

**REPUBLIC OF KENYA**

**OCCUPATIONAL STANDARDS**

**FOR**

**SOFTWARE DEVELOPER**

**KNQF LEVEL 5**

**PROGRAMME CODE: 0613 444A**

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# FOREWORD

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

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

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

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

# PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, middle-income country providing 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 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 worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 and the Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya, emphasized the need toreform 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.

This curriculum has been developed in adherence to the Kenya National Qualification Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

I am grateful to the Council Members, Council Secretariat, …….. NSSC, expert workers and all those who participated in the development of this curriculum.

# ACKNOWLEDGEMENT

This Occupational Standards has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the occupational standards, significant involvement and support was received from industry and various organizations.

I appreciate National ICT Sector Skills Committee who enabled the development of this curriculum. I recognize with appreciation the role of the SSC in ensuring that competencies required by the industry are addressed in this occupational standards.

I also thank all stakeholders in the ICT sector for their valuable input and all those who participated in the process of developing this occupational standards.

I am convinced that this occupational standards will go a long way in ensuring that workers in ICT sector will acquire competencies that will enable them perform their work more efficiently.

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# ACRONYMS AND ABBREVIATIONS

HTTP Hypertext Transfer Protocol

ICT Information Communication Technology

KNQF Kenya National Qualification Framework

TVET Technical and Vocational Education and Training

QAI Qualification Awarding Institution

ISCED International Standard Classification of Education

# KEY TO UNIT CODE

XX X X XXX X X

ISCED level, Programme Orientation and Level of Completion

Unit of Competence Number

Number

Version Control

Sector/Industry

Sub Sector

Occupational Area

# OCCUPATIONAL STANDARDS OVERVIEW

This Software Developer level 5 Occupational Standard consists of competencies that a person must achieve to enable him/her to carry out software development. A person with this qualification would carry out the following responsibilities; establishing software system requirements, managing database systems, offering application end-user support, and creating web applications ensuring their readiness for the dynamic ICT sector.

These responsibilities comprise the units of competency of a software developer certificate level 6 which include the following basic, common and core competencies:

**SUMMARY OF UNITS OF COMPETENCY**

|  |  |
| --- | --- |
| **UNIT CODE** | **UNIT NAME** |
| **BASIC UNITS OF COMPETENCY** | |
| 0413 441 01A | APPLY ENTREPRENEURIAL SKILLS |
| 0417 441 02A | APPLY WORK ETHICS AND PRACTICES |
| **COMMON UNITS OF COMPETENCY** | |
| 0611 441 03A | APPLY COMPUTER APPLICATIONS |
| 0541 451 04A | DISCRETE MATHEMATICAL CONCEPTS |
| 0688 451 05A | APPLY PROJECT MANAGEMENT PRINCIPLES |
| 0613 451 06A | APPLY STRUCTURED PROGRAMMING |
| **CORE UNITS OF COMPETENCY** | |
| 0611 451 07A | ESTABLISH SOFTWARE SYSTEM REQUIREMENTS |
| 0611 451 08A | OFFER APPLICATION END-USER SUPPORT |
| 0612 451 09A | MANAGE COMPUTERIZED DATABASE SYSTEMS |
| 0613 451 10A | CREATE WEB APPLICATION |
|  | INDUSTRY TRAINING |

# BASIC UNITS OF COMPETENCY

## APPLY ENTREPRENEURIAL SKILLS

**UNIT CODE:** 0413 441 01A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT**  These describe the key outcomes that make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements that specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in Range*** |
| --- | --- |
|
| 1. Apply Financial Literacy Skills | 1. **Sources of personal and business** ***funds*** are identified as per financial procedures and standards |
| 1. Personal finances are managed as per financial procedures and standards |
| 1. Savings are managed as per financial procedures and standards |
| 1. Debts are managed as per financial procedures and standards |
| 1. Investments are undertaken as per financial procedures and standards |
| 1. Insurance services are procured as per financial procedures and standards |
| 1. Apply entrepreneurial concept | 1. Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship |
| 1. ***Types of entrepreneurs*** are identified as per principles of entrepreneurship |
| 1. Ways of becoming an entrepreneur are identified as per principles of Entrepreneurship |
| 1. ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship |
| 1. Salaried employment and self-employment are distinguished as per principles of entrepreneurship |
| 1. ***Requirements for entry into self-employment*** are identified according to business procedures and standards |
| 1. Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards |
| 1. **Contributions of entrepreneurship** to National development are identified as per business procedures and standards |
| 1. Identify entrepreneurial opportunities | 1. Business ideas are identified as per business procedures and standards |
| 1. Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards |
| 1. Entrepreneurial opportunities are evaluated as per business procedures and standards |
| 1. Business ideas and opportunities are generated as per business procedures and standards |
| 1. Business life cycle is analyzed as per business procedures and standards |
| 1. Apply business legal aspects | 1. ***Forms of business ownership*** are identified as per legal procedures and practices |
| 1. Business Registration and Licensing processes are identified as per legal procedures and practices |
| 1. Types of Contracts and Agreements are analyzed as per legal procedures and practices |
| 1. Employment Laws are identified as per legal procedures and practices |
| 1. Taxation laws are identified as per legal procedures and practices |
| 1. Innovate Business strategies | 1. Business innovation strategies are determined by the organization standards |
| 1. Creativity in business development is demonstrated in accordance with business standards |
| 1. ***Innovative business standards*** are developed as per business principles |
| 1. Linkages with other entrepreneurs are created as per best practice |
| 1. ICT is incorporated in business growth and development as per best practice |
| 1. Develop Business Plan | 1. Business idea is described as per business procedures and standards |
| 1. Business description is developed as per business plan format |
| 1. Marketing plan is developed as per business plan format |
| 1. Organizational/Management plan is prepared in accordance with business plan format |
| 1. Production/operation plan is prepared in accordance with business plan format |
| 1. Financial plan is prepared in accordance with the business plan format |
| 1. Executive summary is prepared in accordance with business plan format |
| 1. Business plan is presented as per best practice |
| 1. Business ideas are incubated as per institutional policy. |

**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. Sources of personal funds mayinclude but not limited to: | * Salary/Wages * Investments * Savings * Inheritance * Government Benefits |
| 1. Sources of business finance mayinclude but not limited to: | * Equity Financing * Debt Financing, * Personal Savings/Investment * Retained Earnings * Grants and Subsidies * Crowdfunding * supplier Credit: * Leasing and Asset Financing: |
| 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. Forms of businesses ownership may include but not limited to: | * Sole proprietorship * Partnership * Limited companies * Cooperatives |
| 1. Innovative business standards 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 standards
* 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 standards
* Market and feasibility studies
* Government and regulatory processes
* Local and international business environment
* Relevant developments in other industries
* Regional/ County business expansion standards

**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 Sources of personal and business finance as per financial procedures and standards 2. Managed Personal finances as per financial procedures and standards 3. Made Investment decisions as per financial procedures and standards 4. GeneratedBusiness ideas and opportunities based on business procedure and standards 5. Analyzed business life cycle based on business procedure and standards 6. Determined business innovative standards as per business principles 7. Developed and presented a business plan as per regulatory framework. |
| 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. Written tests 2. Oral questions 3. Third party report 4. Interviews 5. Portfolio |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY WORK ETHICS AND PRACTICES

**UNIT CODE:** 0417 441 02A

**UNIT DESCRIPTION**

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

**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 Range*** |
| --- | --- |
|
| 1. Apply self-management skills | 1. Personal vision, mission and goals are formulated based on potential and concerning organization objectives and strategic plan |
| 1. Self-esteem and a positive self-image are developed and maintained based on value |
| 1. Emotional intelligence and stress management are demonstrated as per workplace requirements. |
| 1. Assertiveness is developed and maintained based on the requirements of the job. |
| 1. Accountability and responsibility for one's actions are demonstrated based on workplace instructions. |
| 1. Time management, attendance and punctuality are observed as per the organization’s policy. |
| 1. Personal goals are managed as per the organization’s objective |
| 1. Self-strengths and weaknesses are identified based on personal objectives |
| 1. Motivation, initiative and proactivity are utilized as per the organization policy |
| 1. Individual performance is evaluated and monitored according to the agreed targets. |
| 1. Promote ethical work practices and values | 1. Integrity is demonstrated as per acceptable norms |
| 1. Codes of conduct is applied as per the workplace requirements |
| 1. Policies and guidelines are observed as per the workplace requirements |
| 1. Professionalism is exercised in line with organizational policies |
| 1. Promote Team work | * 1. ***Teams*** are formed to enhance productivity based on organization’s objectives |
| * 1. Duties are assigned to teams under the organization policy. |
| * 1. Team activities are managed and coordinated as per set objectives. |
| * 1. Team performance is evaluated based on set targets as per workplace policy. |
| * 1. Conflicts are resolved between team members in line with organization policy. |
| * 1. Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy. |
| * 1. Healthy relationships are developed and maintained in line with the workplace. |
| * 1. Adaptability and flexibility are applied in dealing with team members as per workplace policies |
| 1. Maintain professional and personal development | * 1. Personal growth and development needs are identified and assessed in line with the requirements of the job. |
| * 1. Training and career opportunities are identified and utilized based on job requirements. |
| * 1. Resources for training are mobilized and allocated based on organizations and individual skills needs. |
| * 1. Licenses and certifications relevant to the job and career are obtained and renewed as per policy. |
| * 1. Recognitions are sought as proof of career advancement in line with professional requirements. |
| * 1. Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives. |
| * 1. Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | * 1. ***Creative, innovative*** and practical solutions are developed based on the problem |
| * 1. Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job. |
| * 1. Team problems are solved as per the workplace guidelines |
| * 1. Problem-solving strategies are applied as per the workplace guidelines |
| * 1. Problems are analysed and assumptions tested as per the context of data and circumstances |
| 1. Promote Customer Care | * 1. Customers' needs are identified based on their characteristics   2. Customer feedback is allowed and |
| * 1. facilitated in line with organization policies. |
| * 1. Customer concerns and complaints are analyzed and resolved in line with the set organizational culture. |
| * 1. Proactive customer outreach programs are implemented as per organizational policies |
| * 1. Customer retention strategies are developed and implemented in line with the organizational policy |

**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. Feedback may include but not limited to: | * Verbal * Written * Informal * Formal |
| 1. Conflicts include but are not limited to: | * Interpersonal Conflict. * Intrapersonal Conflict. * Intergroup Conflict. * Intragroup Conflict. |
| 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. Team may include but not limited to: | * Small work group * Staff in a section/department * Inter-agency group * Virtual teams |
| 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 * Capacity building |
| 1. Resource may include may but not limited to: | * Human * Financial * Technology |
| 1. Creative and innovative 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: | * Artificial Intelligence * Data confidentiality * National cohesion * Open offices |

**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:

* Active listening
* Critical thinking
* Organizational
* Negotiation
* Monitoring
* Evaluation
* Problem solving
* Decision Making
* Leadership
* Creative/innovative thinking
* Adaptability
* Conflict management
* Emotional intelligence
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Work values and ethics
* Company policies and procedures
* Company operations, procedures and standards
* Flexibility and adaptability
* Concept of time and leisure time
* Decision making
* Work planning
* Organizing work
* Monitoring and evaluation
* Record keeping
* Gender and diversity mainstreaming
* Drug and substance abuse
* Professional growth and development
* creativity
* Innovation
* problem solving
* customer care
* mentoring and coaching.
* 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 require evidence that the candidate:   * 1. Applied self-management skills as per organizational procedures.   2. Promoted ethical practices and values as per organizational procedures.   3. Promoted Teamwork as per workplace assignments.   4. Maintained professional and personal development as per organizational procedures.   5. Applied Problem-solving skills based on work requirements.   6. Identified customer needs based on their characteristics.   7. Gave back Customer feedback in line with organization policies. |
| 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. 3. Resources 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. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# COMMON UNITS OF COMPETENCY

## APPLY COMPUTER APPLICATIONS

**UNIT CODE:** 0611 441 03A

**UNIT DESCRIPTION**

This unit covers the competencies in applying computer applications. It involves the ability to: perform word processing, operate spreadsheet program, prepare PowerPoint presentation, perform document production and manage online resources.

**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. Perform word processing | * 1. Ergonomics risk factors observed as per work place procedures |
| * 1. Word document is created as per work requirements |
| * 1. Tables are created and manipulated as per work requirements |
| * 1. Mail merging is performed as per work requirements |
| * 1. ***Word processing Objects*** are inserted as per user requirements |
| * 1. List of figures and table of content are generated as per user requirements |
| 1. Operate spreadsheet programs | 1. Spreadsheet workbook is created as per work requirements |
| 1. Cell referencing is performed as per task requirements |
| 1. Formula and ***functions*** are applied as per work requirements |
| 1. Charts are generated as per work requirements |
| 1. Prepare Power point presentation | 1. Power-point slides are created as per work requirements |
| 1. ***Presentation views*** are exhibited as per work requirements |
| 1. Animations and transitions are performed as per work requirements |
| 1. Slideshow is Presented as per work requirements |
| 1. Perform document production | 1. Document is printed as per user specifications |
| 1. Documents are scanned as per user specifications |
| 1. Documents are duplicated as per user specifications |
| 1. Manage online Resources | 1. Online file transfer is performed as per work requirements |
| 1. ***Online document processing*** is performed as per work |
| requirements   1. ***Online collaboration*** is performed as per task 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. Word Processing Objects may include but are not limited to: | * Picture * Shapes * Table * Charts |
| 1. Functions may include but are not limited to: | * Sum * Count * Average * Max * Min * Rank |
| 1. Presentation views may include but are not limited to: | These are the methods used to show the presentation to the audience.   * Outline * Normal * Slide sorter * Notes page * Reading view |
| 1. Online document processing may include but is not limited to: | Is the use of web-based applications or platforms to create, edit, store, share and collaborate on various types of documents.   * Online data entry * File conversion * Google documents * E- tasks |
| 1. Online collaboration: This may include but not limited to: | These are the online web-based tools and services performed   * Video conferencing * Chatting * Cloud computing * Social media * Online calendar * Mailing |

**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 skills
* Evaluation skills
* Problem solving skills
* Time management

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Social media
* Online storage
* Online meetings
* Online data entry
* E-tasks

**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. Created a word document 2. Inserted objects 3. Performed mail merging 4. Created a table of contents 5. Created a workbook 6. Performed cell referencing 7. Created formula and functions 8. Generated charts 9. Created slides 10. Made a presentation 11. Created animations and transitions 12. Printed a document 13. Scanned a document 14. Duplicated a document 15. Transferred a file online 16. Processed a document online 17. Performed online collaboration |
| 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. Demonstration   2. Practical assignment   3. Oral Questioning   4. Written Test |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY DISCRETE MATHEMATICAL CONCEPTS

**UNIT CODE:** 0541 451 04A

**UNIT DESCRIPTION:**

This unit covers the competence in applying discrete mathematical concepts. It involves carrying out set theory operations, performing matrix operations, applying number system, applying logic gates, performing sequence and series operations, and demonstrating graph theory.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements  ***(Bold and italicized Types of matrices*** are applied as per ***terms are elaborated in the range****)* |
| 1. Carry out set theory operations | * 1. ***Characteristics of sets*** are identified as per workplace requirements. |
| * 1. Methods of set representation are applied as per workplace requirements. |
| * 1. Cardinality of a set is applied as per workplace requirements. |
| * 1. ***Types of sets*** are applied as per workplace requirements. |
| * 1. Venn Diagrams are applied as per workplace requirements. |
| * 1. ***Set Operations*** are applied as per workplace requirements |
| 1. Perform matrix operations | 2.1 Matrix order applied as per workplace requirements. |
| 2.2 Matrix operations are applied as per workplace requirements. |
| 2.3 Transpose of a matrix is applied as per workplace requirements. |
| 2.4 Properties of transpose of a matrix are identified as per workplace requirements. |
| 2.5 Adjoint of a square matrix identified as per workplace requirements. |
| 2.6 Inverse of a square matrix is identified as per workplace requirements. |
| 1. Apply number system | 1. ***Number systems*** are identified as per the mathematical standards |
| 1. Number system conversions are performed as per the conversion procedures |
| 1. Number system arithmetic is performed as per the arithmetic procedures. |
| 1. ***Binary codes*** are applied based on standard mathematics procedures |
| 1. Apply logic gates | 4.1 Logic gates are identified as per the Digital Electronics principles |
| 4.2 Logic circuits are illustrated as per the standard procedures |
| 4.3 Logic circuits are simplified as per the standard procedures |
| 1. Perform sequence and series operations | * 1. ***Key terms of sequences*** are applied as per workplace requirements. |
| * 1. Summation of a sequence is applied as per workplace requirements. |
| * 1. ***Arithmetic series*** is applied as per workplace requirements |
| * 1. Geometric series is applied as per workplace requirements. |
| 1. Demonstrate graph theory | * 1. ***Key Graph terminologies*** are applied as per workplace requirements |
| * 1. ***Types of graphs*** are applied as per workplace requirements |
| * 1. ***Representation of graphs*** are applied as per workplace requirements |
| * 1. Application of graphs are applied as per workplace requirements. |

**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. Characteristics of sets may include but is not limited to: | · Elements  · Size |
| 2. Methods of Set representation may include but is not limited to: | · Statement form  · Tabular form  · Set builder notation |
| 3. Types of sets may include but is not limited to: | · Finite Set  · Infinite Set  · Subset  · Proper Subset  · Universal Set  · Empty or Null  · Equal  · Equivalent Set  · Singleton Set or Unit Set  · Overlapping Set  · Disjoint Set |
| 4. Set operations may include but is not limited to: | · Set Union and Set Intersection  · Set Difference/Relative Complement  · Set Complement  · Cartesian Product |
| 5. Types of matrices may include but is not limited to: | · Square  · Symmetric  · Skew-symmetric  · Diagonal  · Identity  · Orthogonal  · Involuntary |
| 6. 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 |
| 7. Number system may include but is not limited to: | · Decimal  · Binary  · Octal  · Hexadecimal |
| 8. Binary codes | · ASCII  · BCD  · Non weighted  · Alphanumeric code  · Error detection codes  · Error correcting codes  · Gray code,  · Excess-3  · EBCDIC |
| 9. Key terms used in sequences may include but is not limited to: | · Sequence  · Arithmetic Progression  · Geometric Progression |
| 10. Key Graph Terminologies may include but is not limited to: | · Node  · Edge  · Adjacency  · Vertex |
| 11. Types of graphs may include but is not limited to: | · Null  · Simple  · Multigraph  · Directed graphs  · Undirected |
| 12. Representations of graphs may include but is not limited to: | · Adjacency matrix  · Adjacency list |

**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;

· Decision making;

· Research;

· Problem solving;

**Required knowledge**

The individual needs to demonstrate knowledge of:

· Set Theory

· Matrices

· Relations and Functions

· Recursion

· Sequence and Series

· Graph Theory

**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:  1.1 Applied set operations as per workplace requirements.  1.2 Performed matrix operations.  1.3 Performed number system conversions as per the conversion procedures  1.4 Performed number system arithmetic as per the arithmetic procedures.  1.5 Applied binary codes based on standard mathematics procedures  1.6 Illustrated logic circuits as per the standard procedures  1.7 Simplified logic circuits as per the standard procedures  1.8 Applied arithmetic series as per workplace requirements.  1.9 Applied geometric series as per workplace requirements.  1.10 Applied application of graphs as per workplace requirements. |
| 2. Resource Implications | The following resources must be provided:  2.1 Access to relevant workplace where assessment can take place.  2.2 Appropriately simulated environment where assessment can take place.  2.3 Resources relevant to the proposed activity or tasks. |
| 3. Methods of Assessment | Competency may be assessed through:  3.1 Portfolio of evidence  3.2 Written tests  3.3 Interviews  3.4 Third party report  3.5 Practical assessment |
| 4. Context of Assessment | Competency may be assessed:  4.1 On-the-job  4.2 In a simulated work environment |
| 5. Guidance information for assessment | 1.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY PROJECT MANAGEMENT PRINCIPLES

**UNIT CODE:** 0688 451 05A

**UNIT DESCRIPTION:**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes that make up workplace functions | **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. Execute project initiation | * 1. Project scope is identified as per user requirements. |
| * 1. Project deliverables are determined as per user requirements. |
| * 1. Project objectives are identified as per user requirements as per user requirements. |
| * 1. ***Project initiation document (PID)*** is prepared as per work procedures. |
| Perform project planning | * 1. Project budget is prepared as per work requirements. |
| * 1. Project schedule is determined as per work deliverables. |
| * 1. Project resources are allocated as per budget. |
| * 1. Project work breakdown structures are determined as per project schedule. |
| * 1. Project quality plan is prepared as per workplace procedures. |
| * 1. Project team is formed as per project requirements. |
| * 1. Roles and responsibilities are assigned as per project requirements. |
| * 1. Project plan is prepared as per work procedures. |
| Perform project monitoring | * 1. Project costs are tracked as per project budget. |
| * 1. Project deliverables and objectives are monitored as per ***quality standards***. |
| * 1. Project team performance is monitored as per work plan. |
| * 1. Project risks are assessed as per quality plan. |
| * 1. Project risks are managed as per quality plan. |
| Perform project closure | * 1. Project review is performed as a project plan. |
| * 1. Final project budget is reviewed as per project plan. |
| * 1. Detailed project review report is prepared as per work procedures. |

**RANGE**

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

|  |  |
| --- | --- |
| *Variable* | **Range** |
| 1. Quality standards may include but are not limited to: | * ISO 9001:2015 |
| 1. Project initiation document (PID) may be defined as: | * Comprehensive document that outlines the foundation and key aspects of a project. It serves as a reference point throughout the project lifecycle and provides essential information to stakeholders. |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Collecting project data
* Creating project plan
* Managing project tasks
* Managing project resources
* Manage project team

**Required skills**

The individual needs to demonstrate the following skills:

* Active listening
* Basic ICT skills
* Decision making
* Problem solving skills
* Planning
* Interpersonal skills
* Time management
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency | Assessment requires evidence that the candidate:   * 1. Executed project initiation   2. Performed project planning.   3. Performed project monitoring.   4. Performed project closure. |
| 1. Resource Implications | The following resources must be provided:   * 1. Access to relevant workplace where assessment can take place.   2. Appropriately simulated environment where assessment can take place.   3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of Assessment | Competency may be assessed through:   1. Portfolio of evidence 2. Observation 3. Case study 4. Projects 5. Written tests 6. Interviews 7. Third party report 8. Practical assessment |
| 1. Context of Assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | 5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY STRUCTURED PROGRAMMING

**UNIT CODE:** 0613 451 06A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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 computer programming basics | * 1. Programming language types are identified according to the user requirements. |
| * 1. ***Programming paradigms*** are applied as per user requirements. |
| * 1. Program development life cycle is applied according to the work requirements. |
| * 1. ***Program design tools*** are applied as per the user requirements. |
| 1. Write program Code | * 1. ***Program writing tools*** are identified according to the system requirements. |
| * 1. ***Identifiers*** are declared as per program design specification. |
| * 1. Initialization of variables and constants is performed according to program design specifications. |
| 1. Implement Program logic | * 1. Data types are applied as per program specification |
| * 1. ***Data control structures*** in a program are applied as per program design requirements. |
| * 1. ***Data structures*** in a program are applied as per program design specifications. |
| 1. Implement modular programming | * 1. Computer program subroutines are created as per user needs. |
| * 1. Data structures are applied in subroutines according to system requirements. |
| * 1. Computer program debugging is performed as per work procedures. |
| * 1. Computer program is compiled as per system requirements. |

**RANGE**

This section provides a 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. Programming paradigms may include but not limited to: | * Imperative * Functional * Procedural * Object-oriented |
| 1. Program design tools may include but not limited to: | * Flow charts * Decision tables * Decision trees * Pseudocode * Algorithm |
| 1. Program writing tools may include but not limited to: | * Text editors * Compilers Linkers * Debuggers * Special Integrated development Environment (IDE) |
| 1. Identifier may include but not limited to: | * Names assigned to different entities such as variable, functions and arrays. |
| 1. Data control structures include: | * Selection * Loops * Sequence |
| 1. Data structures may include but not limited to: | * Arrays * Queue * Stack * Linked lists |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Structured programming principles.
* Object oriented programming principles.
* Techniques of system analysis and design.
* Software development methodologies.
* Program development techniques.
* Software program testing and debugging techniques.

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written)
* Proficient in ICT
* Time management
* Problem solving
* Planning
* Decision making
* Report writing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Applied program design tools as per the user requirements.   2. Created computer program input as per program design.   3. Data control structures in a program are applied as per program design requirements.   4. Applied data structures in a program as per program design specifications.   5. Created computer program subroutines as per user needs.   6. Coded computer program output as per user requirements.   7. Compiled computer program as per system 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. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   1. Observation 2. Portfolio of evidence 3. Interviews 4. Third party reports 5. Written assessment 6. Practical assessment 7. Projects |
| 1. Context of assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

## ESTABLISH SOFTWARE SYSTEM REQUIREMENTS

**UNIT CODE:** 0611 451 07A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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. Gather user requirements | * 1. Key ***stakeholders*** are selected as per user requirements. |
| * 1. ***Data collection tools*** are selected and prepared as per workplace procedures. |
| * 1. User requirements data is collected as per workplace procedures. |
| 1. Analyse user requirements | * 1. ***System functional requirements*** are specified as per user requirements. |
| * 1. ***System Non-Functional requirements*** are specified as per user requirements. |
| * 1. User requirements arevalidated as per user needs. |
| * 1. ***User requirements documents*** are prepared as per work procedures and user requirements. |
| 1. Plan application deliverables | * 1. Software requirements specifications document is prepared as per workplace procedures |
| * 1. Project work plan is created as per tasks identified. |
| * 1. Project development agreement document is prepared. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Stakeholders may include but not limited to: | * 1. End-users   2. Managers |
| 1. Data collection tools may include but not limited to; | * 1. Questionnaire   2. Observation   3. Forms |
| 1. System functional requirements may include but not limited to: | * 1. Tasks the system should perform,   2. Processes   3. Business rules |
| 1. System Non-Functional requirements may include but not limited to: | * 1. Performance   2. Security   3. Scalability   4. Reliability   5. Usability |
| 1. User requirements documents may include but not limited to: | * 1. Requirements specifications   2. User stories   3. Use case diagrams   4. Process flows |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* System analysis and design principles
* Techniques of system analysis and design
* Software development methodologies
* Program development life cycle
* Project management
* Data collection methods

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Analytical
* Planning;
* Decision making;
* Report writing;

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | * 1. Selected key stakeholders’ areas per user requirements.   2. Selected and prepared data collection tools are as per workplace procedures.   3. Collected user requirements data as per workplace procedures.   4. Specified system functional requirements as per user requirements.   5. Specified system non-functional requirements as per user requirements.   6. Prepared user requirements document as per work procedures and user requirements.   7. Created a project work plan as per tasks identified. |
| 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. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## OFFER APPLICATION END-USER SUPPORT

**UNIT CODE:** 0611 451 08A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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. Develop application technical documents | * 1. ***Application technical Documents*** are identified as per system specifications. |
| 1.2 Application technical documents are prepared as per syste1m specifications. |
| 1.3 Application technical documents are validated as per system specifications. |
| 1. Perform application user training | * 1. Training needs assessment is carried out as per user requirements |
| * 1. ***Training resources*** are prepared as per training needs. |
| * 1. User training schedule is prepared as per user needs. |
| * 1. User training is conducted as per the user training schedule. |
| 1. Gather user feedback | * 1. ***Method of gathering user feedback*** is identified as per user needs. |
| * 1. ***Data collection tools*** are prepared as per user needs. |
| * 1. User Feedback is collected as per workplace procedures. |
| * 1. Customer feedback is analysed as per work procedures. |
| 1. Perform application maintenance | * 1. Technical assistance is carried out as per user requirements. |
| * 1. Performance is monitored as per user requirements. |
| * 1. Application optimization is performed as per user requirements. |
| * 1. Security update is performed as per user requirements. |
| * 1. Routine maintenance is performed as per workplace procedures. |
| * 1. System update is performed as per user requirements. |

**RANGE**

This section provides a 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. Application technical Documents may include but not limited to: | * Software requirement specification * Technical design documents * User interface design document * Database design document * Test plan and test case * Installation and deployment guide * User manual or user guide * Api documentation |
| 1. Training resources may include but not limited to: | * Tutorials * Frequently asked questions * Demo videos * User manuals |
| 1. Method of gathering user feedback may include but not limited to: | * Surveys * Feedback forms * Social media monitoring * Beta tests * User analytics |
| 1. Data collection tools may include but not limited to: | * Surveys * Form builders * Questionnaires * Observation |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Techniques of system analysis and design
* Program development techniques
* System testing debugging methods
* Techniques of system analysis and design
* Documentation processes
* Computer and devices settings
* Principles of management
* Cyber security threats and measures

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving
* Planning;
* Interpersonal skills
* Decision making;
* Report writing;

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Prepared application technical documents as per system specifications.   2. Carried out training needs assessment as per user requirements.   3. Conducted user training as per the user training schedule.   4. Prepared data collection tools as per user needs.   5. Collected user feedback as per workplace procedures.   6. Carried technical assistance out as per user requirements.   7. Performed routine maintenance as per workplace procedures. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environments where assessment can take place.   3. Resources relevant to the proposed activities or task. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party reports   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## MANAGE COMPUTERISED DATABASE SYSTEM

**UNIT CODE:** 0612 451 09A

**UNIT DESCRIPTION**

This unit covers the competencies required to manage computerised database system. It involves designing a database system, creating a database system, manipulating a computerised database, managing database security and performing database maintenance.

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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. Design database system | * 1. ***Database design approaches*** are identified as per workplace procedures. |
| * 1. ***Database design tools*** are identified according to user requirements. |
| * 1. ***Database structures*** are determined in accordance with the database specifications. |
| * 1. ***Database design architecture*** is developed as per user requirements. |
| * 1. Database normalisation is carried out as per application requirements. |
| * 1. Database modeldiagrams are created according to user and application requirements. |
| * 1. Database design report is generated as per workplace procedures. |
| 1. Create database system | * 1. Database management software is identified as per system requirements. |
| * 1. Database development environment is configured as per application requirements. |
| * 1. ***Database objects*** are created as per design specifications. |
| * 1. ***Data attributes*** are applied as per database design specifications. |
| * 1. ***Data relationships*** are created as per database design specifications. |
| * 1. Workplace safety and health practices are Observed as per OSHA |
| * 1. Methods of e-waste storage and disposal are identified as per OSHA |
| * 1. E-waste management is demonstrated as per OSHA |
| 1. Manipulate Computerised Database | * 1. Database business rules are applied as per user needs. |
| * 1. Data is inserted to the database as per business rules. |
| * 1. Data is retrieved from the database as per application requirement. |
| * 1. Data is modified using queries as per application requirement. |
| * 1. Data deletion is performed as per user needs. |
| 1. Manage database security | * 1. ***Database security risks*** are identified as per work procedures. |
| * 1. ***Database security control measures*** are identified as per work procedures. |
| * 1. Database security control measures are implemented as per organisation’s policies. |
| * 1. Database security monitoring and auditing is carried out as per work procedures. |
| * 1. Database security documentation is performed as per work procedures. |
| * 1. ***Database users*** are trained as per work procedures. |
| 1. Perform database maintenance | * 1. Database maintenance schedule is prepared as per workplace procedures. |
| * 1. Database performance is monitored as per database system requirements. |
| * 1. Database performance is optimized according to application requirements |
| * 1. Database maintenance report is generated as per work procedures. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Database design approaches mayinclude but not limited to: | * Top – down design method * Bottom – up design method * Centralized design * Decentralized design |
| 1. Database design architecturetools mayinclude but not limited to: | * Multi-user DBMS Architectures * Web Services and Service-Oriented Architectures * Distributed DBMSs |
| 1. Database model mayinclude but not limited to: | * Record-based model   + Hierarchical models   + Network Models   + Relational Models * Object-based data models   + Entity-Relationship (ER)   + Semantic   + Functional   + Object-oriented * Physical data models   + unifying model and   + the frame memory |
| 1. Database objects mayinclude but not limited to: | * Tables * Constraints * Indexes * Triggers * Sequences * Views * Usage lists |
| 1. Data relationships mayinclude but not limited to: | * One-To-One, * One-To-Many * Many-To-Many |
| 1. Database security risks mayinclude but not limited to: | * SQL Injection Attacks * Denial of Service (DoS/DDoS) Attacks * Poor Permission Management * Malware infections * Database Backup Exposures * Inadequate Auditing * Unprotected Databases Due to Misconfiguration * Credentials * Unencrypted data * Overloads, performance constraints and capacity issues * Physical damage to database servers * Design flaws and programming bugs in databases |
| 1. Database security control measures | * Access control * Auditing * Authentication * Encryption * Integrity controls * Backups * Application security * Database Security applying Statistical Method |
| 1. Database users mayinclude but not limited to: | * End Users   + Naive users / Parametric users   + Sophisticated users * Application Programmer or Specialized users or Back-End Developer * System Analysts * Database Administrator (DBA) * Temporary Users or Casual Users |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Techniques of system analysis and design
* Documentation processes
* Computer and devices settings
* Database management system types
* Data models, attributes and relationships
* Transactions and concurrency mechanisms
* Database design and implementation methods
* Database security features
* Types of database testing
* Principles of management
* Database management system
* Cyber security threats and measures

**Required skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Problem solving;
* Planning;
* Decision making;
* Report writing;

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Created database objects as per design specifications.   2. Applied data attributes as per database design specifications.   3. Created data relationships as per database design specifications.   4. Developed database design architecture as per user requirements.   5. Created database model diagrams according to user and application requirements.   6. Inserted data to the database as per business rules.   7. Retrieved data from the database as per application requirement.   8. Modified data using queries as per application requirement.   9. Performed data deletion as per user needs.   10. Implemented database security control measures as per organization’s policies.   11. Carried out database security monitoring and auditing as per work procedures.   12. Monitored database performance as per database system requirements. |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant work environments where assessment can take place.   3. Resources relevant to the proposed activities or task. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party reports   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## CREATE WEB APPLICATION

**UNIT CODE:** 0613 451 10A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace functions | **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. Design web application | * 1. ***Web application design tool***s are identified as per user needs. |
| * 1. Web application functionality is designed as per user requirements. |
| * 1. Web application interface design is created as per user requirements. |
| * 1. Web application output is designed as per user requirements. |
| 1. Write web application source code | * 1. User interface is created using ***user interface development tools*** as per interface design. |
| * 1. Version control is performed as per work procedures. |
| * 1. Functionality and interactivity are developed using ***front end functionality tools*** as per application requirements. |
| * 1. Responsive design is implemented as per work procedure. |
| * 1. ***Front end frameworks*** are utilised as per user requirements. |
| * 1. Front end components are integrated with backend ***APIs*** as per work procedures. |
| * 1. Server-side code is created using ***server-side coding tools*** as per application requirements. |
| * 1. ***Back-end frameworks*** are implemented as per work procedures. |
| * 1. Back end is connected to the database using ***database tools*** as per application requirements. |
| * 1. Back-end APIis created as per application requirements. |
| * 1. Workplace safety and health practices are Observed as per OSHA |
| * 1. Methods of e-waste storage and disposal are identified as per OSHA |
| * 1. E-waste management is demonstrated as per OSHA |
| 1. Test web application | * 1. ***Web application testing*** ***types*** is identified as per user requirements. |
| * 1. Web application test plan is developed as per work procedures. |
| * 1. Web application is tested as per web application test plan. |
| * 1. Test report is prepared as per work procedures. |
| 1. Debug web application | * 1. Source code is revised for errors, bugs and inconsistencies as per design requirements. |
| * 1. ***Debugging tools*** are appliedas per application requirements. |
| * 1. Regression testing is performed as per application requirements. |
| 1. Host web application | * 1. Web hosting service provider is identified as per job requirements. |
| * 1. Domain is acquired and configured as per work procedures. |
| * 1. Web server is configured as per work procedures. |
| * 1. Web application is deployed using ***deployment tools*** as per work procedures. |
| * 1. ***Web security measures*** are implemented as per work procedures. |
| * 1. Web application maintenance and monitoring are done as per work procedures. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Web application design tools may include but not limited to: | * + Adobe Illustrator   + Adobe XD   + Canva   + Figma |
| 1. User interface development tools may include but not limited to: | * + Text editor   + VS code   + Notepad++   + Artisteer   + Wix   + Bluevoda   + Dreamweaver   + Html   + CSS   + JavaScript |
| 1. Front end frameworks may include but not limited to: | * + React   + Angular   + Vue.js |
| 1. API may include but not limited to: | * + web APIs   + Library APIs   + Operating system APIs   + Web socket APIs |
| 1. Server-side coding tools may include but not limited to: | * + JavaScript   + Python   + Ruby   + PHP |
| 1. Back-end frameworks may include but not limited to: | * + Node.js   + Django(python)   + Ruby   + Laravel |
| 1. database tool may include but not limited to: | * + MySQL   + Access   + Oracle   + Data modeler   + Microsoft Visio |
| 1. Web application testing types may include but not limited to: | * + Functional testing   + Usability testing   + Performance testing   + Security testing |
| 1. Debugging tools may include but not limited to: | * + Integrated development environment   + GDB (GNU Debugger)   + Browser Developer Tools   + Profiling Tools |
| 1. Deployment tool may include but not limited to: | * + GIT |
| 1. Web security measures may include but not limited to: | * + Firewalls   + HTTPS   + Input validation   + Secure authentication and authorization   + Session management |

**REQUIRED KNOWLEDGE AND SKILLS**

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

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Project management
* Introduction to programming
* Web programming
* Documentation processes
* Computerised database management
* Computer and devices settings
* System analysis and design
* Version control

**Required Skills**

The individual needs to demonstrate the following skills:

* Communications (verbal and written);
* Proficient in ICT;
* Time management;
* Analytical
* Planning;
* Decision making;
* Report writing;

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of competency | Assessment requires evidence that the candidate:   * 1. Designed web application functionality as per user requirements.   2. Designed web application interface as per user requirements.   3. Created user interface using user interface development tools as per interface design.   4. Developed functionality and interactivity using front end functionality tools as per application requirements.   5. Created server-side code is using server-side coding tools as per application requirements.   6. Connected back end to the database using database tools as per application requirements.   7. Tested web application as per web application test plan   8. Applied debugging tools as per application requirements.   9. Deployed web application using deployment tools as per work procedures.   10. Implemented web security measures as per work procedures. |
| 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. 3. Resources relevant to the proposed activity or tasks. |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral assessment   3. Portfolio of evidence   4. Interviews   5. Third party report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   1. On-the-job 2. In a simulated work environment |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |