clients and colleagues | 1. Specific communication needs of clients and colleagues are identified and met based on workplace requirements 2. Different communication approaches are identified and applied according to clients’ needs 3. Conflict is identified and addressed as per the standards of the organization |
| 1. Develop communication strategies | * 1. Strategies for effective internal and external dissemination of information are developed as per organization’s requirements   2. Special communication needs are considered in developing strategies according workplace procedures   3. ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs |
| 1. Establish and maintain communication pathways | * 1. Pathways of communication are established as per organization policy   2. Pathways are maintained and reviewed according to organization procedures |
| 1. Promote use of communication strategies | * 1. Information is provided to all areas of the organization as per strategy requirements   2. Effective communication techniques are articulated and modelled according work requirements   3. Personnel are given guidance about adapting communication strategies as per organization procedures |
| 1. Conduct interview | 1. A range of appropriate communication strategies are employed in ***interview situations*** based on the workplace requirements 2. Records of interviews are made and maintained in accordance with organizational procedures 3. Effective questioning, listening and nonverbal communication techniques are used as per needs |
| 1. Facilitate group discussion | 1. Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 2. Strategies to encourage group participation are identified and used as per organizations’ procedures 3. Meeting objectives and agenda are set and followed based on workplace requirements 4. Relevant information is provided and feedback obtained according to set protocols 5. Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6. Specific communication needs of individuals are identified and addressed as per individual needs |
| 1. Represent the organization | 1. 7Relevant presentation are researched and presented based on internal or external communication forums requirements 2. Presentation is delivered in a clear and sequential manner as per the predetermined time 3. Presentation is made as per appropriate media 4. Difference views are respected based on workplace procedures 5. Written communication is done as per organizational standards 6. Inquiries are responded according to organizational standard |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a non-judgmental way * Using active listening * Making decision about appropriate words, behaviour * Putting together response which is culturally appropriate * Expressing an individual perspective * Expressing own philosophy, ideology and background and exploring impact with relevance to communication |
| 1. Situations may include but not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Direct observation 2. Oral questioning 3. Written texts |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE NUMERACY SKILLS

**UNIT CODE:** IT/OS/DE/BC/02/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms*** ***are elaborated in the Range.*** |
| 1. Apply a wide range of mathematical calculations for work | * 1. Mathematical information embedded in a range of workplace tasks and texts is extracted as per workplace procedures.   2. Mathematical information is interpreted and comprehended as per job specifications   3. A range of mathematical and problem solving processes are selected and used as per job specification   4. Different forms of fractions, decimals and percentages are flexibly used as per SOPs   5. Calculation performed with positive and negative numbers as per SOPs   6. Numbers are expressed as powers and roots and are used in calculations as per SOPs   7. Calculations done using routine formulas as per SOPs   8. Estimation and assessment processes are used to check outcome as per workplace procedures   9. Mathematical language is used to discuss and explain the processes, results and implications of the task as per workplace procedures |
| 1. Use and apply ratios, rates and proportions for work | * 1. Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts as per SOPs   2. Mathematical information related to ratios, rate and proportions is analyzed as per SOPs   3. Problem solving processes are used to undertake the task as per workplace procedures   4. Equivalent ratios and rates are simplified as per SOPs   5. Quantities are calculated using ratios, rates and proportions as per SOPS   6. Graphs, charts or tables are constructed to represent ratios, rates and proportions as per SOPs   7. The outcomes reviewed and checked as per job specifications   8. Information is record using mathematical language and symbols as per workplace procedures |
| 1. Estimate, measure and calculate measurement for work | * 1. Measurement information embedded in workplace texts and tasks are extracted and interpreted as per job specifications   2. Appropriate workplace measuring equipment are identified and selected as per job specifications   3. Accurate measurements are estimated and made as per SOPs   4. The area of ***2D shapes*** including compound shapes are calculated as per SOPs   5. The volume of 3D shapes is calculated using relevant formulas as per SOPs   6. Sides of right angled triangles are calculated using Pythagoras’ theorem as per SOPs   7. conversions are perform between units of measurement as per job specification   8. Problem solving processes are used to undertake the task as per workplace Procedures   9. The measurement outcomes are reviewed and checked as per workplace procedures   10. Information is recorded using mathematical language and symbols appropriate for the task as per workplace procedures |
| 1. Use detailed maps to plan travel routes for work | * 1. Different types of maps are identified and interpreted as per job requirements   2. Key features of maps are identified as per job requirements   3. Scales are identified and interpreted as per job requirements   4. Scales are applied to calculate actual distances   5. Positions or locations are determined using directional information as per job requirements   6. Routes are planned by determining directions and calculating distances, speeds and times as per job requirements   7. Information is gathered and identified and relevant factors related to planning a route checked as per job requirements   8. Relevant equipment is select and checked for accuracy and operational effectiveness as per job requirements   9. Task is planned and recorded using specialized mathematical language and symbols appropriate for the task as per job requirements |
| 1. Use geometry to draw 2D shapes and construct 3D shapes for work | * 1. A range of 2D shapes and 3D shapes and their uses in work contexts is identified as per job specifications   2. Features of 2D and 3D shapes are named and described as per job specifications   3. Types of angles in 2D and 3D shapes are identified as per job specifications   4. Angles are drawn, estimated and measured using geometric instruments as per job requirements   5. Angle properties of 2D shapes are named and identified as per SOPs   6. Angle properties are used to evaluate unknown angles in shapes as per SOPs   7. Properties of perpendicular and parallel lines are applied to shapes as per SOPs   8. Understanding and use of symmetry is demonstrated as per SOPs   9. Understanding and use of similarity is demonstrated as per SOPs   10. The workplace tasks and mathematical processes required are identified as per workplace procedures   11. 2D shapes is drawn for work as per job specification   12. 3D shapes is constructed for work as per job specification   13. The outcomes are reviewed and checked as per workplace procedures   14. Specialized mathematical language and symbols appropriate for the task are used as per SOPs |
| 1. Collect, organize, and interpret statistical data for work | * 1. Workplace issue requiring investigation are identified as per workplace procedures   2. Audience / population / sample unit is determined as per workplace procedures as per workplace procedures   3. Data to be collected is identified as per workplace procedures   4. Data collection method is selected as per workplace procedures   5. Appropriate statistical data is collected and organized as per SOPs   6. Data is illustrated in appropriate formats as per SOPs   7. The effectiveness of different types of graphs are compared as per SOPs   8. The summary statistics for collected data is calculated as per SOPs   9. The results / findings are interpreted as per SOPs   10. Data is checked to ensure that it meets the expected results and content as per workplace procedures   11. Information from the results including tables, graphs and summary statistics is extracted and interpreted as per workplace procedure   12. Mathematical language and symbols are used to report results of investigation as per workplace procedure |
| 1. Use routine formula and algebraic expressions for work | * 1. Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated as per SOPs   2. Simple algebraic expressions and equations are developed as per job specification   3. Operate on algebraic expressions as per job requirement   4. Algebraic expressions are simplified as per job requirement   5. Substitution into simple routine equations is done as per SOPs   6. Routine formulas used for work tasks are identified and comprehended as per SOPs   7. Routine formulas are evaluate by substitution as per SOPs   8. Routine formulas transposed as per SOPs   9. Appropriate formulas are identified and used for work related tasks as per workplace procedures   10. Outcomes are checked and result of calculation used as per workplace procedures |
| 1. Use common functions of a scientific calculator for work | * 1. Required numerical information to perform tasks is located as per job specification   2. The order of operations and function keys necessary to solve mathematical calculation are determined as per job specification   3. Function keys on a scientific calculator are identified and used as per SOPs   4. Estimations are referred to check reasonableness of problem solving process as per workplace procedures   5. Appropriate mathematical language, symbols and conventions are used to report results as per workplace procedures |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. 2D shapes may include but not limited may include but not limited to: | * Triangles * Square * Rectangle * Triangle |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Logical thinking
* Computing
* Drawing of graphs
* Applying mathematical formulas
* Analytical

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Types of common shapes
* Differentiation between two dimensional shapes / objects
* Formulae for calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Fundamental operations (addition, subtraction, division, multiplication)
* Rounding techniques
* Types of fractions
* Different types of tables and graphs
* Meaning of graphs, such as increasing, decreasing, and constant value
* Preparation of basic data, tables & graphs

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   1. Developed communication strategies to meet the organization requirements and applied in the workplace 2. Established and maintained communication pathways for effective communication in the workplace 3. Used communication strategies involving exchanges of complex oral information |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE DIGITAL LITERACY

**UNIT CODE:** IT/OS/DE/BC/03/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify appropriate computer software and hardware | * 1. Concepts of ICT are determined in accordance with computer equipment   2. Classifications of computers are determined in accordance with manufacturers specification   3. Appropriate computer software is identified according to manufacturer’s specification   4. Appropriate computer hardware is identified according to manufacturer’s specification   5. Functions and commands of operating system are determined in accordance with manufacturer’s specification |
| 1. Apply security measures to data, hardware, software in automated environment | * 1. ***Data security and privacy are classified*** in accordance with the prevailing technology   2. ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. Protection against computer crimes is undertaken in accordance with laws governing protection of ICT |
| 1. Apply computer software in solving tasks | * 1. ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements   2. ***Word processing utilities*** are applied in accordance with workplace procedures   3. Worksheet layout is prepared in accordance with work procedures   4. Worksheet is build and data manipulated in the worksheet in accordance with workplace procedures   5. Continuous data manipulated on worksheet is undertaken in accordance with work requirements   6. Database design and manipulation is undertaken in accordance with office procedures   7. Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures |
| 1. Apply internet and email in communication at workplace | * 1. Electronic mail addresses are opened and applied in workplace communication in accordance with office policy   2. Office internet functions are defined and executed in accordance with office procedures   3. ***Network configuration*** is determined in accordance with office operations procedures   4. Official World Wide Web is installed and managed according to workplace procedures |
| 1. Apply Desktop publishing in official assignments | * 1. Desktop publishing functions and tools are identified in accordance with manufactures specifications   2. Desktop publishing tools are developed in accordance with work requirements   3. Desktop publishing tools are applied in accordance with workplace requirements   4. Typeset work is enhanced in accordance with workplace standards |
| 1. Prepare presentation packages | * 1. Types of presentation packages are identified in accordance with office requirements   2. Slides are created and formulated in accordance with workplace procedures   3. Slides are edited and run in accordance with work procedures   4. Slides and handouts are printed according to work requirements |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Appropriate computer hardware may include but not limited to: | Collection of physical parts of a computer system such as;   * Computer case, monitor, keyboard, and mouse * All the parts inside the computer case, such as the hard disk drive, motherboard and video card |
| 1. Data security and privacy may include but not limited to: | * Confidentiality of data * Cloud computing * Integrity -but-curious data surfing |
| 1. Security and control measures may include but not limited to: | * Counter measures against cyber terrorism * Risk reduction * Cyber threat issues * Risk management * Pass-wording |
| 1. Security threats may include but not limited to: | * Cyber terrorism * Hacking |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical skills
* Interpretation
* Typing
* Communication
* Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
* Using calculator
* Basic ICT skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Software concept
* Functions of computer software and hardware
* Data security and privacy
* Computer security threats and control measures
* Technology underlying cyber-attacks and networks
* Cyber terrorism
* Computer crimes
* Detection and protection of computer crimes
* Laws governing protection of ICT
* Word processing;
* Functions and concepts of word processing.
* Documents and tables creation and manipulations
* Mail merging
* Word processing utilities
* Spread sheets;
* Meaning, formulae, function and charts, uses and layout
* Data formulation, manipulation and application to cells
* Database;
* Database design, data manipulation, sorting, indexing, storage retrieval and security
* Desktop publishing;
* Designing and developing desktop publishing tools
* Manipulation of desktop publishing tools
* Enhancement of typeset work and printing documents
* Presentation Packages;
* Types of presentation Packages
* Creating, formulating, running, editing, printing and presenting slides and handouts
* Networking and Internet;
* Computer networking and internet.
* Electronic mail and world wide web
* Emerging trends and issues in ICT;
* Identify and integrate emerging trends and issues in ICT
* Challenges posed by emerging trends and issues

**EVIDENCE** **GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified and controlled security threats   2. Detected and protected computer crimes   3. Applied word processing in office tasks   4. Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures   5. Opened electronic mail for office communication as per workplace procedure   6. Installed internet and World Wide Web for office tasks in accordance with office procedures   7. Integrated emerging issues in computer ICT applications   8. Applied laws governing protection of ICT |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace where assessment can take place   2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE ENTREPRENEURIAL SKILLS

**UNIT CODE :** IT/OS/DE/BC/04/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT** | **PERFORMANCE CRITERIA** |
| 1. Demonstrate understanding of an Entrepreneur | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 3. Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 4. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 5. Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship |
| 1. Demonstrate understanding of Entrepreneurship and self-employment | 1. Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. Importance of self-employment is analysed based on business procedures and strategies 3. ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 4. Role of an Entrepreneur in business is determined according to business procedures and strategies 5. Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 6. Entrepreneurship culture in Kenya is explored as per business procedures and strategies 7. Born or made Entrepreneurs are distinguished as per entrepreneurial traits |
| 1. Identify Entrepreneurship opportunities | 1. Sources of business ideas are identified as per business procedures and strategies 2. Business ideas and opportunities are generated as per business procedures and strategies 3. Business life cycle is analysed as per business procedures and strategies 4. Legal aspects of business are identified as per procedures and strategies 5. Product demand is assessed as per market strategies 6. Types of ***business environment*** are identified and evaluated as per business procedures 7. Factors to consider when evaluating business environment are explored based on business procedure and strategies 8. Technology in business is incorporated as per best practice |
| 1. Create entrepreneurial awareness | 1. ***Forms of businesses*** are explored as per business procedures and strategies 2. Sources of business finance are identified as per business procedures and strategies 3. Factors in selecting source of business finance are identified as per business procedures and strategies 4. ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 5. Problems of starting and operating SSEs are explored as per business procedures and strategies |
| 1. Apply entrepreneurial motivation | 1. ***Internal and external motivation*** factors are determined in accordance with motivational theories 2. Self-assessment is carried out as per entrepreneurial orientation 3. Effective communications are carried out in accordance with communication principles 4. Entrepreneurial motivation is applied as per motivational theories |
| 1. Develop innovative business strategies | 1. Business innovation strategies are determined in accordance with the organization strategies 2. Creativity in business development is demonstrated in accordance with business strategies 3. ***Innovative business strategies*** are developed as per business principles 4. Linkages with other entrepreneurs are created as per best practice 5. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Identified Business is described as per business procedures and strategies 2. Marketing plan is developed as per business plan format 3. Organizational/Management plan is prepared in accordance with business plan format 4. Production/operation plan in accordance with business plan format 5. Financial plan is prepared in accordance with the business plan format 6. Executive summary is prepared in accordance with business plan format 7. Business plan is presented as per best practice |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Types of entrepreneurs may include but not limited to: | * Innovators * Imitators * Craft * Opportunistic * Speculators |
| 1. Characteristics of Entrepreneurs may include but not limited to: | * Creative * Innovative * Planner * Risk taker * Networker * Confident * Flexible * Persistent * Patient * Independent * Future oriented * Goal oriented |
| 1. Requirements for entry into self-employment may include but not limited to | * Technical skills * Management skills * Entrepreneurial skills * Resources * Infrastructure |
| 1. Internal and external motivation may include but not limited to: | * Interest * Passion * Freedom * Prestige * Rewards * Punishment * Enabling environment * Government policies |
| 1. Business environment may include but not limited to: | * External * Internal * Intermediate |
| 1. Forms of businesses may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Governing policies may include but not limited to: | * Increasing scope for finance * Promoting cooperation between entrepreneurs and private sector * Reducing regulatory burden on entrepreneurs * Developing IT tools for entrepreneurs |
| 1. Innovative business strategies may include but not limited to: | * New products * New methods of production * New markets * New sources of supplies * Change in industrialization |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Analytical
* Management
* Problem-solving
* Root-cause analysis
* Communication

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Decision making
* Business communication
* Change management
* Competition
* Risk
* Net working
* Time management
* Leadership
* Factors affecting entrepreneurship development
* Principles of Entrepreneurship
* Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
* Conflict resolution
* Health, safety and environment (HSE) principles and requirements
* Customer care strategies
* Basic financial management
* Business strategic planning
* Impact of change on individuals, groups and industries
* Government and regulatory processes
* Local and international market trends
* Product promotion strategies
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | 1. Assessment requires evidence that the candidate: 2. Distinguished entrepreneurs and businesspersons correctly 3. Identified ways of becoming an entrepreneur appropriately 4. Explored factors affecting entrepreneurship development appropriately 5. Analysed importance of self-employment accurately 6. Identified requirements for entry into self-employment correctly 7. Identified sources of business ideas correctly 8. GeneratedBusiness ideas and opportunities correctly 9. Analysed business life cycle accurately 10. Identified legal aspects of business correctly 11. Assessed product demand accurately 12. Determined Internal and external motivation factors appropriately 13. Carried out communications effectively 14. Identified sources of business finance correctly 15. Determined Governing policy on small scale enterprise appropriately 16. Explored problems of starting and operating SSEs effectively 17. Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 18. Prepared executive summary correctly 19. Determined business innovative strategies appropriately 20. Presented business plan effectively |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | 1. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio of Evidence |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# 

# DEMONSTRATE EMPLOYABILITY SKILLS

**UNIT CODE:** IT/OS/DE/BC/05/6/A

**UNIT DESCRIPTON**

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.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Conduct self-management | 1. Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 2. Emotional intelligence is demonstrated as per workplace requirements. 3. Individual performance is evaluated and monitored according to the agreed targets. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for own actions are demonstrated based on workplace instructions. 6. Self-esteem and a positive self-image are developed and maintained based on values. 7. Time management, attendance and punctuality are observed as per the organization policy. 8. Goals are managed as per the organization’s objective 9. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Demonstrate interpersonal communication | 1. Writing skills are demonstrated as per communication policy 2. Negotiation and persuasion skills are demonstrated as per communication policy 3. Internal and external stakeholders’ needs are identified and interpreted as per the communication policy 4. Communication networks are established based on workplace policy 5. Information is shared as per communication policy |
| 1. Demonstrate critical safe work habits | * 1. Stress is managed in accordance with workplace policy.   2. Punctuality and time consciousness is demonstrated in line with workplace policy.   3. Personal objectives are integrated with organization goals based on organization’s strategic plan.   4. ***Resources*** are utilized in accordance with workplace policy.   5. Work priorities are set in accordance to workplace goals and objectives.   6. Leisure time is recognized and utilized in line with personal objectives.   7. ***Drugs and substances of abuse*** are identified and avoided based on workplace policy.   8. HIV and AIDS prevention awareness is demonstrated in line with workplace policy.   9. Safety consciousness is demonstrated in the workplace based on organization safety policy.   10. ***Emerging issues*** are identified and dealt with in accordance with organization policy. |
| 1. Lead a workplace team | 1. Performance targets for the ***team*** are set based on organization’s objectives 2. Duties are assigned in accordance with the organization policy. 3. ***Forms of communication*** in a team are established according to organization’s policy. 4. Team performance is evaluated based on set targets as per workplace policy. 5. Conflicts are resolved between team members in line with organization policy. 6. Gender related issues are identified and mainstreamed in accordance workplace policy. 7. Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 8. Healthy relationships are developed and maintained in line with workplace. |
| 1. Plan and organize work | 1. Work plans are prepared based on activities and budget. 2. Assigned tasks are interpreted and expectations identified as per the workplace instructions. 3. Task occupational safety and health requirements are identified and observed regulations. 4. Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5. Work activities are monitored and evaluated in line with work plans and workplace policy. 6. Work plans are reviewed based on target and available resources. |
| 1. Maintain professional growth and development | * 1. Personal training needs are identified and assessed in line with the requirements of the job.   2. ***Training and career opportunities*** are identified and utilized based on job requirements.   3. Resources for training are mobilized and allocated based organizations and individual skills needs.   4. Licensees and certifications relevant to job and career are obtained and renewed as per policy.   5. Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives.   6. Recognitions are sought as proof of career advancement in line with professional requirements. |
| 1. Demonstrate workplace learning | * 1. Learning opportunities are sought and managed based on job requirement and organization policy.   2. Improvement in performance is demonstrated based on courses attended.   3. Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job   4. Time and effort is invested in learning new skills based on job requirements   5. Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy.   6. New systems are developed and maintained in accordance with the requirements of the job.   7. Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job. |
| 1. Demonstrate problem solving skills | * 1. Creative, innovative and practical solutions are developed based on the problem   2. Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job.   3. Team problems are solved as per the workplace guidelines   4. Problem solving strategies are applied as per the workplace guidelines   5. Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Manage ethical performance | * 1. Policies and guidelines are observed as per the workplace requirements   2. Self-worth and professionalism is exercised in line with personal goals and organizational policies   3. Code of conduct is observed as per the workplace requirements   4. Integrity is demonstrated as per legal requirement |

**RANGE**

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Drug and substance abuse may include but not limited to: | Commonly abused   * Alcohol * Tobacco * Miraa * Over-the-counter drugs * Cocaine * Bhang * Glue |
| 1. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Relationships may include but not limited to: | * Man/Woman * Trainer/trainee * Employee/employer * Client/service provider * Husband/wife * Boy/girl * Parent/child * Sibling relationships |
| 1. Forms of communication may include but not limited to: | * Written * Visual * Verbal * Non verbal * Formal and informal |
| 1. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group |
| 1. Personal growth may include but not limited to: | * Growth in the job * Career mobility * Gains and exposure the job gives * Net workings * Benefits that accrue to the individual as a result of noteworthy performance |
| 1. Personal objectives may include but not limited to: | * Long term * Short term * Broad * Specific |
| 1. Trainings and career opportunities may include but not limited to | * Participation in training programs * Serving as Resource Persons in conferences and workshops |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Innovation may include but not limited to: | * New ideas * Original ideas * Different ideas * Methods/procedures * Processes * New tools |
| 1. Emerging issues may include but not limited to: | * Terrorism * Social media * National cohesion * Open offices |
| 1. Range of media for learning may include but not limited to: | * Mentoring * peer support and networking * IT and courses |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Interpersonal
* Communication
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Record keeping
* Problem solving
* Decision Making
* Resource utilization
* Resource mobilization

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies
* Company operations, procedures and standards
* Occupational Health and safety procedures
* Fundamental rights at work
* Workplace communication
* Concept of time
* Time management
* Decision making
* Types of resources
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender mainstreaming
* HIV and AIDS
* Drug and substance abuse
* Professional growth and development
* Technology in the workplace
* Innovation
* Emerging issues

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical aspects of Competency | Assessment requires evidence that the candidate:   * 1. Conducted self-management   2. Demonstrated interpersonal communication   3. Demonstrated critical safe work habits   4. Demonstrated the ability to lead a workplace team   5. Planned and organized work   6. Maintained professional growth and development   7. Demonstrated workplace learning   8. Demonstrated problem solving skills   9. Demonstrated the ability to manage performance ethically |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** IT/OS/DE/BC/06/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1.1 Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS.  1.2 Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS.  1.3 ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution | * 1. Environmental pollution ***control measures*** are implemented in accordance with international protocols.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with based on organizational waste management guide   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69. |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided as per work groups/sector   2. Current resource usage is measured and recorded as per work group   3. Current purchasing strategies are analysed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact  5.2 Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 6.1 Programs/Activities are identified according to organizations policies and guidelines.  6.2 Individual roles/responsibilities are determined and performed based on the activities identified.  6.3 Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines  6.4 Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program  7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations  7.3 Data gathered are analyzed based on Evaluation requirements  7.4 Recommendations are submitted based on the findings  7.5 Management support systems are set/established to sustain and enhance the program  7.6 Environmental incidents are monitored and reported to  concerned/proper authorities |
| 1. Analyze resource use | 8.1. All resource consuming processes are Identified as per the organizational work plan  8.2. Quantity and nature of resource consumed is determined based on processes  8.3. Resource flow is analyzed as per different parts of the process.  8.4. Wastes are classified according to NEMA regulations on waster management. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined according to industry protocol.  9.2. Causes of low efficiency of use of resources are Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. PPE may include but not limited to | * + Mask   + Gloves   + Goggles   + Safety hat   + Overall * Hearing protector |
| 1. Control measures may include but not limited to | * Methods for minimizing or stopping spread and ingestion of airborne particles * Methods for minimizing or stopping spread and ingestion of gases and fumes * Methods for minimizing or stopping spread and ingestion of liquid wastes |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Analytical
* Monitoring
* Communication
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* PPEs
* Environmental regulations
* OSHS
* Pollution
* Waste management
* Principle of 3Rs
* Types of resources
* Techniques in measuring current usage of resources
* Environmental hazards
* Regulatory requirements

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Controlled environmental hazard   2. Controlled environmental pollution   3. Demonstrated sustainable resource use   4. Evaluated current practices in relation to resource usage   5. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns.   6. Described industrial standard environmental practices according to the different environmental issues/concerns.   7. Resolved problems/ constraints encountered based on management standard procedures   8. Implemented and monitored environmental practices on a periodic basis as per company guidelines   9. Recommended solutions for the improvement of the program   10. Monitored and reported to proper authorities any environmental incidents |
| 1. Resource Implications | The following resources should be provided:   * 1. Workplace with storage facilities   2. Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags)   3. PPE, manuals and references   4. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   5. Case studies/scenarios relating to environmental Protection |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Portfolio of Evidence   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** IT/OS/DE/BC/07/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Identify workplace hazards and risk | 1.1 ***Hazards*** in the workplace are identified ***based their indicators***  1.2 Risks and hazards are evaluated based on legal requirements.  1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements. |
| 1. Control OSH hazards | 2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement.  2.2 Risk assessment is conductedand a risk matrix developed based on likely impact.  2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures. |
| 1. Implement OSH programs | 3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements.  3.2 Company OSH programs are implemented as per legal requirements.  3.3 Workers are capacity built on OSH standards and procedures as per legal requirements  3.4 ***OSH-related records*** are maintained as per legal requirements. |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Hazards may include but not limited to: | * Physical hazards – impact, illumination, pressure, noise, * vibration, extreme temperature, radiation * Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects * Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors * Ergonomics * Psychological factors – over exertion/ excessive force,   awkward/static positions, fatigue, direct pressure,   * varying metabolic cycles * Physiological factors – monotony, personal relationship, work out cycle * Safety hazards (unsafe workplace condition) –confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris * Unsafe workers’ act (Smoking in off-limited areas, Substance and alcohol abuse at work) |
| 1. Indicators may include but not limited to: | * Increased of incidents of accidents, injuries * Increased occurrence of sickness or health complaints/ symptoms * Common complaints of workers related to OSH * High absenteeism for work-related reasons |
| 1. OSH concerns may include but not limited to: | * Workers’ experience/observance on presence of work hazards * Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) * Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines |
| 1. Safety gears /PPE (Personal Protective Equipment) may include but not limited to: | * 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 |
| 1. Appropriate risk controls   may include but not limited to: | * Appropriate risk controls in order of impact are as follows: * Eliminate the hazard altogether (i.e., get rid of the dangerous machine) * Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) * Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) * Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) * Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) * Use personal protective equipment (i.e., wear * gloves and goggles when using the machine) |
| 1. Contingency measures may include but not limited to: | * Evacuation * Isolation * Decontamination * (Calling designed) emergency personnel |
| 1. Incidents and emergencies may include but not limited to: | * Chemical spills * Equipment/vehicle accidents * Explosion * Fire * Gas leak * Injury to personnel * Structural collapse * Toxic and/or flammable vapors emission. |
| 1. OSH-related Records may include but not limited to: | * Medical/Health records * Incident/accident reports * Sickness notifications/sick leave application * OSH-related trainings obtained |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Interpersonal
* Presentation
* Risk assessment
* Evaluation
* Critical thinking
* Problem solving
* Negotiation

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* General OSH Principles
* Occupational hazards/risks recognition
* OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
* National OSH regulations; company OSH policies and protocols
* Systematic gathering of OSH issues and concerns
* General OSH principles
* National OSH regulations
* Company OSH and recording protocols, procedures and policies/guidelines
* Training and/or counselling methodologies and strategies

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Identified hazards in the workplace based their indicators 2. Evaluated workplace hazards based on legal requirements. 3. Addressed OSH concerns raised by workers as per legal requirements. 4. Implemented hazard prevention and control measures as per legal requirement. 5. Conducted risk assessment as per legal requirement. 6. Developed risk matrix based on likely impact. 7. Recognized and established contingency measures in accordance with organization procedures. 8. Identified, evaluated and reviewed company OSH program based on legal requirements. 9. Implemented company OSH programs as per legal requirements. 10. Capacity built workers on OSH standards and procedures as per legal requirements 11. Maintained OSH-related records as per legal requirements. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Portfolio of Evidence 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed   1. On-the-job 2. Off-the –job 3. During Industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

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# COMMON UNIT OF COMPETENCY

# APPLY BASIC ELECTRONIC SKILLS

**UNIT CODE:** IT/OS/DE/CC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Demonstration of basic electronic skills

**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.

**ELEMENTS AND PERFORMANCE CRETIRIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the range.*** |
| 1. Identify electrical circuits | * 1. Electrical circuit are identified   2. ***Electrical quantities and their units*** are identified   3. ***Types of electrical circuits*** are identified |
| 1. Identify Electronic components | * 1. Identification of electrical components is done   2. Characteristic of electroniccomponents are identified   3. Application of electronic components are Identified   4. Characteristics of integrated circuit are identified |
| 1. Understand Semi-conductor theory | 3.1 Explanation of semiconductor theory is done  3.2 Structure of matter is described  3.3 Electrons in conductors and semiconductors are explained  3.4 Types of semiconductor materials are identified  3.5 P-type and N-type materials are explained  3.6 Description of P-N junction diodes operations is done  3.7 ***Types and operations of transistors*** are identified |
| 1. Identify and classify memory | 4.1 ***Types of memories*** are identified  4.2 Memory hierarchy is identified  4.3 ***Levels of memory storage*** are identified  4.3 ***Classification of memories*** is done |
| 1. Apply Number Systems and binary coding | * 1. ***Types of number systems*** are identified   2. Base conversion is done   3. Binary arithmetic operations are done   4. ***Binary codes*** are identified   5. Representation of decimals in BCD is done   6. BCD arithmetic are performed |
| 1. Emerging trends in Electronics | * 1. Description of emerging trends is done   2. Challenges of emerging trends are explained   3. Explanation on coping with the emerging trends is done |

**RANGE**

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

| **Variable** | **Range**  ***May include but is not limited to:*** |
| --- | --- |
| 1. Electrical quantities and their unitsmay include but not limited to: | E.M.F in volts   * + Power in watts   + Energy in joules   + Resistance in ohms   + Current in amperes |
| 1. Types of electrical circuits may include and not limited to: | * + AC – Alternating Current   + DC – Direct Current |
| 1. Types and operations of transistors may include and not limited to: | * + Types * PNP * NPN * Operations * Forward biasing * Reverse Biasing |
| 1. Types of memoriesmay include and not limited to: | * Semi-conductor * Magnetic * Optical |
| 1. Classification of memoriesmay include and not limited to: | * RAM * ROM |
| 1. Levels of memory storagemay include and not limited to: | * Internal * Main * Online * Offline bulk |
| 1. Types of number systems   may include and not limited to: | * Decimal * Binary * Octal * Hexadecimal * Binary Arithmetic’s |
| 1. Binary codesmay include and not limited to: | * 8421 BCD * Excess 3 * BCD arithmetic’s |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Proficient in ICT
* Time management
* Problem solving
* Decision making
* First aid

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical Components
* Electrical Quantities and units of measurement
* Electrical circuits
* Semiconductor theory
* Number systems
* Types of Computer memories

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required knowledge and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Identified Electrical Components, quantities and their units of measurement   2. Constructed a simple circuit   3. Identified types of transistors and their operations   4. Categorized the memories according to their levels, types and hierarchy   5. Identified the number systems, binary codes and their operations. |
| 1. Resource Implications for assessment | The following resources must be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:  3.1 Observation  3.2 Oral questioning  3.3 Practical demonstration |
| 1. Context of Assessment | Competency may be assessed:   1. On the job 2. Off the job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

# DEMONSTRATE FOUNDATIONAL COMPUTER SCIENCE SKILLS

**UNIT CODE:** IT/OS/DE/CR/01/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate foundational computer science skills. It involves identifying computer components, performing computer arithmetic, solving digital logic, demonstrating basic networking skills, demonstrating spreadsheet skills using MS Excel and demonstrating presentation skills using MS PowerPoint

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| * + - 1. Identify computer components | * 1. Hardware and software are defined   2. ***Types of software*** are outlined   3. ***Computer hardware components*** are explained   4. Functions of computer hardware components are outlined according to manufacturer’s specifications   5. Functions of computer software types are outlined according to manufacturer’s specifications   6. Installation and operation of operating systems is demonstrated   7. Troubleshooting of a computer is demonstrated |
| 1. Perform computer arithmetic | * 1. ***Number systems*** are explained   2. Integer and floating point representations are demonstrated according to IEEE standard   3. Integer and floating point arithmetic is explained |
| 1. Solve Digital Logic Problems | * 1. Boolean algebra is explained.   2. ***Boolean operations*** are outlined   3. Writing of Boolean expressions is illustrated   4. ***Methods of simplifying Boolean expressions*** are illustrated. |
| 1. Demonstrate networking skills | * 1. Key ***computer networking terminologies*** are explained   2. ***Components of a computer network*** are explained   3. ***Types of networks*** are explained   4. ***Network topologies*** are identified based on IEEE standards.   5. ***Internet protocols*** are explained.   6. Network troubleshooting tools are demonstrated |
| 1. Demonstrate spreadsheet skills using MS Excel | 1. Spreadsheet is explained. 2. Worksheets are created 3. Data importation and linking is demonstrated. 4. Formulas and functions in MS excel are demonstrated. 5. Use of excel data tools is demonstrated 6. Creation of pivot tables is demonstrated 7. Visualization using charts is demonstrated 8. Exporting data in MS Excel is demonstrated |
| 1. Demonstrate presentation skills using MS PowerPoint | * 1. Presentation software is explained.   2. Development of a PowerPoint presentation is demonstrated   3. Use of ***presentation views*** is demonstrated   4. ***Presentation******masters***are designed   5. Data importation into PowerPoint is demonstrated   6. Customizing of external templates is demonstrated.   7. A presentation is created using a set of requirements |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| **1. Types of software** may include but is not limited to: | * Application software * System software * Utility software * Language translators |
| 1. Computer hardware components may include but is not limited to: | * I/O devices * CPU * Memory |
| 1. Number systems may include but is not limited to: | * Decimal * Positional * Binary * Hexadecimal |
| 1. Boolean operations   may include but is not limited to: | * AND * OR * NOT * NAND * NOR * EX-OR * EX-NOR |
| 1. Methods of simplifying Boolean expressions may include but is not limited to: | * Using algebraic functions * Using Truth tables * Using Karnaugh Maps |
| 1. Computer networking terminologies may include but is not limited to: | * Network server * Client server * Intranet * Extranet * Transmission media * VoIP * Download * Upload |
| 1. Components of a network may include but is not limited to: | * Hub * Network interface card * Switch * Connecting media * Network OS |
| 1. Types of networks may include but is not limited to: | * LAN * WAN * MAN * PAN |
| 1. Network topologies may include but is not limited to: | * Star * Bus * Ring * Mesh |
| 1. Internet Protocols may include but is not limited to: | * HTTP * TCP * FTP * UDP |
| 1. Presentation views may include but is not limited to: | * Normal view * Slide sorter view * Notes page view * Slide show view |
| 1. Presentation masters may include but is not limited to: | * Slide masters * Notes master * Handout master |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Computer components
* Computer arithmetic
* Digital logic problems
* Basic networking skills
* Spreadsheet skills using MS Excel
* Presentation skills using MS PowerPoint

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| * 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Differentiated computer hardware and software   2. Explained the different types of software   3. Demonstrated troubleshooting of a computer   4. Explained number systems   5. Demonstrated Integer and floating point representations according to IEEE standard   6. Performed Boolean operations   7. Explained different types of networks   8. Identified network topologies based on IEEE standards.   9. Explained various internet protocols   10. Demonstrated network troubleshooting tools   11. Developed spreadsheet solutions using Excel   12. Created PowerPoint presentations. |
| * 1. Resource Implications for assessment | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| * 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| * 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| * 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE MATHEMATICAL SKILLS FOR DATA SCIENCE

**UNIT CODE:** IT/OS/DE/CR/02/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate mathematical skills for data science. It involves performing calculus operations, performing linear algebra operations, analysing events using probability theory and analysing data using statistics.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Perform Calculus Operations | * 1. Calculus is explained   2. Applications of calculus in data science are cited.   3. Functions and graphs are explained   4. Differential calculus is illustrated   5. Integral calculus is illustrated |
| 1. Perform Linear Algebra Operations | * 1. Linear Algebra is defined   2. Applications of Linear Algebra in data science are cited.   2.3 Linear equations are solved  2.4 Vectors are explained   * 1. ***Vector operations*** are illustrated   2.6 Matrices are explained  2.7 ***Matrix operations*** are illustrated  2.8 Inverse of a square matrix is illustrated |
| 1. Analyse events using Probability Theory | * 1. ***Key terminologies in Probability*** are explained   3.2 Applications of probability theory in data science are cited.  3.3 Probability axioms and simple counting problems are illustrated  3.4 Permutations and combinations are illustrated  3.5 Conditional probability and the multiplication rule are illustrated |
| 1. Analyse data using statistics | * 1. ***Key terminologies in statistics*** are explained   2. Applications of Statistics in data science are cited.   3. ***Distribution in statistics*** are illustrated   4. Data representation techniques are illustrated   5. Descriptive statistics are explained   6. ***Measures of central tendency*** are illustrated   7. ***Measures of spread*** are illustrated   8. Inferential statistics is explained   9. Linear regression and correlation are illustrated |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Vector operations may include but is not limited to: | * Addition * Multiplication * Dot product |
| 1. Matrix operations may include but is not limited to: | * Sum of two matrices * Sum of a matrix and a scalar * Matrix subtraction * Product of two matrices * Product of a matrix and a vector |
| 1. Key terminologies in probability theory may include but is not limited to: | * Event * Outcome * Experiment * Chance * Sample space * Mutually exclusive event * Independent events |
| 1. Key terminologies in statistics may include but is not limited to: | * Population * Sample * Parameter * Statistic * Distribution |
| 1. Distribution in statistics may include but is not limited to: | * Binomial * Normal * Poison |
| 1. Measures of central tendency may include but is not limited to: | * Mean * Median * Mode |
| 1. Measures of spread may include but is not limited to: | * Variance * Standard deviation * Percentile * Quartiles |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Calculus
* Linear Algebra
* Probability
* Statistics

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| * + 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Solved real life problems using differential calculus   2. Solved real life problems using integral calculus   3. Solved real life problems Linear equations   4. Performed vector operations   5. Performed matrix operations   6. Explained samples spaces, events and sets   7. Solved real life problems using probability axioms   8. Solved real life problems using permutations and combinations   9. Solved real life problems using conditional probability   10. Explained various types of distribution in statistics   11. Differentiated descriptive and inferential statistics   12. Represented data using statistical techniques   13. Illustrated measures of central tendency   14. Illustrated measures of spread   15. Illustrated linear regression and correlation |
| * + 1. Resource Implications for assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| * + 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| * + 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| * + 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE PROGRAMMING SKILLS USING PYTHON

**UNIT CODE:** IT/OS/DE/CR/03/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate programming skills using python. It involves identifying programming building blocks, working in the python environment, performing data operations, using control structures, applying functions for problem solving, demonstrating Object Oriented programming, handling errors in a program, working with files, demonstrating unit testing and demonstrating git version control skills.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify programming building blocks | * 1. **Programming is defined**   2. ***Phases of program development* are explained**   3. ***Key terms used in programming*** are defined   4. ***Types of code*** are explained   5. Translators are explained   6. Program specification is designed |
| 1. Work in the Python environment | * 1. Python is installed   2. Python programming environment is demonstrated   3. Features of Python are outlined   4. Python syntaxis demonstrated |
| 1. Perform data operations | * 1. 3.1***Python data types*** are outlined   2. ***Types of statements*** are illustrated   3. 3.3 Variables and constants are explained   4. 3.4 ***Data operations***are illustrated   5. 3.5 Program to perform specified operations is created. |
| 1. Use Control Structures | * 1. 4.1 ***Control Structures*** are explained   2. 4.2 Uses of different control structures are demonstrated   3. 4.3 Programs using control structures are created |
| 1. Apply functions for problem solving | * 1. 5.1 Functions are explained   2. 5.2 ***Types of functions*** are explained   3. 5.3 Functions are demonstrated   4. 5.4 Programs using functions and their return values are created |
| 1. Demonstrate Object Oriented Programming | * 1. 6.1 Object oriented programming concepts are explained   2. 6.2 Classes and objects are demonstrated.   3. 6.3 Programs demonstrating inheritance are developed |
| 1. Handle errors in a program | * 1. 7.1 ***Types of errors*** in python are explained   2. 7.2 Catching and raising errors is explained   3. 7.2 Programs using error handing are created |
| 1. Work with files | * 1. 8.1 Opening of files for writing is demonstrated   2. 8.2 Writing to a file is demonstrated   3. 8.3 Closing a file is demonstrated   4. ***8.4 Reading a file*** is demonstrated |
| 1. Demonstrate unit testing skills | * 1. 9.1 Unit test are explained   2. 9.2 Unit test module is identified   3. 9.3 Test cases are built |
| 1. Demonstrate git version control skills | * 1. 10.1 Git version control is explained   2. 10.2 Initializing a git repository is demonstrated   3. 10.3 Adding files to git version control is demonstrated   4. 10.4 Committing files to git version control is demonstrated   5. 10.5 pushing files to a remote repository is demonstrated. |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. **Phases of program development** may include but is not limited to: | * Establish program requirements * Design a program * Coding * Code test and debug * Document * Maintain |
| 1. Key terms used in programming may include but is not limited to: | * Algorithm * Source code * Executable * Compiling * Debugging |
| 1. Types of code may include but is not limited to: | * Source code * Object code * Machine code |
| 1. Python data types may include but is not limited to: | * Integer * Float * Strings * Boolean * Lists |
| 1. Types of statements may include but is not limited to: | * Declaration * Executable |
| 1. Data Operations may include but is not limited to: | * Number operations * String operations |
| 1. Control Structures may include but is not limited to: | * Decision * Looping |
| 1. Types of functions may include but is not limited to: | * User defined * Built in functions * Lambda functions |
| 1. Types of errors may include but is not limited to: | * Index * Value * Key * Syntax * Programmer |
| 1. Reading a file may include but is not limited to: | * Line by line * Multiple line |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management
* Problem solving
* Planning
* Decision Making
* Research

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Programming building blocks
* The Python environment
* Data Operations
* Control Structures
* Functions for problem solving
* Object oriented programming
* Error handling in a program
* Working with files
* Unit testing skills

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| * 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained phases of program development   2. Installed Python   3. Demonstrated understanding of Python environment   4. Created a program to perform data operations   5. Explained different types of control statements   6. Created a program using control statements   7. Created a program using various types of functions   8. **Explained applications of Object-Oriented Programming**   9. Demonstrated classes and objects   10. Demonstrated inheritance   11. Demonstrated handling errors in a program   12. Wrote a unit test for a program   13. Pushed files to a remote repository |
| * 1. Resource Implications for assessment | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| * 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| * 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| * 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY QUANTITATIVE MODELLING SKILLS

**UNIT CODE:** IT/OS/DE/CR/04/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to apply quantitative modelling skills. It involves identifying key quantitative modelling concepts, performing regression modelling, performing linear programming, applying simulation modelling techniques and performing statistical quality control.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| * + - 1. Identify key quantitative modelling concepts | 1. Quantitative modelling is defined 2. ***Key terms*** ***in quantitative modelling*** are explained 3. Quantitative modelling techniques are explained |
| * + - 1. Perform regression modelling | 1. ***Types of regression*** models are explained 2. ***Key assumptions in regression*** are explained 3. Linear regression modeling is illustrated 4. The regression model is evaluated 5. Linear regression models are created to solve real world problems |
| * + - 1. Perform linear programming | 1. Linear programming using graphical method is illustrated 2. Linear programming modelling using simplex method is illustrated 3. Linear programming models are created to solve real world problems |
| * + - 1. Apply simulation modelling techniques | 1. ***Types of simulation models*** are explained 2. Monte Carlo simulation model is illustrated 3. Monte Carlo simulation models are created to solve financial related problems |
| * + - 1. Perform statistical quality control | * 1. Statistical quality control is explained.   2. ***Key terms in statistical quality control*** are explained   3. Quality problems related to manufacturing are specified   4. ***Statistical quality control tools*** are selected and applied to analyse and solve specified quality problem   5. Statistical quality controls are applied in the lean six sigma process |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Key terms in quantitative modelling may include but is not limited to: | * Simulation * Equations * Optimization |
| 1. Types of regression may include but is not limited to: | * Linear regression * Logistic regression * Lasso regression * Ridge regression * Polynomial regression |
| 1. Key Assumptions in regression may include but is not limited to: | * Linear relationship * Multivariate normality * No or little multicollinearity * No auto correlation |
| 1. Types of simulation models may include but is not limited to: | * Monte Carlo * Agent Based * Discrete events * system dynamics |
| 1. Key terms in statistical quality control may include but is not limited to: | * Upper Control Limit * Lower Control Limit * Mean control Limit |
| 1. Statistical quality control tools may include but is not limited to: | * Fishbone diagram * Check sheet * Control chart * Pareto diagram * Scatter diagram * Histogram |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Key quantitative modelling Concepts
* Regression modelling
* Linear programming modelling
* Simulation modelling techniques
* Statistical quality control

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| * 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained modelling   1.2 Explained applications of quantitative modelling  1.3 Explained regression  1.4 Created a regression model  1.5 Explained linear programming  1.6 Created a linear programming model  1.7 Explained simulation modelling  1.8 Created a Monte Carlo simulation model  1.9 Explained statistical quality control  1.10 Specified quality problems related to manufacturing  1.11 Selected and applied statistical quality control tools toanalyse and solve specified quality problem  1.12 Applied statistical quality controls in the lean six sigma process |
| * 1. Resource Implications for assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| * 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| * 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| * 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY PYTHON IN DATA SCIENCE

**UNIT CODE:** IT/OS/DE/CR/05/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to apply Python in Data Science. It involves identifying data science concepts, performing python data processing, performing python data visualization and performing statistical data analysis.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify key data science concepts | * 1. **Data Science is defined**   2. ***Key terms used in data science*** are defined   3. ***Foundations of Data Science*** are explained.   4. ***Data science libraries*** in python are explained   5. ***Data requirements*** are specified from a problem statement   6. Dataset is prepared from specified data requirements. |
| 1. Perform Python data processing | * 1. Python scientific libraries are installed   2. Choice of scientific libraries to use in python data processing is are explained   3. ***Data formats*** is imported using pandas   4. Exploratory Data Analysis is demonstrated.   5. Data formatting and ***data type conversions*** are demonstrated.   6. Data cleaning is demonstrated using the dataset   7. ***Pandas operations*** are demonstrated using the dataset. |
| 1. Perform Python data visualization | 3.1 Visualizations are explained.   * 1. ***Types of data visualizations*** are demonstrated.   2. Sub plots are created from given data   3. Addition of ***elements of visualizations*** is demonstrated.   4. Data visualizations using Matplotlib and seaborn are created using the dataset. |
| 1. Perform statistical data analysis | * 1. 4.1 ***Types of statistics*** are explained   2. Descriptive statisticsmeasuresare demonstrated.   3. 4.3 Inferential statisticsmeasures are demonstrated   4. 4.4 Data Science blog is published from the dataset analysis and visualizations. |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Key terms used in data science may include but is not limited to: | * Dataset * Data mining * Data visualization * Data wrangling * Business intelligence * Data modelling * Data governance |
| 1. Foundations of Data Science may include but is not limited to: | * Statistics * Linear algebra * Calculus * Programming * Databases * Research * Computer networks |
| 1. Data science libraries may include but is not limited to: | * NumPy * Pandas * Matplotlib * Seaborn * SciPy * Stats models |
| 1. Data requirements may include but is not limited to: | * Sources * Users * Type * Format |
| 1. Data formats may include but is not limited to: | * Excel files * SQL files * CSV files * JSON * HDFS |
| 1. Data type conversions may include but is not limited to: | * Integer * Float * Strings * Datetime * Categorical * ND-array |
| 1. Pandas operations may include but is not limited to: | * Dropping rows and columns * Indexing columns * Slicing data frames * Sorting * Grouping and melting * Concatenating, merging and joining data frames * Pivoting Data |
| 1. Types of data visualizations may include but is not limited to: | * Histograms * Bar graphs * Line plots * Scatter plots * Pie charts * Box plots |
| 1. Elements of visualizations may include but is not limited to: | * Title * Legend/ key * Axis labels * Annotations |
| 1. Types of statistics may include but is not limited to: | * Descriptive * Inferential |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Key data science concepts
* Python data processing
* Python data visualization
* Statistical data analysis

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained foundations of data science   2. Specified data requirements from a problem statement   3. Explained data science libraries in python.   4. Imported data in various formats using pandas   5. Conducted Exploratory Data Analysis.   6. Performed data cleaning from a dataset   7. Demonstrated Pandas operations using a dataset   8. Created different types of data visualizations using Matplotlib and Seaborn from the dataset   9. Created sub plots from the dataset.   10. Differentiated descriptive and inferential of statistics   11. Published a data science blog from the dataset analysis and visualization |
| 1. Resource Implications for assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DESIGN AND DEVELOP DATABASES AND DATA WAREHOUSES

**UNIT CODE:** IT/OS/DE/CR/06/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate designing and development of databases and data warehouses. It involves identifying key database concepts, designing a relational database from given requirements, using Structured Query Language to implement a database design, designing a data warehouse and implementing a data warehouse

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify key Database concepts | 1. **Databases are explained** 2. Key concepts in relational modelling are explained 3. Relational Database Management Systems (RDBMSs) products are compared 4. Installation of MS SQL server is demonstrated 5. MS SQL server interface is explained 6. Properties of MS SQL server database are explained 7. RDBMS product for a simulated environment is prescribed 8. Object Relational Mappers are illustrated |
| 1. Design a relational Database from given requirements | 1. ***Phases of database design*** are explained 2. Entity modeling is illustrated using Unified Modelling Language (UML) notation 3. Normalisation is demonstrated 4. Validation of the Entity Relationship (ER) model is done according to the requirements |
| 1. Use Structured Query Language to implement database design | 1. Structured Query Language (SQL) is explained 2. ***Data definition queries*** are explained 3. Creation of tables using the SQL CREATE TABLE statement is demonstrated 4. ***CREATE TABLE statement constraints*** are demonstrated 5. The table schema is edited using the SQL ALTER statement 6. A table is dropped using the SQL DROP TABLE statement 7. ***Data manipulation query statements*** are demonstrated. 8. SQL joins are explained 9. Database is created and queried from validated ER model 10. A simple join is created from the database |
| 1. Design a data warehouse | * 1. Data warehousing is explained   2. Online Analytical Processing (OLAP) is illustrated   3. Online Transaction Processing (OLTP) is illustrated   4. ***Data warehouse schemas*** are designed from a set of requirements |
| 1. Implement a Data warehouse Design | * 1. Data Mining Query Language (DMQL) is explained   2. Cubes and dimension tables are created using schema specifications   3. Extract Transform Load (ETL) operations are performed from the created data warehouse |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Phases of database design may include but is not limited to: | * Conceptual design * Logical design * Physical design |
| 1. Data definition queries may include but is not limited to: | * CREATE * DROP * ALTER |
| 1. CREATE TABLE statement constraints may include but is not limited to: | * Primary key * Foreign key * UNIQUE * CHECK * NOT NULL * DEFAULT |
| 1. Data manipulation query statements may include but is not limited to: | * INSERT * SELECT * UPDATE * DELETE |
| 1. Data warehouse schemas may include but is not limited to: | * Star * Snowflake * Fact Constellation Schema |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Database concepts
* Relational Database Design
* Using Structured Query Language
* Designing a data warehouse
* Implementing a data warehouse design

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Prescribed RDMBS product as per user requirements 2. Installed MS SQL server 3. Explained relational modelling concepts 4. Illustrated object relational mappers 5. Created an entity relationship model 6. Normalized database tables 7. Validated an ER model 8. Used SQL to create, edit and drop tables 9. Used SQL to add, retrieve, update and delete records from tables. 10. Designed data warehouse schemas from a set of requirements 11. Used DMQL to implement data warehouse schemas 12. Demonstrated data warehouse ETL operations |
| 1. Resource Implications for competence assessment | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Oral questioning 2. Practical demonstration 3. Observation 4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEVELOP MACHINE LEARNING APPLICATIONS USING PYTHON

**UNIT CODE:** IT/OS/DE/CR/07/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to develop machine learning applications. It involves identifying concepts of machine learning, developing classification-based applications, developing regression-based applications, developing clustering based applications, applying ensemble learning techniques, using cross validation to optimize machine learning methods and demonstrating model deployment skills

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify key concepts of machine learning | * 1. **Machine learning is explained**   2. ***Key terms used in Machine learning*** are defined   3. Importance of data preparation is explained.   4. ***Foundations of machine learning*** are explained   5. ***Types of machine learning*** are explained.   6. Applications of machine learning are explained   7. Scikit-learn library is explained   8. Prescribe real life application areas of machine learning. |
| 1. Develop classification-based applications | * 1. Classification is explained   2. Features and targets are identified from given data   3. ***Data preprocessing*** is demonstrated from given data   4. Fitting a classifier is demonstrated   5. Predictions are demonstrated   6. ***Evaluation*** ***of the classifier*** is demonstrated.   7. Saving the classifier is demonstrated   8. Classifiers are created using given data |
| 1. Develop regression-based applications | * 1. Regression is explained   2. Features and targets are identified from given data   3. Data preprocessing is demonstrated.   4. Fitting a regressor is demonstrated   5. Predictions are demonstrated   6. Evaluation of the regressor is demonstrated.   7. Saving the regressor is demonstrated   8. Regressors are created using given data |
| 1. Develop clustering-based applications | * 1. Clustering is explained   2. Clusters are identified from given data   3. Data preprocessing is demonstrated.   4. Fitting a cluster is demonstrated   5. Predictions are demonstrated   6. Evaluation of the cluster is demonstrated.   4.7 Saving the classifier is demonstrated  4.8 Clusters are created using given data |
| 1. Apply ensemble learning techniques | 1. Ensemble learning is explained. 2. Ensemble learning methods are compared 3. Advantages and disadvantages of ensemble learning are explained 4. Ensemble learning in regression and classification are demonstrated using given data 5. Ensemble learning regressor and classifier are evaluated |
| 1. Use cross validation to optimize machine learning methods | 1. Cross validation is defined 2. ***Cross validation techniques*** are illustrated 3. Cross validation is demonstrated using given data 4. Hyper parameter tuning is demonstrated using GridSearchCV |
| 1. Demonstrate model deployment skills | * 1. Flask is installed   2. ***HTTP methods*** and JSON are explained.   3. Serialization and deserialization of data is explained   4. Connecting to a database is demonstrated.   5. Deploying a saved model on Heroku is demonstrated. |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Key terms used in Machine learning may include but is not limited to: | * Train * Predict * Features * Labels * Encoding * Overfitting and under fitting * Bias-variance trade-off |
| 1. Foundations of machine learning may include but is not limited to: | * Math * Programming * Databases |
| 1. Types of machine learning may include but is not limited to: | * Supervised * Unsupervised |
| 1. Data pre-processing may include but is not limited to: | * Label encoding * Scaling * Cleaning data * Feature extraction |
| 1. Evaluation of the classifier may include but is not limited to: | * Accuracy * Precision * Recall * F1 score |
| 1. Evaluation of the regressor may include but is not limited to: | * Root mean squared error * Mean absolute error * R2 |
| 1. Evaluation of the cluster may include but is not limited to: | * Accuracy * F1 score |
| 1. Cross validation techniques may include but is not limited to: | * K-fold * Stratified K-fold * Leave one out cross validation (LOOCV) |
| 1. HTTP methods may include but is not limited to: | * GET * PUT * POST * DELETE |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Key concepts of machine learning
* Classification based applications
* Regression based applications
* Clustering based applications
* Ensemble learning techniques
* Cross validation to optimize machine learning methods
* Model deployment skills

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained machine learning   2. Explained the foundations of machine learning   3. Explained the Scikit-learn library   4. Identified features and targets   5. Created a classifier using given data   6. Explained Regression   7. Created a regressor using given data   8. Clustering is explained   9. Created a cluster using given data   10. Demonstrated ensemble learning in regression and classification using given data   11. Illustrated cross validation techniques   12. Demonstrated cross validation using given data   13. Demonstrated hyper parameter tuning using GridSearchCV   14. Deployed a machine learning model on Heroku. |
| 1. Resource Implications for competence assessment | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

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# DEMONSTRATE DATA MINING AND ANALYTICS SKILLS IN BIG DATA MANAGEMENT

**UNIT CODE:** IT/OS/DE/CR/08/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate data mining and analytics skills in big data management. It involves identifying key concepts of data mining and Big Data, applying data mining techniques, visualising real world big data problems, managing Big data using Hadoop and recognising ethical, social and legal issues in computing and Big Data.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify key concepts of data mining and Big data | * 1. Data mining concept is explained   2. Architecture of data mining is illustrated   3. Data mining process is illustrated   4. Applications of data mining are cited   5. Target mining data is sourced and pre-processed.   6. Big Data Concept is explained   7. Big data analytics areas in business are prescribed |
| 1. Apply data mining techniques | * 1. Mining technique is selected on the basis of given data characteristics   2. ***Data mining software tool*** is selected   3. Classification technique is demonstrated from a given dataset   4. Regression technique is demonstrated from a given dataset   5. Clustering technique is demonstrated from a given dataset |
| 1. Visualize real world big data problems | 3.1 ***Big Data visualization tools*** are identified  3.2 Visualization using Ms Excel is demonstrated from a given dataset  3.3 Visualization using Ms PowerBi is demonstrated from a given dataset |
| 1. Manage Big data using Hadoop | * 1. Hadoop framework is explained   2. Hadoop Environment set up is demonstrated   3. ***Hadoop File System (HDFS) operations*** are demonstrated using Python   4. Hadoop Processing using MapReduce is demonstrated using Python |
| 1. Recognize ethical, social and legal issues in computing and Big Data | * 1. Computing ethics is explained   2. Legal and ethical issues are classified based on guidelines of regulatory bodies   3. Social issues and emerging trends in computing are explained   4. Big data ethics concerns and principles are explained |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Data mining software tool may include but are not limited to: | * Python * R * Microsoft Power Bi * SaaS * Tableau * ACL * Idea * Orange * Weka * Apache Mahout * Oracle data Mining * Rattle * DataMelt |
| 1. Big data visualization tools may include but are not limited to: | * Python * R * Microsoft Power Bi * SaaS * Oracle Visual Analyser * Tableau * Google Chart |
| 1. Hadoop File System (HDFS) operations may include but is not limited to: | * Listing Files * Inserting data * Retrieving data |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required Knowledge**

* The individual needs to demonstrate knowledge of:
* Key concepts of data mining and analytics
* Data mining techniques
* Visualizing real world big data problems
* Managing Big data using Hadoop

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained the Data mining concept   2. Illustrated the data mining architecture   3. Explained the process of data mining.   4. Explained the Big Data Concept.   5. Prescribe application areas for data mining and big data.   6. Demonstrated classification technique from a given dataset using Python   7. Demonstrated regression technique from a given dataset using Python   8. Demonstrated clustering technique from a given dataset using Python   9. Demonstrated various forms of visualizations from a given dataset using Python   10. Demonstrated various forms of visualizations using PowerBI from a given dataset using Python   11. Explained the Hadoop framework   12. Demonstrated Hadoop Environment set up   13. Demonstrated Hadoop File System (HDFS) operations using Python   14. Demonstrated Hadoop Processing using MapReduce using Python   15. Classified legal, social and ethical issues based on guidelines of regulatory bodies   16. Explained ethical concerns arising from using big data |
| 1. Resource Implications for competence assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE PROJECT MANAGEMENT SKILLS FOR DATA SCIENCE

**UNIT CODE:** IT/OS/DE/CR/09/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to demonstrate project management skills for data science. It involves identifying concepts in project management, demonstrating business understanding using CRISP-DM, demonstrating data understanding using CRISP-DM, demonstrating data preparation skills using CRISP-DM, demonstrating data modelling and evaluation skills using CRISP-DM and deploying data mining model using CRISP-DM.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify concepts in project management | * 1. Project management is explained   2. ***Project management methodologies*** in data science are explained   3. ***Project management software*** features are compared   4. Appropriate project management software and methodology are selecting |
| 1. Demonstrate business understanding using CRISP-DM | * 1. Desired outputs of the project are identified   2. The current situation is assessed   3. Goals of data mining are identified   4. A project plan is created using selected project management software |
| 1. Demonstrate data understanding using CRISP-DM | 3.1 Data collection is performed  3.2 Data description is performed  3.3 Data exploration is performed  3.4 Verification of data quality is performed   * 1. Data quality report is prepared |
| 1. Demonstrate data preparation skills using CRISP-DM | 4.1 Data selection is demonstrated  4.2 Data cleaning is performed  4.3 Data construction is demonstrated  4.4 Data integration is performed |
| 1. Demonstrate data modelling and evaluation skills using CRISP-DM | 1. Model selection is performed 2. Test metrics are identified 3. Model building is demonstrated 4. Model assessment is performed 5. Process review is demonstrated 6. Next steps are determined |
| 1. Deploy data mining model using CRISP-DM | 6.1 Model deployment plan is created  6.2 Monitoring and maintenance plan is created  6.3 Final project report is created and reviewed. |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. **Project management methodologies** may include but not limited to: | * Kanban * Scrum * Waterfall * Research and Development * Agile * CRISP-DM |
| 1. Project management software may include but not limited to: | * Jira * Asana * Trello * Microsoft project * Pivotal tracker |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Project management concepts
* Business understanding using CRISP-DM
* Data understanding using CRISP-DM
* Data preparation skills using CRISP-DM
* Data modelling and evaluation skills using CRISP-DM
* Deploying data mining model using CRISP-DM

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained project management methodologies in data science   2. Selected appropriate project management software   3. Identified desired outputs of the project   4. Assessed the current situation   5. Identified data mining goals   6. Created a project plan using the selected project management software   7. Performed data exploration   8. Prepared a data quality report   9. Performed data cleaning, construction and integration   10. Selected model design and test metrics   11. Built and assessed the model design   12. Reviewed the model design and determined the next steps   13. Created a model deployment plan   14. Created a monitoring and maintenance plan   15. Created and reviewed the final project report |
| 1. Resource Implications for competence assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DEMONSTRATE RESEARCH SKILLS FOR DATA SCIENCE

**UNIT CODE:** IT/OS/DE/CR/10/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required demonstrate research skills for data science. It involves identifying foundational research concepts, selecting and using data collection methods, organising collected data using a statistical software tool, analysing research data using a statistical software tool and presenting and reporting of research findings.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify foundational research concepts | 1. Key foundational research concepts are explained 2. ***Types of data*** are explained 3. ***Levels of measurements*** *are explained* 4. ***Sources of data*** are explained 5. Different sources of data are recommended for a given research assignment. |
| 1. Select and use data collection methods | 1. ***Methods of data* *collection*** are explained 2. An interview instrument is developed 3. A questionnaire instrument is developed 4. Data collection process is demonstrated |
| 1. Organize collected data using a statistical software tool | 1. ***Types of data*** in data organization are identified 2. ***Data organization methods*** are demonstrated from the collected data 3. Features of ***statistical software tools*** are compared 4. A codebook is developed using R 5. Data entry is performed using the codebook 6. ***Data cleaning*** is demonstrated using R |
| 1. Analyse research data using a statistical software tool | * 1. Data is summarized usingdescriptive statistics in R   2. Data is summarized using Inferential statistics in R   3. Different ***types of visualizations*** are created using R |
| 1. Presentation and reporting of research findings | * 1. ***Methods of data presentation*** are explained   2. Data is presented using various methods of data Presentation   3. Research reports are generated using R outputs |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Types of data may include but is not limited to: | * Quantitative * Qualitative |
| 1. Levels of measurements may include but is not limited to: | * Nominal * Ordinal * Interval * ratio |
| 1. Sources of data may include but is not limited to: | * primary source * secondary source |
| 1. Methods of data collection may include but is not limited to: | * Observation * Interviews * Questionnaires * Experiments |
| 1. Types of data organization may include but is not limited to: | * Structured data * Unstructured data |
| 1. Data organization methods may include but is not limited to: | * Location * Alphabetical organization * Time * Hierarchy * Category |
| 1. Statistical software tools may include but is not limited to: | * SPSS * R (R Foundation for Statistical Computing) * Matlab * Microsoft Excel * SAS |
| 1. Data cleaning may include but is not limited to: | * Removing duplicates * Removing outliers * Sorting |
| 1. Types of Data visualization may include but is not limited to: | * Bar Chart * Line Graph * Histogram * Pie Chart * Scatter Plot |
| 1. Methods of data presentation may include but is not limited to: | * Textual * Tabular * Graphical |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Foundational research concepts
* Research data collection
* Organizing research data using a statistical software tool
* Analysing research data using a statistical software tool
* Presentation and reporting of research findings

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   1. Explained types of data 2. Recommended sources of data for a research assignment 3. Explained methods of data collection 4. Demonstrated data collection process 5. Developed interview and questionnaire instruments for a research assignment. 6. Administered interview and questionnaire instruments 7. Compared features of statistical software tools 8. Developed a codebook using R 9. Performed data entry using R 10. Performed data cleaning using R 11. Generated descriptive and inferential statistics from an R dataset 12. Generated visualizations using the dataset 13. Demonstrated textual methods of data presentation 14. Demonstrated tabular and graphical methods of data presentation using R 15. Created a presentation of key research outputs 16. Generated a report on research findings |
| 1. Resource Implications for competence assessment | The following resources should be provided:   * 1. Access to relevant workplace or appropriately simulated environment where assessment can take place   2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Oral questioning 2. Practical demonstration 3. Observation 4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# DESIGN AND IMPLEMENT CLOUD DATA BASE SOLUTIONS

**UNIT CODE:** IT/OS/DE/CR/11/6/A

**UNIT DESCRIPTION**

This unit covers the competencies required to design and implement cloud database solutions. It involves identifying key concepts of cloud computing, designing and implementing database solutions for SQL Server, monitoring and troubleshooting database implementation in Azure.

| **ELEMENT**  These describe the **key outcomes** which make up **workplace function**. | **PERFORMANCE CRITERIA**  These are **assessable** statements which specify the required level of performance for each of the elements.  ***(Bold and italicized terms are elaborated in the range.)*** |
| --- | --- |
| 1. Identify key concepts of cloud computing | * 1. Cloud computing is explained   2. Cloud computing architecture is explained   3. ***Cloud computing* *technologies*** are illustrated   4. ***Cloud computing deployment models*** are illustrated   5. ***Cloud computing service models*** are illustrated   6. ***Cloud service providers*** are outlined by service category   7. Advantages and disadvantages of cloud solutions are explained.   8. Deployment and service models are prescribed for a simulated organisation |
| 1. Design and implement database solutions for SQL Server and Microsoft Azure | * 1. Microsoft Azure is explained   2. Azure account is created   3. ***Azure components*** are illustrated   4. A SQL server database solution on Azure is developed   5. SQL Server on Azure virtual machines is implemented   6. Other virtual machine types are demonstrated |
| 1. Manage, design and implement database security and privacy | * 1. ***SQL Server Database security issues*** are explained   2. Security authentication and authorization requirements are specified.   3. SQL Server authentication and authorization is implemented   4. ***Azure SQL Database security capabilities*** are explained   5. Azure SQL Database security capabilities are implemented |
| 1. Monitor and Troubleshoot Database implementation in Azure | * 1. Resources that need monitoring on Azure SQL database are identified.   2. Database performance problems are diagnosed   3. Monitoring tools are selected and configured |

**RANGE**

This section provides work conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

| **Variable** | **Range** |
| --- | --- |
| 1. Cloud computing technologies may include but not limited to: | * Virtualization * Grid computing * Utility computing |
| 1. Cloud computing deployment models may include but not limited to: | * Public * Private * Hybrid * Community |
| 1. Cloud computing service models may include but not limited to: | * Infrastructure * Platform * Software * Identity * Network |
| 1. Cloud service providers may include but not limited to: | * Infrastructure as a Service(IaaS) * Amazon web Services * Google Cloud Platform (GCP) * AT&T * Microsoft Azure Cloud * CA Technologies * Cloudscaling. * DATAPIPE * Eucalyptus Systems. * HP * Platform as a Service (PaaS) * Amazon web Services – AWS Elastic Beanstalk * Microsoft Azure Cloud * Google Cloud Platform (GCP) * Appistry – CloudQ Platform. * App Scale * CA technologies * Engine Yard * Flexi Scal. * Software as a Service (SaaS) * Abiquo * Akamai. * App Dynamics * Cloud Switch * CloudTran * Eloqua * Software as a Service (SaaS) * Google Cloud Platform (GCP) |
| 1. Azure components may include but is not limited to: | * + Data Management   + Networking   + Identity and Access   + Caching   + Big Data and Big Compute   + Mobile Service   + Back Up   + Media   + Commerce |
| 1. SQL Server Database security issues may include but not limited to: | * + Authentication   + Authorisation |
| 1. Azure SQL Database security capabilities may include but not limited to: | * + Access management   + Authentication   + Data protection   + Monitoring, logging and auditing   + Network security |

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Time management;
* Problem solving;
* Planning;
* Decision Making;
* Research;

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Key concepts of cloud computing
* Designing and implementing database solutions for SQL Server and Microsoft Azure
* Managing, designing and implementing database security and privacy
* Monitoring and troubleshooting Database implementation in Azure

**EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Explained cloud computing architecture   2. Illustrated cloud computing technologies   3. Illustrated cloud computing deployment models   4. Illustrated Cloud computing service models   5. Prescribed deployment and service models for a simulated organization   6. Created an account on the Azure portal   7. Developed an SQL server database   8. Implemented SQL server on Azure virtual machines   9. Implemented other virtual machines   10. Implemented SQL server authentication and authorization   11. Implemented Azure SQL server database security capabilities   12. Diagnosed database performance problems   13. Selected and configured appropriate database monitoring tools |
| 1. Resource Implications for competence assessment | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Oral questioning   2. Practical tests   3. Observation   4. Written test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. Off-the-job 3. In work placement (attachment)   Off the job assessment must be undertaken in a closely simulated workplace environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |