

**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**BIOMEDICAL ENGINEERING TECHNICIAN**

**KNQF LEVEL 5**

**OCCUPATIONAL STANDARD ISCED CODE: 0914 454A**

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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. 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 that allows for multiple entry and exit in TVET programs.

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

It is my conviction that this occupational standard will play a great role towards development of competent human resource for the Biomedical Engineering 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 CAP 210A 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 occupational standard has been developed in adherence to the Kenya National Qualification Framework and CBETA standards and guidelines. The OS 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, biomedical engineering NSSC, expert workers and all those who participated in the development of this occupational standard.

# ACKNOWLEDGEMENT

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

I appreciate National biomedical engineering 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 curriculum.

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

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

# ACRONYMS

**CSSD** Central Sterile Supply Department

**ENT** Ear Nose and Throat

**ICU** Intensive Care Unit

**RO** Reverse Osmosis

**UV** Ultraviolet

# KEY TO UNIT CODE

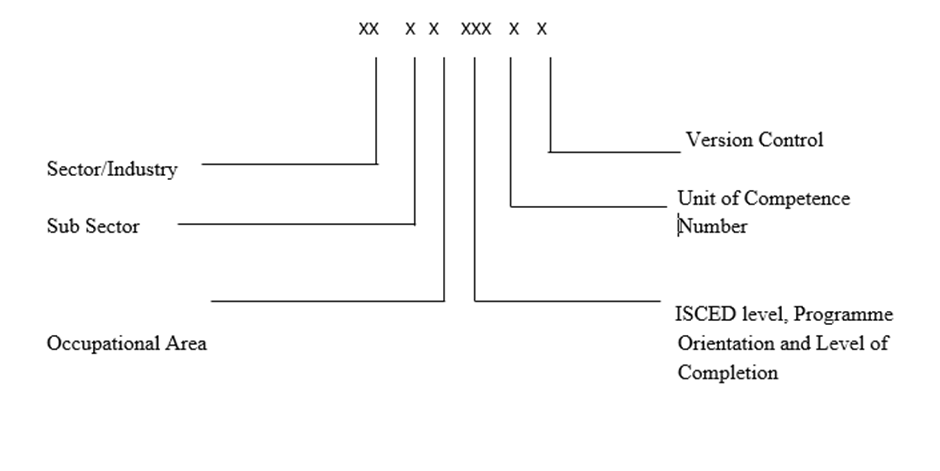
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# OVERVIEW

This Biomedical Engineering Technology Level 5 qualification consists of competences that an individual must achieve to perform biomedical engineering activities. It involves Performing Maintenance of Diagnostic and laboratory Equipment, Theatre Equipment, Dental Equipment, Maternity Equipment, Refrigeration and Air Conditioning Equipment and Hospital Plant and Building Services.

## SUMMARY OF UNITS OF COMPETENCY

|  |  |
| --- | --- |
| **BASIC UNITS OF COMPETENCY** | |
| **UNIT CODE** | **UNIT TITLE** |
| 0611441 01B | Apply digital Literacy |
| 0031441 02B | Apply communication skills |
| 0417441 03B | Apply work ethics and practices |
| 0413441 04B | Apply entrepreneurial skills |
| **COMMON UNITS OF COMPETENCY** | |
| 0541441 05A | Apply Engineering technician Mathematics I |
| 0541441 06A | Apply Engineering technician Mathematics II |
| 0713441 07A | Perform workshop practice |
| 0914441 08A | Apply Human Anatomy and Physiology Principles |
| 0714441 09A | Apply mechanical science principles |
| 0714441 10A | Apply analogue electronics I |
| 0714441 11A | Apply analogue electronics II |
| 0713441 12A | Apply electrical principles I |
| 0713441 13A | Apply electrical principles II |
| 0713441 14A | Apply electrical principles III |
| 0732441 15A | Prepare technical drawings I |
| 0732441 16A | Prepare technical drawings II |
| **CORE UNITS OF COMPETENCY** | |
| 0914451 17A | Perform diagnostic and laboratory equipment maintenance I |
| 0914451 18A | Perform operation theatre equipment maintenance |
| 0914451 19A | Perform dental equipment maintenance |
| 0914451 20A | Perform maternity equipment maintenance |
| 0914451 21A | Perform refrigeration and air conditioning equipment maintenance |
| 0914451 22A | Perform hospital plant and building services maintenance I |
| 0914451 23A | Perform hospital plant and building services maintenance II |

## APPLY DIGITAL LITERACY

**UNIT CODE:** 0611 441 01B

**UNIT DESCRIPTION:**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, accessing online/offline data and information, performing online communication and collaboration, applying cybersecurity skills, performing jobs online and applying job entry techniques.

**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. Operate computer devices | * 1. C***omputer device*** usage is determined as per workplace requirements.   2. ***Computer hardware*** is identified according to job requirements.   3. ***Computer software*** is identified according to workplace requirements.   4. Computer devices are turned on or off as per the correct workplace procedure.   5. ***Mouse techniques*** are applied in solving tasks as per workplace requirements.   6. Keyboardtechniques are applied in solving tasks as per workplace requirements.   7. Computer files and folders are created and managed as per workplace requirements.   8. ***Internet connection option***s are identified and applied in connecting computer devices to the Internet.   9. ***External devices*** are identified and connected to the computer devices as per the job requirement. |
| 1. Solve tasks using Office suite | 1. ***Word processing concepts***are applied in solving workplace tasks as per job requirements. 2. Worksheet data is entered and prepared in accordance with work procedures. 3. Worksheet data is built and edited in accordance with workplace procedures. 4. ***Data manipulation*** on a worksheet is undertaken in accordance with work requirements. 5. Worksheets are saved and printed in accordance with job requirements. 6. ***Electronic presentation concepts***are applied in solving workplace tasks as per job requirements. |
| 1. Manage data and information | * 1. Office ***internet services*** are identified and applied in accordance with office procedures.   2. ***Internet access applications*** are determined in accordance with office operation procedures.   3. Internet search is performed as per job requirements.   4. Online digital content is downloaded in accordance with workplace requirements.   5. Digital content is identified and backed up in accordance with workplace procedures. |
| 1. Perform online communication and collaboration | * 1. Netiquette principles are observed as per work requirements.   2. Electronic mail communication is executed in accordance with workplace policy.   3. Digital content copyright and licenses are identified and applied according to workplace policies and regulatory requirements.   4. ***Online*** ***collaboration tools*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Apply cybersecurity skills | * 1. ***Data protection*** and ***privacy*** is classified in accordance with workplace policies and regulatory requirements.   2. ***Internet security threats*** are identified as per workplace policies and regulatory requirements.   3. Computer threats and crimes are detected in accordance to Information Management security guidelines   4. ***Cybersecurity control measures*** are applied in accordance with workplace policies and regulatory requirements. |
| 1. Perform online jobs | * 1. ***Online job platforms*** are identified as per the job requirements.   2. Online accounts and profiles are created in accordance with the work requirements.   3. Online jobs are identified according to the bidder’s skillset.   4. Online digital identity is managed according to industry best practices.   5. Online job bidding is done as per the specific job requirements.   6. Online tasks are executed according to the job requirements.   7. Personal online payment account is managed in accordance with financial regulations. |
| 1. Apply job entry techniques | * 1. ***Job opportunities*** are sought based on competencies.   2. A winning resume/CV is developed as per job advertisement.   3. An application/cover letter is developed based on the job advertisement.   4. ***certificates and testimonials*** are organized as per resume.   5. ***Interview skills*** are demonstrated as per job advertisement. |

**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. Computer devices may include but are not limited to: | * Desktops * Laptops * Smartphones * Tablets * Smartwatches |
| 1. Computer hardware may include but are not limited to: | * The System Unit E g. Motherboard, CPU, casing, * Input Devices e g. Pointing, keying, scanning, voice/speech recognition, direct data capture devices. * Output Devices e.g. hardcopy output and softcopy output * Storage Devices e.g. main memory e.g. RAM, secondary storage (Solid state devices, Hard Drives, CDs & DVDs, Memory cards, Flash drives * Computer Ports e.g. HDMI, DVI, VGA, USB type C etc. |
| 1. Computer software may include but are not limited to: | * System software e.g. Operating System (Windows, Macintosh, Linux, Android, iOS) * Application Software e.g. Word Processors, Spreadsheets, Presentations etc. * Utility Software e.g. Antivirus programs |
| 1. External devices may include but are not limited to: | * Printers * Projectors * Smart Boards * Speakers * External storage drives * Digital/Smart TVs |
| 1. Word processing concepts may include but are not limited to: | * Creating word documents * Editing word documents * Formatting word documents * Saving word documents * Printing word documents |
| 1. Mouse techniques may include but are not limited to: | * Clicking * Double-clicking * Right-clicking * Drag and drop |
| 1. Internet connection options may include but are not limited to: | * Mobile Networks/Data Plans * Wireless Hotspots * Cabled (Ethernet/Fiber) * Dial-Up * Satellite * ISDN (Integrated Services Digital Network) |
| 1. Data manipulation may include but are not limited to: | * Use of formulae * Use of functions * Sorting * Filtering * Visual representation using charts |
| 1. Electronic presentation concepts may include but are not limited to: | * Creating slides * Editing slides * Formatting slides * Applying slide effects and transitions * Creating and playing slideshows * Saving presentations * Printing slides and handouts |
| 1. Internet services may include but are not limited to: | * Communication Services * Information Retrieval Services * File Transfer * World Wide Web Services * Web Services * Directory Services * Automatic Network Address Configuration * News Group * Ecommerce |
| 1. Internet access applications/software may include but are not limited to: | * Browsers * Email Apps * eCommerce Apps |
| 1. Online collaboration tools may include but are not limited to: | * Online Storage * Online productivity applications * Online meetings, * Online learning environments, * Online calendars * Social networks |
| 1. Data protection and privacy may include but not limited to: | * Confidentiality of data/information * Integrity of data/information * Availability of data/information |
| 1. Internet security threats may include but not limited to: | * Malware attacks * Social engineering attacks * Software supply chain attacks * Advanced persistent threats (APT) * Distributed denial of service (DDoS) * Man-in-the-middle attack (MitM) * Password attacks * IoT Attacks * [Phishing Attacks](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#phishing-attacks) * [Ransomware](https://onlinedegrees.sandiego.edu/top-cyber-security-threats/#ransomware) |
| 1. Security threats control measures may include but not limited to: | * Counter measures against cyber terrorism * Physical Controls * Technical/Logical Controls * Operational Controls |
| 1. Online job platforms may include but are not limited to: | * Remotask * Data an notation. tech * Cloud worker * Upwork * One forma * Appen |
| 1. Job opportunities may include but not limited to: | * Self employment * Service provision * product development * salaried employment |
| 1. Certificates and testimonialsmay include but not limited to: | * Academic credentials * Letters of previous employments/ services rendered * Letters of commendation * Certifications of participation * Awards |
| 1. Interview skills may include but not limited to: | * Listening skills * Grooming * Language command * Articulation of issues * Body language * Time management * Honesty * Generally knowledgeable in current affairs and technical area |

**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:

* Computer Hardware and Software Concepts
* Computer Security Concepts (Data security and privacy)
* Cyber security threats and control measures
* Understanding Computer Crimes
* Detection and protection against computer crimes
* Laws governing protection of ICT in Kenya
* Digital Identity Management
* Netiquette Principles
* Fundamentals of Copyright and Licenses
* Word processing;

Functions and concepts of word processing;

Documents and tables creation and manipulations;

Document editing;

Document formatting;

Word processing utilities

* Spreadsheets;

Meaning, types and importance of spreadsheets;

Components of spreadsheets;

Functions, formulae, and charts, uses and layout;

Data formulation, manipulation and application to cells;

Editing & formatting spreadsheets;

* Presentation Packages;

Types of presentation Packages.

Creating, formulating, running, editing, printing and presenting slides and handouts

* Networking and Internet;

Internet connectivity.

Browser and digital content management;

Managing data, information, and digital content

Electronic mail and World Wide Web

* Fundamentals of Online Working;

Online Profile Management;

e-Portfolio Management;

Online Jobs Bidding;

Online Payment Systems;

* Job entry techniques

Job searching sites

Interview preparation skills

Interview handling

**Required skills**

The individual needs to demonstrate the following skills:

* Active listening
* Keyboard Skills
* Mouse Skills
* Analytical skills
* Creativity
* Interpretation Skills
* Communication
* Spreadsheet operations (applying fundamental operations such as addition, subtraction, division and multiplication)
* Computer Use Safety Skills
* Document Editing Skills
* Document Formatting Skills
* Document Printing Skills
* Netiquette Skills
* Internet Browsing Skills
* Problem Solving Skills
* Online Collaboration Skills
* Cybersecurity Skills
* CV writing
* grooming

**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. Operated computer devices as per workplace policies and regulations.   2. Solved tasks using the office suite as per workplace policies and regulations.   3. Manage data and information as per workplace policies and regulations.   4. Performed online communication and collaboration as per workplace policies and regulations.   5. Applied cybersecurity skills in accordance with workplace policies and regulations.   6. Executed online tasks according to the job requirements.   7. Searched for job opportunity based on competencies.   8. Prepared job requirement documentations based on job opportunity.   9. Demonstrated interview skills based on the job opportunity. |
| 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 report   6. Written assessment   7. Practical assessment   8. Projects |
| 1. Context of assessment | Competency may be assessed:   * 1. Workplace or simulated workplace. |
| 1. Guidance information for assessment | * 1. Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY COMMUNICATION SKILLS

**UNIT CODE:** 0031 441 02B

**UNIT DESCRIPTION**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**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 the Range*** |
| --- | --- |
| 1. Apply communication channels | 1. Specific communication channels are identified and applied based on workplace requirements. 2. Challenges are identified and addressed as per the operational standards of the organization. 3. Communication channels are evaluated to meet workplace needs. |
| 1. Apply written communication skills | * 1. Types of written communication are identified and applied according to the workplace requirements.   2. Written communication needs are identified and implemented according to workplace procedures.   3. Written communication guidelines are analyzed, evaluated, and revised based on workplace needs. |
| 1. Apply non-verbal communication skills | 3.1 Existing non-verbal communication techniques are identified and applied based on organization policy.  3.2 Non-verbal communication techniques are articulated and modeled to enhance inclusivity according to workplace requirements. |
| 1. Apply oral communication skills | 4.1 Types of oral communication are identified and established as per organization policy.  4.2 Pathways of oral communication are identified and established as per organization policy.  4.3 Pathways of oral communication are reviewed according to organization procedures.  4.4 Pathways of oral communication are maintained according to the organization standards. |
| 1. Apply group communication skills | 1. Group communication strategies are appliedbased on the workplace needs. 2. Groups are organized in accordance with workplace procedures. 3. Effective questioning, listening and non-verbal communication techniques are used as per needs.   5.4 Group communication challenges are identified and addressed according to the workplace needs. |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Communication strategies may include but are not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrasing * Clarification request * Translation * Restructuring * 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, behavior. * 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 are not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans |

**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
* Interpretation
* Negotiation
* Writing
* Oral skills
* Creative thinking
* Critical thinking
* Decision making
* Analytical
* Innovation
* Conflict skills
* Leadership
* Problem solving skills
* Management
* Organizational
* Teamwork

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Communication process
* Dynamics of groups
* Styles of group leadership
* Key elements of communications strategy
* Principles of effective communication
* Turn-taking techniques
* Conflict resolution techniques
* Work planning
* Work organization
* Company policies
* Company operations and procedure standards
* Fundamental rights at the workplace
* Personal hygiene
* Accountability
* Workplace problems and how to deal with them

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Identified and applied specific communication channels based on workplace requirements.   2. Identified and applied specific written communication correspondence according to the workplace requirements.   3. Applied and developed non-verbal strategies to communicate in all areas of the workplace requirements.   4. Established pathways of oral communication as per workplace policy.   5. Applied group communication strategies based on workplace needs. |
| 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 | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY WORK ETHICS AND PRACTICES

**UNIT CODE:** 0417441 03B

**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 2. Self-esteem and a positive self-image are developed and maintained based on value 3. Emotional intelligence and stress management are demonstrated as per workplace requirements. 4. Assertiveness is developed and maintained based on the requirements of the job. 5. Accountability and responsibility for one's actions are demonstrated based on workplace instructions. 6. Time management, attendance and punctuality are observed as per the organization’s policy. 7. Personal goals are managed as per the organization’s objective 8. Self-strengths and weaknesses are identified based on personal objectives 9. Motivation, initiative and proactivity are utilized as per the organization policy 10. 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 2. Codes of conduct is applied as per the workplace requirements 3. Policies and guidelines are observed as per the workplace requirements 4. Professionalism is exercised in line with organizational policies |
| 1. Promote Team work | 1. ***Teams*** are formed to enhance productivity based on organization’s objectives 2. Duties are assigned to teams under the organization policy. 3. Team activities are managed and coordinated as per set objectives. 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 and diversity-related issues are identified and mainstreamed in accordance with workplace policy. 7. Healthy ***relationships*** are developed and maintained in line with the workplace. 8. Adaptability and flexibility are applied in dealing with team members as per workplace policies |
| 1. Maintain professional and personal development | 4.1 ***Personal growth and development*** needs are identified and assessed in line with the requirements of the job.  ***4.2 Training and career opportunities*** are identified and utilized based on job requirements.  4.3 ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs.  4.4 Licenses and certifications relevant to the job and career are obtained and renewed as per policy.  4.5 Recognitions are sought as proof of career advancement in line with professional requirements.  4.6 Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives.  4.7 Dynamism and on-the-job learning are embraced in line with the organization’s goals and objectives. |
| 1. Apply Problem solving skills | 5.1 ***Creative, innovative*** and practical solutions are developed based on the problem  5.2 Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job.  5.3 Team problems are solved as per the workplace guidelines  5.4 Problem-solving strategies are applied as per the workplace guidelines  5.5 Problems are analyzed and assumptions tested as per the context of data and circumstances |
| 1. Promote Customer Care | 6.1 Customers' needs are identified based on their characteristics  6.2 Customer ***feedback*** is allowed and facilitated in line with organization policies.  6.3 Customer concerns and complaints are analyzed and resolved in line with the set organizational culture.  6.4 Proactive customer outreach programs are implemented as per organizational policies  6.5 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. |

## APPLY ENTREPRENEURIAL SKILLS

**UNIT CODE :** 0413441 04B

**UNIT DESCRIPTION**

This unit covers the competencies required to apply entrepreneurial skills. It involves applying 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 2. Personal finances are managed as per financial procedures and standards 3. Savings are managed as per financial procedures and standards 4. Debts are managed as per financial procedures and standards 5. Investments are undertaken as per financial procedures and standards 6. 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 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. Salaried employment and self-employment are distinguished as per principles of entrepreneurship 6. ***Requirements for entry into self-employment*** are identified according to business procedures and standards 7. Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards 8. **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 2. Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards 3. Entrepreneurial opportunities are evaluated as per business procedures and standards 4. Business ideas and opportunities are generated as per business procedures and standards 5. Business life cycle is analysed as per business procedures and standards |
| 1. Apply business legal aspects | 1. ***Forms of business ownership*** are identified as per legal procedures and practices 2. Business Registration and Licensing processes are identified as per legal procedures and practices 3. Types of Contracts and Agreements are analysed as per legal procedures and practices 4. Employment Laws are identified as per legal procedures and practices 5. Taxation laws are identified as per legal procedures and practices |
| 1. Innovate Business strategies | 1. Innovative business strategies are determined by the organization standards 2. Creativity in business development is demonstrated in accordance with business standards 3. ***Innovative business standards***  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. Business idea is described as per business procedures and standards 2. Business description is developed as per business plan format 3. Marketing plan is developed as per business plan format 4. Organizational/Management plan is prepared in accordance with business plan format 5. Production/operation plan is prepared in accordance with business plan format 6. Financial plan is prepared in accordance with the business plan format 7. Executive summary is prepared in accordance with business plan format 8. Business plan is presented as per best practice 9. 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. Analysed 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 ENGINEERING TECHNICIAN MATHEMATICS I

**UNIT CODE:** 0541441 05 A

**UNIT DESCRIPTION:**

This unit describes the competencies required by a technician in order to apply engineering technician mathematics. It enables the learner to; apply algebra, carry out mensuration, apply number systems, trigonometry and hyperbolic functions.

**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 algebra | * 1. Indices calculations are performed as per laws of indices   2. Logarithms calculations are performed as per laws of logarithms   3. Simultaneous equations are performed as per Mathematical methods.   4. Quadratic equations are solved as per mathematical methods |
| 1. Carry out mensuration | * 1. Perimeter and areas of regular figures are obtained as per mathematical methods.   2. Volume and surface area of solids are obtained as per mathematical methods.   3. Area of irregular figures is obtained as per mathematical methods as per mathematical methods. |
| 1. Apply number systems | * 1. Calculations involving various ***types of numbers*** are performed as per the concept.   2. ***Arithmetic operations*** on integers are carried out as per the concept.   3. Mathematical problems are solved as per concepts. |
| 1. Apply trigonometry functions | * 1. Calculations are performed as per trigonometric rules   2. Trigonometric Ratios and Functions are performed as per trigonometric rules   3. Trigonometric Equations are applied according to Mathematical methods.   4. Trigonometric identities are applied according to Mathematical methods. |
| 1. Apply hyperbolic functions | * 1. Calculations are performed according to ***hyperbolic functions*** rules.   2. Hyperbolic Identities are applied according to Mathematical methods.   3. Hyperbolic Equations are solved according to Mathematical methods.   4. Hyperbolic Functions are applied according to Mathematical methods. |

**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** |
| --- | --- |
| Types of numbers may include but not limited to: | * Integers * Decimals * Fractions |
| Arithmetic operations may include but not limited to: | * Addition * Subtraction * Multiplication * Division |
| Hyperbolic functions may include but not limited to: | * Sinh x * Cosh x * Cosec x * Tanh x * Sech x |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Algebra
* Linear algebra
* Fundamental operations (addition, subtraction, division, multiplication)
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions

**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. Applied algebra as per mathematical methods 2. Applied number systems as per mathematical methods 3. Carried out mensuration as per mathematical methods 4. Applied trigonometric functions as per mathematical methods 5. Applied hyperbolic functions as per mathematical methods |
| 1. Resource implications | The following resources should be provided:   1. Mathematical tables 2. Whiteboards 3. Marker 4. Scientific calculator 5. Measuring equipment |
| 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. Workplace or simulated workplace. |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

## APPLY ENGINEERING TECHNICIAN MATHEMATICS II

**UNIT CODE:** 0541441 06A

**UNIT DESCRIPTION:**

This unit describes the competencies required by a technician in order to apply engineering technician mathematics. It enables the learner to; apply statistics and probability, matrices, and vector theorem, and carry out binomial expansion.

**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 statistics and probability | * 1. ***Measures of central tendency*** are obtained as per mathematical methods.   2. ***Measures of dispersion*** are obtainedas per mathematical methods.   3. Laws of probability are applied as per mathematical methods.   4. ***Probability distribution*** ***methods*** are applied as per mathematical methods.   5. Sampling distribution methods are applied as per mathematical methods. |
| 1. Apply matrices | * 1. Matrices operations are performed as per mathematical methods   2. Inverse of matrices are obtained as per mathematical methods   3. Simultaneous equations are solved using matrices as per mathematical methods. |
| 1. Apply vector theorem | * 1. Vectors and scalar quantities are defined as per mathematical methods   2. ***Operations*** on vectors are performed as per mathematical methods   3. Position vectors are determined as per mathematical methods   4. Resolution of vectors is performed as per mathematical methods   5. Vector and scalar products are obtained as per mathematical methods |
| 1. Carry out binomial expansion | * 1. Binomial series is determined as per mathematical methods.   2. Roots of numbers are determined as per mathematical methods.   3. Errors of small changes are determined as per mathematical methods. |

**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** |
| --- | --- |
| ***Measures of central tendency*** may include but not limited to: | * Mean * Mode * Median |
| ***Measures of dispersion*** may include but not limited to: | * Standard deviation * Variance |
| ***Probability distribution*** ***methods*** may include but not limited to: | * Normal distribution * Poisson distribution * Chi distribution |
| ***Operations*** may include but not limited to: | * Addition * Subtraction * Multiplication * Division |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Applying fundamental operations (addition, subtraction, division, multiplication)
* Using and applying mathematical formulas
* Logical thinking
* Problem solving
* Applying statistics
* Drawing graphs
* Using different measuring tools

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Algebra
* Linear algebra
* Geometry
* Fundamental operations (addition, subtraction, division, multiplication)
* Calculating area and volume
* Types and purpose of measuring instruments
* Units of measurement and abbreviations
* Rounding techniques
* Types of fractions
* Types of tables and graphs
* Presentation of data in tables and graphs

**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. Applied statistics and probability as per mathematical methods   2. Applied matrices as per mathematical methods.   3. Applied vector theorem as per mathematical methods.   4. Applied binomial expansion as per mathematical methods. |
| 1. Resource implications | The following resources should be provided:   * 1. Mathematical tables   2. Whiteboards   3. Marker   4. Scientific calculator   5. Measuring equipment |
| 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. Workplace or simulated workplace. |
| 1. Guidance information for assessment | 1. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

## PERFORM WORKSHOP PRACTICE

**UNIT CODE:** 0713441 07A

**UNIT DESCRIPTION**

This unit covers the competencies required to perform workshop practice. It involves: applying workshop safety practice, controlling OSH hazards, implementing OSH programs, controlling environmental pollution, demonstrating sustainable resource use, implementing specific environmental programs, monitoring activities on environmental protection programs, preparing workshop tools, equipment and materials, using workshop machines and tools and storing electrical tools and materials.

|  |  |
| --- | --- |
| **ELEMENTS**  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 workshop safety practice | * 1. ***PPEs*** are applied as per work requirement   2. Workshop safety rules are applied as per work procedure   3. First Aid is carried out as per work procedure   4. Workshop safety hazards are prevented as per work procedure   5. Workshop safety risk assessment is conducted as per work procedure   6. Fire drills are carried out as per workplace procedure |
| 1. Control OSH hazards | 1. Risks ***hazards and emergency*** are evaluated based on ***hazard indicators*** 2. ***OSH concerns*** raised by workers are addressed as per legal requirements. 3. Hazard ***prevention and control measures*** are implemented as per legal requirement. 4. ***Contingency measures* and *emergency* *procedure*** are recognized and implemented in accordance with organization procedures. |
| 1. Implement OSH programs | 1. Company OSH programs are implemented as per legal requirements. 2. Workers are trained on OSH standards and procedures as per legal requirements 3. ***OSH-related records*** are maintained as per legal requirements. |
| 1. Control environmental pollution | 4.1 ***Environmental pollution* *control measures*** are implemented in accordance with NEEMA   * 1. Procedures for solid waste management are observed as per Environmental Management and Coordination Act 1999   4.3 Methods for minimizing noise pollution is complied as per 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 as per 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   4. Develop***resource*** conservation plan as per work procedures |
| 1. Implement specific environmental programs | 1. Individual responsibilities on implement specific environmental programs are determined and performed as per activities identified. 2. Problems encountered are resolved in accordance with ***organizations’ policies and guidelines*** 3. Stakeholders are consulted as per company guidelines |
| 1. Monitor activities on Environmental protection Programs | 1. Activities are periodically monitored and evaluated as per objectives of the environmental program. 2. Recommendations are submitted as per findings. 3. Management support systems are set established to sustain and enhance the program. 4. Environmental incidents are reported to concerned proper authorities. |
| 1. Prepare workshop tools, equipment and materials | * 1. Materials and tools are identified as per the work specification.   2. Required tools, equipment and materials are prepared as per job specification.   3. Safety measures are adhered to when handling tools, equipment and materials. |
| 1. Use of workshop machines and tools | 1. Health and safety procedures are applied as per work procedure. 2. Workshop machines are identified as per job specification 3. Tools are used as per the job specification. 4. Machine is operated as per manufacturer’s specification. |
| 1. Store Electrical tools and material | 1. Tools and equipment are cleaned as per standard operating procedure. 2. Machine is cleaned as per manufacturer’s specification. 3. Tools and equipment are checked against the issuing list as per workplace procedure. 4. Tools and equipment are stored out as per their standard operating procedure. 5. Tools, equipment and machines are maintained as per manufacturer’s specification. 6. Waste management is performed as per the EHS. |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required skills**

The individual needs to demonstrate the following skills:

* Measuring
* Recording
* Monitoring
* Writing
* Interpersonal
* Presentation
* Risk assessment
* Evaluation
* Critical thinking
* Negotiation
* Electrical Installation
* Wiring systems
* Troubleshooting
* Survey and data capture
* Electrical system testing
* Interpretation of maintenance manuals
* Problem solving
* Use of electrical & mechanical tools
* Analytical
* First aid
* Planning
* Communications
* Digital literacy
* Time management
* Report writing
* Decision making
* Soldering

**Required knowledge**

The individual needs to demonstrate knowledge of:

* PPEs
* Environmental regulations
* OSH standards
* Pollution
* Waste management
* Principle of 3Rs
* Types of resources
* Environmental hazards
* Regulatory requirements
* Various laws in electrical engineering
* Safety procedures and practices
* Electrical symbols and their meanings
* Electrical standards
* Digital and analogue instruments
* Analogue electronics
* Digital electronics
* Instrumentation and calibration
* Sensors and transducers
* Physical quantities
* Measurement

**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. Hazard*s* 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. Hazard indicatorsmay 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 indicatorsmay 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. prevention and control measuresmay 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 measuresmay include but not limited to | * Evacuation * Isolation * Decontamination * (Calling designed) emergency personnel |
| 1. Emergency 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. Emergency proceduresmay include but not limited to | * Fire drill * Earthquake drill * Basic life support CPR * First aid * Spillage control * Decontamination of chemical and toxics * Disaster preparedness * Use of fire extinguishes |
| 1. PPE*s* may include but not limited to | * + Mask   + Gloves   + Goggles   + Safety hat   + Overall   + Ear protector |
| 1. OSH-related recordsmay include but not limited to | * Medical Health records * Incident accident reports * Sickness notifications sick leave application * OSH-related trainings obtained |
| 1. Environmental pollution 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 |
| 1. Waste management procedures may include but not limited to | * Sorting * Storing of items * Recycling of items * Disposal of items |
| 1. Resource may include but not limited to | * Electricity * Water * Fuel * Telecommunications * Supplies * Materials |
| 1. Organizations’ policies and guidelines may include but not limited to | * supply chain, procurement and purchasing * quality assurance * making recommendations and seeking approvals |

**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. Adhered to workshop safety regulations   2. Handled tools, instruments and equipment are as per manufacture’s manuals   3. Tested functionality of tools and instruments   4. Prepared a work piece using right Machine as per the task.   5. Repaired Replaced faulty components and tools as per the expected functionality  1. Evaluated workplace hazards based on legal requirements. 2. Addressed OSH concerns raised by workers as per legal requirements. 3. Implemented hazard prevention and control measures as per legal requirement. 4. Conducted risk assessment as per legal requirement. 5. Implemented company OSH programs as per legal requirements. 6. Maintained OSH-related records as per legal requirements    1. Controlled environmental hazard    2. Controlled environmental pollution    3. Demonstrated sustainable resource use    4. Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues concerns.    5. Implemented and monitored environmental practices on a periodic basis as per company guidelines    6. Recommended solutions for the improvement of the program 7. Reported to proper authorities any environmental incidents |
| * + - 1. Resource Implications | The following resources should be provided:   * 1. Electrical installation tool kit   2. Testing equipment   3. Measuring equipment   4. First Aid kit   5. Access to relevant workplace where assessment can take place   6. Appropriately simulated environment where assessment can take place   7. Workplace with storage facilities   8. Tools, materials and equipment relevant to the tasks (e.g. cleaning tools, cleaning materials, trash bags)   9. PPE, manuals and references   10. Legislation, policies, procedures, protocols and local ordinances relating to environmental protection   11. Case studies scenarios relating to environmental Protection |
| * + - 1. Methods of Assessment | **Competency may be assessed through:**   * 1. Practical   2. Demonstration   3. Oral tests   4. Written test   5. Portfolio of Evidence   6. Third party report |
| * + - 1. Context of Assessment | * 1. Competency may be assessed individually in the actual workplace or simulated setting of the actual work place |
| * + - 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY HUMAN ANATOMY AND PHYSIOLOGY PRINCIPLES

**UNIT CODE:** 0914441 08A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to Apply Human Anatomy and Physiology Principles. Competencies include: Applying knowledge of Basics of Human Anatomy and Physiology, Applying Musculoskeletal System knowledge, Applying Cardiovascular System knowledge, Applying Respiratory System knowledge, Applying Digestive System knowledge, Applying Urinary System knowledge, Applying Nervous System knowledge, Applying Reproductive System knowledge, Applying dental anatomy knowledge, Applying Special Sensory Organs knowledge and Applying basic patient care and medical ethics knowledge.

**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 Basics of Human Anatomy and Physiology | 1. ***Medical terminology*** knowledge is applied as per work requirement. 2. Human body compartments are identified as per work requirement 3. Human body cells, tissues and organ knowledge is applied as per work requirement |
| 1. Apply Special Sensory Organ knowledge | * 1. ***Eye Anatomy and Physiology*** knowledge is applied as per work requirement   2. ***Ear Anatomy and Physiology*** knowledge is applied as per work requirement   3. Nose Anatomy and Physiology knowledge is applied as per work requirement   4. Sensory Organ disorderknowledge is applied as per work requirement. |
| 1. Apply Musculoskeletal System knowledge | 1. ***Bone Anatomy and Physiology*** knowledge is applied as per work requirement 2. ***Muscle Anatomy and Physiology*** knowledge is applied as per work requirement 3. Musculoskeletal disorder knowledge is applied as per work requirement. |
| 1. Apply Cardiovascular System knowledge | * 1. ***Heart Anatomy and Physiology*** knowledge is applied as per work requirement   2. ***Blood circulation knowledge*** is applied as per work requirement.   3. Cardiovascular disorder knowledge is applied as per work requirement. |
| 1. Apply Respiratory System knowledge | * 1. ***Respiratory System Anatomy and Physiology*** knowledge is applied as per work requirement   2. Respiration process knowledgeis applied as per work requirement.   3. Respiratory disorderknowledge is applied as per work requirement. |
| 1. Apply Digestive System knowledge | * 1. ***Digestive System Anatomy and Physiology*** knowledge is applied as per work requirement   2. Digestive process knowledgeis applied as per work requirement.   3. Digestive disorderknowledge is applied as per work requirement. |
| 1. Apply Urinary System knowledge | * 1. ***Kidney Anatomy and Physiology*** knowledge is applied as per work requirement   2. Urinary process knowledgeis applied as per work requirement.   3. Urinary disorderknowledge is applied as per work requirement. |
| 1. Apply Nervous System knowledge | * 1. Knowledge of cells and tissues of nervous system is applied as per work requirement.   2. ***Nervous System Anatomy and Physiology*** knowledge is applied as per work requirement   3. Nervous disorderknowledge is applied as per work requirement. |
| 1. Apply Reproductive System knowledge | * 1. ***Female Reproductive Anatomy and Physiology*** knowledge is applied as per work requirement   2. ***Male Reproductive Anatomy and Physiology*** knowledge is applied as per work requirement   3. Human development processknowledgeis applied as per work requirement.   4. Reproductive disorderknowledge is applied as per work requirement. |
| 1. Apply dental anatomy knowledge | * 1. The tooth and buccal cavity are sketched and labelled as per work requirement   2. Common dental disease and disorders are identified as per work requirement   3. Dental diagnostic and therapeutic measures and equipment are identified as per work requirement |
| 1. Apply basic patient care and medical ethics knowledge | 1. Basic patient care knowledge is applied as per work requirement 2. Medical ethics knowledge is applied as per work requirement. 3. Code of practice knowledge is adhered to as per work requirement. |

**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. Medical terminologies | * Directional terms * Regional terms * Body and plane sections * Terms of motion * Body cavities |
| 1. Bone Anatomy and Physiology include but not limited to: | * Functions of bones * Types of bones * Bone structure * Microscopic structure of bone * Development of bone tissue * Healing of bone * Types of skeletons * Types of joints |
| 1. Muscle Anatomy and Physiology include but not limited to: | * Organization of skeletal muscle * The neuromuscular junction * Action of skeletal muscle * Principal skeletal muscles |
| 1. Heart Anatomy and Physiology include but not limited to: | * Position * Structure * Flow of blood through the heart * Blood supply to the heart (the coronary   circulation)   * Conducting system of the heart * The cardiac cycle * Cardiac output |
| 1. Blood circulation knowledgeinclude but not limited to: | * Blood pressure * Types of blood circulations * Fetal circulation |
| 1. Respiratory System Anatomy and Physiologyinclude but not limited to: | * Nose and nasal cavity * Pharynx * Larynx * Trachea * Lungs * Bronchi and bronchioles * Respiratory bronchioles and alveoli * Respiration processes |
| 1. Digestive System Anatomy and Physiologyinclude but not limited to: | * The digestive tract * Pancreas * Liver * Biliary tract * Bile ducts Gall bladder * Digestive processes |
| 1. Kidney Anatomy and Physiologyinclude but not limited to: | * Gross structure of the kidney * Microscopic structure of the kidney * Functions of the kidney * Ureters * Urinary bladder * Urethra * Urinary processes |
| 1. Nervous System Anatomy and Physiology include but not limited to: | * Cells and Tissues of Nervous System * The meninges and cerebrospinal * fluid (CSF) * The meninges * Central nervous system * Brain * Spinal cord * Peripheral nervous system * Autonomic nervous system |
| 1. Female Reproductive Anatomy and Physiology include but not limited to: | * External genitalia (vulva) * Internal genitalia * Breasts * Puberty in the female * The reproductive cycle |
| 1. Male Reproductive Anatomy and Physiology include but not limited to: | * Scrotum * Testes * Seminal vesicles * Ejaculatory ducts * Prostate gland * Urethra and penis |
| 1. Eye Anatomy and Physiologyinclude but not limited to: | * Structure * Physiology of sight |
| 1. Ear Anatomy and Physiology include but not limited to: | * Structure * Physiology of hearing |

**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:

* Drawing/sketching skills
* Problem solving
* Critical thinking
* Report writing
* Record keeping

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Medical terminologies
* Human body systems
* Functions of the human body organs
* Hospital hygiene
* Vital body organs
* Medical ethics and codes of practice
* Medical equipment

**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. Applied Basics of Human Anatomy and Physiology knowledge as per work requirement. 2. Applied Musculoskeletal System anatomy and physiology knowledge as per work requirement 3. Applied Cardiovascular System anatomy and physiology knowledge as per work requirement 4. Applied respiratory system anatomy and physiology knowledge as per work requirement 5. Applied Digestive system anatomy and physiology knowledge as per work requirement 6. Applied Urinary system anatomy and physiology knowledge as per work requirement 7. Applied nervous system anatomy and physiology knowledge as per work requirement 8. Applied reproductive system anatomy and physiology knowledge as per work requirement 9. Applied dental anatomy and physiology knowledge as per work requirement 10. Applied special sensory organ knowledge as per work requirement 11. Applied human body disorder knowledge as per work requirement. 12. Applied Basic patient care and medical ethics knowledge as per work requirement. |
| 1. Resource Implications | 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:   * 1. Observation   2. Oral presentation   3. Projects   4. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or Simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY MECHANICAL SCIENCE PRINCIPLES

**UNIT CODE:** 0714441 09A

**UNIT DESCRIPTION**

This unit specifies the competencies required to apply mechanical science principles. Competencies includes: Applying forces in a system, Applying knowledge of moments, Applying friction principles, Applying motions laws, Describing work, energy and power, performing machine calculations, Demonstrating gas principles, Applying heat knowledge, Applying density knowledge, Applying pressure principles, Applying optical principles and Applying wave principles.

**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 forces in a system | * 1. Forces are applied as per physics concept   2. ***Forces theorems*** are applied as per the physics concept   3. Resultant of coplanar forces are calculated as per the mass x acceleration formula.   4. ***Mechanical calculations*** are performed as per the mass x acceleration formula. |
| 1. Apply knowledge of moments | 1. Moments are applied as per the physics concept 2. Moments are calculated as per the moment’s formula 3. Principles of moments are applied as per the moments formula 4. Couples are identified and applied in engineering systems as per work requirement. |
| 1. Apply friction principles | 1. Laws of friction are applied as per the physics concept. 2. Limiting friction is calculated as per the coefficient of friction formula. 3. Forces applied at an angle to a horizontal plane are calculated as per the coefficient of friction formula. 4. Coefficient of friction is applied as per the work requirement. 5. Advantages and disadvantages of friction are identified. |
| 1. Apply motions laws | 1. Motion concepts are applied as per the physics concept. 2. Motion calculations are performed as per the equations of motion. 3. Displacement/time graphs are applied as per the work requirement. |
| 1. Describe work, energy and power | 1. Work is calculated as per the force\* distance formula 2. Energy is calculated as per the force\* distance formula 3. Power calculations are performed as per the watt’s formula 4. ***Problems on simple machines*** and levers are solved as per the work requirement. |
| 1. Demonstrate gas principles | * 1. ***Gas laws*** are applied as per the physics concept   2. Gas laws are applied in solving engineering problems as per the work requirement.   3. Uses of gases in engineering systems are identified as per the work requirement. |
| 1. Apply heat knowledge | 1. Heat physics concepts are applied as per the specific heat formula. 2. Working principle of heat applied as per the specific heat formula. 3. Heat capacity is calculated as per the specific heat formula. 4. Heat problems are solved as per work requirements. |
| 1. Apply density knowledge | * 1. Density physics concepts are applied as per the physics concept.   2. Density measurements are carried out as per the density equation formula.   3. Density problems are calculated as per the density equation formula. |
| 1. Apply pressure principles | * 1. Pressure physics concepts are applied as per the pascal’s theorem.   2. Working principles of pressure is applied as per the pascal’s theorem.   3. Pressure problems are solved as per the pascal’s formula.   4. ***Pressure applications*** are applied as per the work requirement. |
| 1. Apply pneumatics and hydraulics principles | 1. Pneumatics and hydraulics physics concepts are applied as per the pound’s formula. 2. Pneumatics and hydraulics problems are solved as per the pound’s formula. 3. Working principle of pneumatics and hydraulics is applied as per the work requirement. |
| 1. Apply optical principles | 1. Nature of Light concepts are applied as per light propagation concepts 2. ***Geometrical Optics concepts*** are applied as per the snells laws 3. Fiber optics concepts are applied as per optical concepts |
| 1. Apply wave principles | 1. Wave phenomenon concepts are applied as per wave propagation concepts 2. Electromagnetic waves concepts are applied as per radiation concept. 3. Light waves concepts are applied as per radiation concepts 4. Sound waves concepts are applied as per radiation concepts |

**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. 1.Forces theoremsinclude but not limited to: | * Newton's First law * Newton's Second Law * Newton's Third Law |
| 1. 2***.***Mechanical calculations | * Mechanical advantage * Efficiency * Torque * Power/Energy * Work done |
| 1. 3***.***Problems on simple machines include but not limited to: | * + Machine advantage   + Velocity ratio * Efficiency |
| 1. 4***.*** laws include but not limited to: | * + Boyles law   + Charles law * Gas equation |
| 1. 5.Pressure applications include but not limited to: | * + Vacuum pump   + Hydraulic pump * Hydrometers |
| 6. Geometrical Optics concepts | * + Light propagation,   + Reflection   + Refraction   + Image formation   + Mirrors   + Lenses |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Installation
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Determined forces in a system as per the physics concept   2. Demonstrated knowledge of moments as per the formula   3. Solved problems on friction principles as per the mass acceleration formula   4. Solved problems on motions in engineering as per the equations of motion formula   5. Described work, energy and power as per the physics concept   6. Solved problems on gas principles as per the physics concept   7. Applied heat knowledge as per the physics concept   8. Applied density knowledge as per the physics concept   9. Applied pressure principles as per the physics concept   10. Applied pneumatics and hydraulics principles as per the physics concept   11. Applied optical principles as per the physics concept.   12. Applied wave principles as per the physics concept. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Access to mechanical tools and equipment which can be used for assessment 3. Access to relevant tools which can be used for installation and maintenance |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Written test 2. Practical Demonstration 3. Interview |
| 1. Context of Assessment | 1. Competency may be assessed individually in the actual workplace or Simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ANALOGUE ELECTRONICS I

**UNIT CODE:** 0714441 10A

**UNIT DESCRIPTION**

This unit describes the competencies required to apply analogue electronics. It involves applying semiconductor theory, semiconductor diodes, understanding of transistors, special semiconductor devices and performing rectification.

|  |  |
| --- | --- |
| **ELEMENTS**  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. Understand semiconductor theory | * 1. Types of ***materials*** are identified in line with semiconductor theory   2. Semiconductor materials are identified as per electrical conductivity properties |
| 1. Apply semiconductor diodes | * 1. Types of diodes are identified as per functionality   2. ***Diodes*** characteristics are determined as per properties   3. Forward and reverse bias characteristics are established as per properties of the semiconductor material |
| 1. Apply transistors | * 1. ***Transistors*** are identified as per characteristics   2. NPN and PNP are determined as per operation   3. P and N channels are identified as per operation   4. ***Biasing*** and determination of gain of transistors is performed as per standard operating procedure   5. Transistor configuration is performed as per application |
| 1. Apply special semiconductor devices | * 1. Special semiconductor devices are identified as per operation   2. Special semiconductors are applied as per standard operating procedure   3. Types of special semiconductor devices are identified |
| 1. Performed rectification | * 1. Types of rectifiers are identified as per functions   2. Classes of rectifiers are identified as per input voltage   3. Applications of rectifiers are established   4. Converters are identified as per functions   5. Applications of converters are established as per functions |

**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. Materials may include but is not limited to: | * Insulators * Conductors * Semiconductors |
| 1. Diodes may include but is not limited to: | * Photo diodes * Laser * Zener diodes * Light emitting diode * Schottky diodes |
| 1. Transistors may include but is not limited to: | * BJTs * FETs |
| 1. Biasing may include but is not limited to: | * Forward bias * Reverse bias |
| 1. Amplifiers may include but is not limited to: | * RC coupled amplifiers * Small signal amplifiers * Power amplifiers * Tuned amplifier * Wide band amplifiers * Op-Amp amplifiers |

**REQUIRED KNOWLEDGE AND UNDERSTANDING**

* The manufacturer's warranty requirements relating to electronics installation systems and related components.
* The legal requirements relating to electricalinstallations
* Kenyan legislation and workplace procedures relevant to:
* Health and safety;
* Environment (including waste disposal);
* Appropriate personal protective equipment (PPE).
* Work place communication;
* Time management
* Materials management
* The importance of documentation and keeping records
* The relationship between time and costs
* The importance of using the correct sources of technical information.
* Interpreting circuits, drawings, specifications and instructions
* Preparing work plans in accordance with legislative and regulatory requirements and standard operating procedures and health and safety requirements
* Contractual agreements
* Necessary insurance and policies including security bonds, performance bonds, contractors all risks
* Insurance of contractor’s work
* Keeping records of income
* Financial statements

**FOUNDATION SKILLS**

* Communications (verbal and written);
* Proficient in logistic management;
* Time management;
* Meeting organization;
* Analytical
* Faults troubleshooting;
* Planning;
* Decision making;
* First aid;
* Report writing;
* Problem solving;
* Management

**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 different semiconductor material as per work procedure. 2. Applied diodes in electronic circuits as per work procedure. 3. Applied transistors in basic electronic circuits as per work procedure. 4. Identified special semiconductor devices as per work procedure. 5. Performed rectification of ac power to dc power as per work procedure. 6. Identified operational amplifiers as per application as per work procedure. 7. Carried out wave shaping and pulse generation circuits as per standard operating procedure. |
| 1. Resource Implications | The following resources must be provided:   * 1. Appropriately simulated environment where assessment can take place.   2. Access to relevant workplace environment.   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Portfolio of evidence 3. Third party report 4. Oral questioning 5. Written tests |
| 1. Context of Assessment | Competency may be assessed in actual workplace or simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ANALOGUE ELECTRONICS II

**UNIT CODE:** 0714441 11A

**UNIT DESCRIPTION**

This unit covers the competencies required in applying analogue electronics II. These competencies include; building amplifier circuits, constructing signal generators, constructing signal filter circuits and applying opto-electronics

**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. Build amplifier circuits | * 1. ***Amplifier*** circuit construction components, tools and equipment are assembled as per work requirement   2. Amplifier circuitsare built as per circuit design   3. Amplifier circuitsare tested as per work requirement |
| 1. Construct signal generators | * 1. ***Signal generator*** construction components, tools and equipment are assembled as per work requirement   2. Signal generator circuits are built as per circuit design   3. Signal generator circuitsare tested as per work requirement |
| 1. Construct signal filter circuits | * 1. ***Signal filter*** circuit construction components, tools and equipment are assembled as per work requirement   2. Signal filter circuits are built as per circuit design   3. Signal filter circuitsare tested as per work requirement |
| 1. Apply opto-electronics | 1. Types of Opto-electronics semiconductors are identified as per operation characteristics 2. Lasers and masers are identified as per operations 3. Drive requirements are determined as per display. |

**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. ***Amplifier*** may include but not limited to: | * Operational amplifiers * Classical amplifier |
| 1. ***Signal generator*** may include but not limited to: | * Function generator * Radio Frequency generator * Audio signal generator * Pulse generator |
| 1. ***Signal filter*** may include but not limited to: | * Band pass filters * Low pass filters * High pass filters |
| 1. Lasers may include but is not limited to | * Gaseous lasers * Solid lasers |

**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
* Listening skills
* Problem solving skills
* Organizational skills
* Time management
* Critical thinking
* Mathematical skills
* Geometrical skills
* Electronic troubleshooting
* Interpretation of information
* Technical reporting skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Entrepreneurship
* Environmental awareness
* Electrical and electronics safety awareness
* Electrical and electronics measurements and units

**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. Built amplifier circuits as per circuit design    1. Tested Amplifier circuits as per work requirement    2. Built Signal generator circuits are as per circuit design    3. Tested Signal generator circuits as per work requirement    4. Built signal filter circuits as per circuit design    5. Identified Opto-electronics semiconductors as per operation characteristics |
| 1. Resource implications | The following resources should be provided:   * 1. Appropriately simulated environment where assessment can take place   2. Access to relevant work environment   3. Resources relevant to the proposed activities or tasks |
| 1. Methods of assessment | Competency in this unit may be assessed through:   * 1. Practical assessment   2. Project   3. Portfolio of evidence   4. Third party reports   5. Written tests   6. Oral questioning |
| 1. Context of assessment | Competency may be assessed in a:   * 1. Workplace or   2. simulated workplace |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector and workplace job role is recommended. |

## APPLY ELECTRICAL PRINCIPLES I

**UNIT CODE:** 0713441 12A

**UNIT DESCRIPTION**

This unit describes competences required to apply electrical principles. Competences include applying electrical quantities, using cells and batteries and applying concepts of dc circuits.

**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 Electrical quantities | 1. Electrical quantities and units are identified as per SI systems. 2. Calculations involving various electrical quantities are performed as per formula. 3. Electrical quantities measuring instruments are identified as per IEC standards. |
| 1. Use cells and batteries | 1. Simple cells are constructed as per work procedure. 2. ***Types of cells and batteries*** are identified as per work requirement. 3. E.M.F and internal resistance of cells is determined as per the measurement. 4. Maintenance of batteries is carried out based on manufacturer’s specification. 5. Applications of batteries are identified as per work requirement. |
| 1. Apply DC circuit | * 1. Resistance and resistivity is determined in DC circuit as per IEC standards.   2. Calculations involving parallel and series circuits are performed based on DC circuit.   3. Calculations involving ***DC theorems*** are performed based on DC circuit. |

**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. ***Types of cells and batteries*** may include but not limited to: | * + Dry cells   + Leclanché   + Mercury   + Lead-acid   + Alkaline   + Lithium |
| 1. ***DC theorems*** may include but not limited to: | * + Kirchhoff’s theorem   + Superposition theorem   + Thevenin’s theorem   + Norton theorem   + Maxwell theorem |

**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:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Power factor correction
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**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. Applied the correct SI units of Electrical quantities. 2. Constructed simple cells as per work procedure. 3. Identified primary and secondary cells. 4. Maintained batteries based on manufacturer’s specification. 5. Applied DC circuit theory concepts. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Measuring equipment 3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Project 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL PRINCIPLES II

**UNIT CODE:** 0713441 13A

**UNIT DESCRIPTION**

This unit describes competences required to apply electrical principles. Competences include applying magnetism and electromagnetism, applying electrostatics principles, applying ac circuits and conducting system earthing and protection.

**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 magnetism and electromagnetism | * 1. Magnetic and non-magnetic materials are identified as per requirement.   2. Concepts of magnetic fields and field distribution are described as per electromagnetic laws   3. Existence of magnetic field is verified based on magnetic field strength.   4. ***Laws of electromagnetic induction*** are identified based on magnetic fields.   5. Concepts of electromagnetism are applied based on magnetic properties.   6. Concepts of self and mutual induction are applied as per electromagnetic laws. |
| 1. Apply Electrostatics principles | * 1. Electrostatics quantities are identified as per type of charges.   2. Types of capacitors are identified as per application requirement.   3. Calculations involving capacitors in series and parallel are performed as per electrostatic quantities.   4. Capacitors are applied in electrical circuits as per application requirement.   5. Capacitors are tested as per IEC standards. |
| 1. Apply AC circuits | * 1. AC fundamentals are applied as per working principles.   2. Equation of the sine wave is derived as per AC working principles.   3. Calculation involving passive elements in AC circuits is performed based on the circuit requirement.   4. Concept of Power triangle is applied as per AC working principles.   5. Calculations involving power factor correction is performed as per working principles.   6. Methods of power factor correction are applied as per working principles. . |
| 1. Conduct Electrical installation, System Earthing and protection | * 1. ***Electrical installation*** is performed as per the applicable IEC and IET standards.   2. System and equipment ***protection principles*** are applied as per the IEC and IET standards.   3. ***Protection system design*** is performed as per the IEC standard.   4. ***Earthing system*** is designed as per the IEC standards.   5. ***Test on an earthing* system** is performed as per the applicable IEC and IET standards.   6. Types of lightning strikes are identified based on Benjamin Franklin recommendations.   7. ***Lightning system design*** is performed as per the applicable IEC and IET standards. |

**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. ***Laws of electromagnetic induction*** may include but not limited to: | * + Screw rule   + Grip   + Flemings   + Faradays |
| 1. **Electrical installation** may include but not limited to: | * + Call and alarm circuits   + Domestic wiring circuits |
| 1. ***Protection principles*** may include but not limited to: | * + Protection zones   + Protection systems |
| 1. ***Protection system design*** may include but not limited to: | * + Protection system Drawings   + Protection system Device sizing   + Protection system Location |
| 1. ***Earthing system*** **is designed** may include but not limited to: | * + TT   + TNC   + TNCS   + IT   + TNS |
| 1. ***Test on an earthing system*** may include but not limited to: | * + Earth resistance test   + Earth loop impedance test |
| 1. ***Lightning system design*** may include but not limited to: | * + Lightning arrestors   + Lightning design drawing   + Size of lightning system |

**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:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Power factor correction
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**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:   * Applied concepts of magnetism and electromagnetism. * Applied concepts of A.C circuits. * Applied concepts of electrostatics. * Conducted System Earthing and protection * Applied Two Port networks * Applied Electromagnetic field Theory |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Measuring equipment 3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Project 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ELECTRICAL PRINCIPLES III

**UNIT CODE:** 0713441 14A

**UNIT DESCRIPTION**

This unit describes competences required to apply electrical principles. Competences include performing electrical measurements, applying basic electrical machines, applying three phase power supply and applying transients in dc circuits.

**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 electrical measurements | * 1. Types of instruments are identified as per work procedure.   2. Construction and operation of instruments is demonstrated as per work procedure.   3. Methods of range extension are applied as per work procedure.   4. Null-indicating instruments are identified as per work procedure.   5. Calculations involving electrical instruments are performed as per the formula.   6. Instrumental/systematic errors and mitigations are demonstrated as per work requirement.   7. Calculations involving systematic errors are performed as per the formula. |
| 1. Apply basic electrical machines | * 1. Electrical machines are identified as per work requirement.   2. Operations involving ***electrical machines*** are applied as per machine type.   3. Generator e.m.f equation is derived as per AC working principles.   4. Electrical machines are controlled as per work procedure.   5. Calculations involving electrical machines are performed based on formula.   6. Applications of electrical machines are identified as per work requirement. |
| 1. Apply three phase power supply | * 1. Principles of three phase power generation is demonstrated as per AC fundamentals.   2. Connections of three phase power supply are performed as per load requirement.   3. Calculations involving three phase power supply connections are performed as per the circuit theories.   4. Three phase power is measured as per IET regulation. |
| 1. Apply transients in DC Circuits | 1. Growth and decay equations are derived in R-L and R-C circuits as per working principles. 2. Growth and decay curves in R-L and R-C circuits are sketched as per equation. 3. Calculations involving Growth and decay in R-L and R-C are performed based on the time constants. 4. Effect of time constant in switching inductive and capacitive loads is applied as per work procedure. 5. Passive and active filters are analyzed as per the applications. |

**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. ***Electrical machines*** may include but not limited to: | * + DC motors   + DC generators   + AC single phase motors   + AC three phase machines: Induction, Synchronous   + Transformers |

**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:

* Apply basic Electrical formulas
* Use of basic Electrical instruments
* Perform various unit conversions of Electrical quantities
* Power factor correction
* logical thinking
* problem solving
* applying statistics
* drawing graphs
* Using different measuring tools

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Electrical power calculations
* Various laws in Electrical engineering
* Electrical formulas
* Power triangle
* SI units of various electrical parameters
* Selecting the correct type of electrical machines for various uses
* Types and purpose of measuring instruments
* Units of measurement and abbreviations

**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. Performed electrical measurements. 2. Applied basic electrical machines 3. Applied three phase power supply 4. Applied transients in DC Circuits |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace or appropriately simulated environment where assessment can take place 2. Measuring equipment 3. Materials relevant to the proposed activity or tasks |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical 2. Project 3. Third party report 4. Portfolio of evidence 5. Written tests 6. Oral questioning |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PREPARE TECHNICAL DRAWINGS I

**UNIT CODE:** 0732441 15A

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare technical drawings. Its competencies include; preparing drawing equipment and materials, producing plane geometry drawings, managing basic operations in AutoCAD, developing 2D Drawings in AutoCAD.

| **ELEMENTS**  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. Prepare drawing equipment and materials | 1. ***Drawing equipment*** are identified according to task requirements 2. ***Drawing materials*** are identified according to task requirements 3. Drawing equipment are used as per technical drawing standards 4. Drawing equipment are maintained as per technical drawing standards 5. Drawing materials are used as per workplace procedures 6. Waste materials are disposed in accordance with workplace procedures and environmental legislations | |
| 1. Produce plane geometry drawings | 1. Different types of lines used in drawing and their meanings are identified according to technical drawing standards 2. Freehand printing of letters and numbers carried out as per technical drawing standards 3. Borderlines and title blocks are drawn as per technical drawing standards. 4. Different types of angles are constructed as per technical drawing standards 5. Different types of ***geometric figures*** are constructed as per required dimensions 6. Different types of ***Tangents*** are constructed according to technical drawing standards. | |
| 1. Manage basic operations in AutoCAD | * 1. ***Key features*** of CAD software are identified as per software manual.   2. ***AutoCAD visual reference commands*** are operated as per software manual.   3. AutoCAD navigation commands option is operated as per software manual.   4. AutoCAD ***ribbon*** tools are used as per software manual.   5. AutoCAD ***status bar*** tools are used as per software manual.   6. AutoCAD drawing files are saved in proper format as per organisational procedures   7. AutoCAD drawing work is printed as per software manual. | |
| 1. Develop 2D Drawings in AutoCAD | 1. Drawing interface is set up as per required specifications. 2. Layout is created as per given specification. 3. 2D drawing is created as per given dimension. 4. 2D drawing is edited as per given requirement changes. 5. AutoCAD drawing is saved in CAD file format as per software manual. 6. AutoCAD 2D drawing work is printed as per software manual. | |

**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. Drawing Equipment may include but is not limited to: | * Drawing boards * T and set squares * Drawing set |
| 1. Drawing materials may include but is not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * 2.5 Paper clips |
| 1. Geometric figures may include but is not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms |
| 1. Tangents may include but is not limited to: | * Exterior tangents to a circle * Interior tangents to a circle |
| 1. Key features may include but is not limited to: | * 2D drafting and drawing * 3D drafting and drawing |
| 1. AutoCAD visual reference commands may include but is not limited to: | * Visual styles * Materials and textures * Writing * Rendering * View port |

**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:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Basic computer skills
* Communication
* Inter personal

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**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:   * Used drawing equipment as per technical drawing standards * Used drawing materials as per workplace procedures * Identified different types of lines used in drawing and their meanings according to technical drawing standards * Constructed different types of angles as per technical drawing standards * Constructed different types ofTangents according to technical drawing standards * Constructed different types of geometric figures as per required dimensions * Operated AutoCAD visual reference commands as per software manual. * Used AutoCAD ribbon tools as per software manual. * Used AutoCAD status bar tools as per software manual. * Operated AutoCAD navigation commands option as per software manual. * Printed AutoCAD drawing work as per software manual * Printed AutoCAD 2D drawing work as per software manual * Edited 2D drawing as per given requirement changes. * Created 2D drawing as per given dimension * Produced pictorial sketches and pictorial drawings of components as per technical drawing standards. * Produced First and third angle orthographic sketches and drawings of components as per technical drawing standards. * Freehand sketched different types of geometric forms, tools and equipment as per technical drawing standards * Produced ***Pictorial and orthographic drawings*** using AutoCAD software as per software manual * Drew Electrical schematic diagrams as per installation requirement * Produced Electrical and Electronic drawings using appropriate CAD software as per software manual * Placed Electrical installation components on a building plan using AutoCAD as per required design. |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   * Drawing room * Drawing equipment and materials * Computers * CAD packages * Drawing softwares |
| 1. Methods of Assessment | **Competency may be assessed through:**   1. Practical demonstration 2. Projects 3. Written tests  * Oral test |
| 1. Context of Assessment | * Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PREPARE TECHNICAL DRAWINGS II

**UNIT CODE:** 0732441 16A

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare technical drawings. Its competencies include; Producing pictorial, orthographic drawings and electrical drawings.

| **ELEMENTS**  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. Produce pictorial drawings of components | 1. Different symbols and abbreviations are identified, and their meaning interpreted as per technical drawing standards. 2. Pictorial sketches and ***pictorial drawings*** of components are interpreted and produced as per technical drawing standards. 3. Different types of geometric forms, tools and equipment is freehand sketched as per technical drawing standards. | |
| 1. Produce orthographic drawings of components | 1. First angle orthographic sketches and drawings of components are interpreted and produced as per technical drawing standards. 2. Third angle orthographic sketches and drawings of components are interpreted and produced as per technical drawing standards. 3. Isometric projections and oblique projections are interpreted and produced as per technical drawing standards. | |
| 1. Produce electrical drawings | * 1. Electrical symbols and abbreviations are identified according to BS 3939 standards   2. Electrical schematic diagrams are drawn as per installation requirement   3. Electrical wiring diagrams are drawn as per installation requirement   4. ***Electrical and Electronic drawings*** are produced using appropriate CAD software as per software manual   5. Electrical installation components are placed on a building plan using AutoCAD as per required design   6. Electrical and electronic drawings are simulated as per software manual | |

**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. Pictorial and orthographic drawings may include but is not limited to: | * Range * Elevation * Isometric * Sectioning |
| 1. Electrical and Electronic drawings may include but is not limited to: | * Block * Wiring diagram * schematic * PCB |

**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:

* Critical thinking
* Drawing
* Interpretation
* Drawing equipment handling
* Analysis and synthesis
* Basic computer skills
* Communication
* Inter personal

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Isometric drawing conventions, features, characteristics, components
* Orthographic drawing conventions, features, characteristics, components
* Sketches and drawings of simple patterns

**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. Produced ***Pictorial and orthographic drawings*** using AutoCAD software as per software manual 2. Drew Electrical schematic diagrams as per installation requirement 3. Produced Electrical and Electronic drawings using appropriate CAD software as per software manual 4. Placed Electrical installation components on a building plan using AutoCAD as per required design. |
| 1. Resource Implications | Resources the same as that of workplace are advised to be applied.   1. Drawing room 2. Drawing equipment and materials 3. Computers 4. CAD packages 5. Drawing software |
| 1. Methods of Assessment | Competency may be assessed through:   1. Practical demonstration 2. Projects 3. Written tests 4. Oral test |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM DIAGNOSTIC AND LABORATORY EQUIPMENT MAINTENANCE I

**UNIT CODE:** 0914451 17 A

**UNIT DESCRIPTION**:

This unit specifies the competencies required to perform diagnostic and laboratory equipment maintenance. Competencies include: perform vital-signs monitors, microscope and centrifuge maintenance.

|  |  |
| --- | --- |
| **ELEMENTS**  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 Vital-Signs Monitors Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Vital-signs monitors*** are disinfected as per work procedure. 3. Vital-signs monitors parts are inspected as per service manual**.** 4. Fault diagnosis is carried out as per service manual. 5. Vital-signs monitor parts are cleaned as per service manual 6. Vital-signs monitors parts are maintained as per manufacturer’s specifications. 7. Vital-signs monitors faulty parts are maintained as per manufacturer’s specifications. 8. Vital-signs monitors functionality check is carried out as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Vital-signs monitors Service report is prepared as per work procedure. |
| 1. Perform Microscope Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Microscope*** is disinfected as per work procedure. 3. ***Microscope* *parts*** are inspected as per service manual**.** 4. Fault diagnosis is carried out as per service manual. 5. ***Lenses*** andstageare cleaned as per service manual 6. Microscope parts are maintained as per manufacturer’s specifications. 7. Microscope faulty parts are maintained as per manufacturer’s specifications. 8. ***Microscope*** functionality check is carried out as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Microscope Service report is prepared as per work procedure. |
| 1. Perform Centrifuge Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Centrifuge*** is disinfected as per work procedure. 3. ***Centrifuge parts*** are inspected as per service manual. 4. Centrifuge fault diagnosis is carried out as per service manual. 5. Centrifuge Movable parts are lubricated as per manufacturer’s specifications. 6. Centrifuge Faulty parts are maintained as per manufacturer’s specifications. 7. Centrifuge functionality check is carried out as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Centrifuge Service report is prepared as per work procedure. |

**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. Vital-signs monitors include but not limited to: | * Blood pressure machines * Pulse oximeters * Capnograph machine * Blood gas analysers * EEG machine * ECG machine * Glucometer * Bilirubinometer * Diagnostic set |
| 1. Microsco***pe*** include but not limited to: | * Light * Electron |
| 1. Microscope parts include but not limited to: | * Base * Stage * Lenses * Adjustment knobs |
| 1. Lense***s*** include but not limited to: | * Eye piece * Objective |
| 1. Centrifuge include but not limited to: | * Table top bench top * Haematocrit * Ultracentrifuge * Refrigerated centrifuge |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Installation
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Applied Health hazards and safety procedures as per work procedure. 2. Disinfected diagnostic and laboratory equipment as per work procedures. 3. Inspected all parts of diagnostic and laboratory equipment as per service manual. 4. Performed fault diagnosis of diagnostic and laboratory equipment as per service manuals. 5. Cleaned parts of diagnostic and laboratory equipment as per service manual. 6. Maintained parts of diagnostic and laboratory equipment as per manufacturer’s specifications. 7. Maintained faulty parts of diagnostic and laboratory equipment as per manufacturer’s specifications. 8. Carried out calibration of diagnostic and laboratory equipment as per manufacturer’s specifications. 9. Performed functionality check of diagnostic and laboratory equipment as per service manual. 10. Carried out Equipment user training is in line with the user manual. 11. Prepared diagnostic and Laboratory Equipment Service report as per work procedure. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Access to medical diagnostic and laboratory equipment which can be used for assessment 3. Access to relevant tools which can be used for |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Practical Demonstration   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or Simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM OPERATION THEATRE EQUIPMENT MAINTENANCE

**UNIT CODE:** 0914451 18A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to perform operation theatre equipment maintenance. Competencies include: performing surgical diathermy equipment, anaesthesia equipment, operating theatre table, operating theatre light, patient monitor, CSSD equipment, c-arm equipment, cath lab machine and heart lung machine maintenance.

|  |  |
| --- | --- |
| **ELEMENTS**  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 Surgical Diathermy Equipment Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Surgical Diathermy*** ***Equipment*** is disinfected as per work procedure. 3. ***Surgical Diathermy Parts*** are inspected as per service manual. 4. Surgical Diathermy Equipment Fault diagnosis is performed as per service manual. 5. ***Surgical Diathermy faulty parts*** are maintained as per manufacturer’s specifications. 6. Surgical Diathermy Equipment functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Diathermy Equipment service report is prepared as per work procedure |
| 1. Perform Anaesthesia Equipment Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Anaesthesia Equipment parts*** and ***accessories*** as per work procedure. 3. ***Anaesthesia Equipment parts*** are inspected as per service manual. 4. Anaesthesia Equipment Fault diagnosis is performed as per service manual. 5. Anaesthesia Equipment Calibration is carried out as per manufacturer’s specifications. 6. Anaesthesia Equipment functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Anaesthesia Equipment service report is prepared as per work procedure |
| 1. Perform Operating Theatre Table Maintenance | * 1. Health hazards and safety procedures are carried out as per work procedure.   2. ***Operating Theatre Table*** is disinfected as per work procedure   3. ***Operating Theatre Table* *Parts*** are inspected as per service manual   4. Operating Theatre Table Fault diagnosis is performed as per service manual.   5. Operating Theatre Table parts are maintained as per manufacturer’s specifications.   6. Operating Theatre Table Faulty parts are maintained as per manufacturer’s specifications.   7. Operating Theatre Table functionality check is performed as per service manual.   8. Equipment user training is carried out in line with the user manual.   9. Operating Theatre Table service report is prepared as per work procedure |
| 1. Perform Operating Theatre Light Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Operating Theatre Light*** is disinfected as per work procedure. 3. ***Operating Theatre Light* *Parts*** are inspected as per service manual. 4. Operating Theatre Light Fault diagnosis is performed as per service manual. 5. Operating Theatre Light parts are maintained per manufacturer’s specifications. 6. Operating Theatre Light faulty parts are maintained as per manufacturer’s specifications. 7. Operating Theatre Light functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Operating Theatre Light service report is prepared as per work procedure |
| 1. Perform Patient Monitor Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Patient Monitor is disinfected as per work procedure 3. ***Patient Monitor Parts*** are inspected as per service manual 4. Patient Monitor Fault diagnosis is performed as per service manual. 5. Patient Monitor faulty parts are maintained as per manufacturer’s specifications. 6. Patient Monitor Calibration is carried out as per manufacturer’s specifications. 7. Patient Monitor functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Patient Monitor service report is prepared as per work procedure |
| 1. Perform CSSD Equipment Maintenance | * 1. Health hazards and safety procedures are carried out as per work procedure.   2. ***CSSD Equipment*** are sanitized as per work procedure   3. CSSD Equipment are inspected as per service manual.   4. CSSD Equipment fault diagnosis is performed as per service manual.   5. CSSD Equipment faulty parts are maintained as per manufacturer’s specifications.   6. CSSD Equipment functionality check is performed as per service manual.   7. Equipment user training is carried out in line with the user manual.   8. CSSD equipment service report is prepared as per work procedure |
| 1. Perform C-ARM Equipment Maintenance | 1. Health hazards and safety procedures are applied as per work procedure. 2. ***C-ARM Equipment parts*** are disinfected as per work procedure 3. C-ARM Equipment parts are inspected as per service manual. 4. C-ARM Equipment Fault diagnosis is performed as per service manual. 5. C-ARM Equipment parts are cleaned as per service manual 6. C-ARM Equipment Faulty parts are maintained as per manufacturer’s specifications. 7. C-ARM Equipment operational check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. C-ARM Equipment service report is prepared as per work procedure |
| 1. Perform Cath Lab machine Maintenance | * 1. Health hazards and safety procedures are applied as per work procedure.   2. ***Cath Lab******machine parts*** are disinfected as per work procedure   3. Cath Lab machine partsare inspected as per service manual.   4. Cath Lab machine Fault diagnosis is performed as per service manual.   5. Cath Lab machine parts are cleaned as per service manual   6. Cath Lab machine Faulty parts are maintained as per manufacturer’s specifications.   7. Cath Lab machine operational check is performed as per service manual.   8. Equipment user training is carried out in line with the user manual.   9. Cath Lab machine service report is prepared as per work procedure |
| 1. Perform Heart lung machine Maintenance | * 1. Health hazards and safety procedures are applied as per work procedure.   2. ***Heart lung machine parts*** are inspected as per service manual.   3. Heart lung machine Fault diagnosis is performed as per service manual.   4. Heart lung machine parts are cleaned as per service manual   5. Heart lung machine Faulty parts are maintained as per manufacturer’s specifications.   6. Heart lung machine operational check is performed as per service manual.   7. Equipment user training is carried out in line with the user manual.   8. Heart lung machine service report is prepared as per work procedure |

**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. Surgical Diathermy Equipmentinclude but not limited to: | * Monopolar * Bipolar |
| 1. Surgical Diathermy Partsinclude but not limited to: | * Patient pad * Electrodes * Oscillator generator |
| 1. Anaesthesia Equipment partsinclude but not limited to: | * Vaporizer * Ventilator * Scavenging System * Patient Monitor * Bellows * Flowmeter tubes * Pressure regulator * Check valves * O-rings * Oxygen Sensor * Regulators |
| 1. Operating Theatre Tableinclude but not limited to: | * Hydraulic * Electromechanical |
| 1. Operating Theatre Table Partsinclude but not limited to: | * Arm rest * Head rest * Clamps * Base * Column |
| 1. Operating Theatre Light Parts include but not limited to: | * Base * Spring Arms * Lamp head * Sterilisation Handles |
| 1. Patient Monitor Partsinclude but not limited to: | * ECG leads * Probes * NIBP Cuff * Display |
| 1. CSSD Equipment include but not limited to: | * Autoclave * Oven * Ultrasonic washer * UV steriliser |
| 1. C-ARM Equipment parts include but not limited to: | * X-ray tube * X-ray generator * Image intensifier * Monitor * Gantry |
| 1. Cath Lab machine partsinclude but not limited to: | * Patient table * Monitor * Image intensifier * Injector pump * Angioplasty balloons * Defibrillator |
| 1. Heart lung machine partsinclude but not limited to: | * Pumps * Reservoir * Oxygenator * Heat exchanger * Arterial line filter * Tubings * Cannulae |
| 1. Cryotherapy machine partsinclude but not limited to: | * Cryogenic tank * Chamber * Temperature controls * Ventilation system * User interface |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Installation
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Applied Health and Safety Procedures as per work procedure.   2. Disinfected Theatre Equipment as per work procedure.   3. Inspected all parts of Theatre Equipment as per service manual.   4. Performed fault diagnosis of Theatre Equipment as per service manuals.   5. Cleaned parts of Theatre Equipment as per service manual.   6. Maintained faulty parts of Theatre Equipment as per manufacturer’s specifications.   7. Carried out calibration of Theatre Equipment as per manufacturer’s specifications.   8. Carried out equipment user training as per user manual.   9. Performed complete operational check of Theatre Equipment as per service manual.   10. Prepared Theatre Equipment service report as per work procedure. |
| * + - * 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Access to Theatre Equipment which can be used for assessment 3. Access to relevant tools which can be used for |
| * + - * 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Oral questioning 3. Written test 4. Practical Demonstration 5. Interview 6. Third party report |
| * + - * 1. Context of Assessment | Competency may be assessed individually in the actual workplace or Simulated work place. |
| * + - * 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM DENTAL EQUIPMENT MAINTENANCE

**UNIT CODE:** 0914451 19A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to Perform Dental Equipment Maintenance. Competencies include: maintaining dental unit, maintaining amalgamator, maintaining light cure machine, maintaining dental laser, maintaining dental x-ray and maintaining dental laboratory equipment and maintaining dental scaler.

**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 Dental unit Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Dental unit is disinfected as per work procedure 3. ***Dental unit parts*** are inspected as per service manual 4. Dental unit Fault diagnosis is performed as per service manual. 5. Dental unit parts are maintained as per manufacturer’s specifications. 6. Dental unit faulty parts are maintained as per manufacturer’s specifications. 7. Dental unit functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Dental unit Service report is prepared as per work procedure. |
| 1. Perform Amalgamator Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Amalgamator*** ***parts*** are inspected as per service manual. 3. Amalgamator fault diagnosis is performed as per service manual. 4. Amalgamator parts are cleaned as per service manual. 5. Amalgamator Faulty parts are maintained as per manufacturer’s specifications. 6. Amalgamator functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Amalgamator Service report is prepared as per work procedure. |
| 1. Perform Light Cure Machine Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Light Cure Machine is disinfected as per work procedure 3. Light Cure Machine parts are inspected as per service manual. 4. Light Cure Machine Fault diagnosis is performed as per service manual. 5. Light Cure Machine Faulty parts are maintained as per manufacturer’s specifications. 6. Light Cure Machine functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Light Cure Machine Service report is prepared as per work procedure. |
| 1. Perform Dental Scaler Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Dental Scaler is disinfected as per work procedure 3. Dental Scaler Parts are inspected as per service manual 4. Dental Scaler Fault diagnosis is performed as per service manual. 5. Dental Scaler Faulty parts are maintained as per manufacturer’s specifications. 6. Dental Scaler functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Dental Scaler Service report is prepared as per work procedure. |
| 1. Perform Dental X-Ray Machine Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Dental X-Ray Machine*** ***parts*** of the dental X-Ray equipment are inspected as per service manual 3. Dental X-Ray Fault diagnosis is performed as per service manual. 4. Dental X-Ray Movable parts are lubricated as per manufacturer’s specifications. 5. Dental X-Ray faulty parts are maintained as per manufacturer’s specifications. 6. Dental X-Ray functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Dental X-Ray Machine Service report is prepared as per work procedure. |
| 1. Perform Dental Laboratory Equipment Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Dental Laboratory Equipment*** ***parts*** are inspected as per service manual 3. Dental Laboratory Equipment Fault diagnosis is performed as per service manual. 4. Dental Laboratory Equipment Movable parts are lubricated as per manufacturer’s specifications. 5. Dental Laboratory Equipment Faulty parts are maintained as per manufacturer’s specifications. 6. Dental Laboratory Equipment functionality check is performed as per service manuals 7. Equipment user training is carried out in line with the user manual. 8. Dental Laboratory Equipment Service report is prepared as per work procedure. |
| 1. Perform Dental laser Equipment Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Dental laser Equipment parts*** are inspected as per service manual 3. Dental laser Equipment Fault diagnosis is performed as per service manual. 4. Dental laser Equipment Faulty parts are maintained as per manufacturer’s specifications. 5. Dental laser Equipment functionality check is performed as per service manuals 6. Equipment user training is carried out in line with the user manual. 7. Dental laser Equipment Service report is prepared as per work procedure. |

**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. Dental unit parts include but not limited to: | * Compressor * Handpieces * Inter-oral camera * Dental Chair * Examination Lamp * Spittoon bowl / cuspidor * Utility box |
| 1. Amalgamator parts include but not limited to: | * Time setting * LCD display * Rubber tray * Clip * Start/stop buttons |
| 1. Dental X-Ray Machine parts include but not limited to: | * X-ray tube * Collimator * Arms * Control panel * Position indicating device |
| 1. Dental Laboratory Equipment parts include but not limited to: | * Dental Microscope * Dental Scanner * Porcelain Machine * Model trimmer * Suspension motor |
| 1. Dental laser Equipment parts include but not limited to: | * Laser Unit * Handpiece * Fiber Optic Cable * Safety Interlocks * Beam Delivery System * Calibration Tools |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Carried out health hazards and safety procedures as per work procedure.   2. Disinfected Dental Equipment as per work procedure.   3. Inspected all parts of Dental Equipment as per service manual.   4. Carried out fault diagnosis of Dental Equipment as per service manuals.   5. Cleaned parts of Dental Equipment as per service manual.   6. Maintained faulty parts of Dental Equipment as per manufacturer’s specifications.   7. Carried out calibration of Dental Equipment as per manufacturer’s specifications.   8. Carried out equipment user training as per user manual.   9. Carried out functionality check of Dental Equipment as per service manual.   10. Prepared Dental Equipment service report as per work procedure. |
| 1. Resource Implications | The following resources should be provided:   * 1. Access to relevant workplace where assessment can take place   2. Access to Dental & RenalEquipment which can be used for assessment   3. Access to relevant tools which can be used for installation and maintenance |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Practical Demonstration   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM MATERNITY EQUIPMENT MAINTENANCE

**UNIT CODE:** 0914451 20A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to Perform MaternityEquipment Maintenance. Competencies include Performing Infant Incubator Maintenance, Performing CPAP Machine Maintenance, Performing Phototherapy Machine Maintenance, Performing Resuscitatiare Maintenance, Performing Delivery Bed Maintenance, Performing Weighing Balance Maintenance, Performing Cardiotocography (CTG) Machine Maintenance and Performing Room Warmers Maintenance.

**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 Infant Incubator Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Infant Incubator is disinfected as per work procedure 3. ***Infant Incubator parts*** inspected as per service manual. 4. Infant Incubator Fault diagnosis is performed as per service manual. 5. Infant Incubator water chamber is refilled as per service manual. 6. Infant Incubator Faulty parts are maintained as per manufacturer’s specifications. 7. Infant Incubator functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Infant Incubator service report is prepared as per work procedure |
| 1. Perform continuous positive airway pressure (CPAP) Machine Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. CPAP Machine is disinfected as per work procedure 3. CPAP Machine Parts are inspected as per service manual 4. Fault diagnosis is performed as per service manual. 5. Air and gas passages are cleaned as per service manuals 6. CPAP Machine ***Service kit components*** are replaced on the machine as per manufacturer’s specifications. 7. CPAP Machine Faulty parts are maintained as per manufacturer’s specifications. 8. CPAP Machine functionality check is performed as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. CPAP Machine service report is prepared as per work procedure |
| 1. Perform Phototherapy Machine Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Phototherapy Machine parts*** is sanitized as per work procedure 3. Phototherapy Machine Parts are inspected as per service manual 4. Phototherapy Machine Fault diagnosis is performed as per service manual. 5. Phototherapy Machine Faulty parts are maintained as per manufacturer’s specifications. 6. Phototherapy Machine functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Phototherapy Machine service report is prepared as per work procedure |
| 1. Perform Resuscitaire Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Resuscitaire parts are sanitized as per work procedure 3. Resuscitaire Parts are inspected as per service manual 4. Resuscitaire Fault diagnosis is performed as per service manual. 5. Resuscitaire Faulty parts are maintained as per manufacturer’s specifications. 6. Resuscitaire Calibration is carried out as per manufacturer’s specifications. 7. Resuscitaire functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Resuscitaire service report is prepared as per work procedure |
| 1. Perform Delivery Bed Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Delivery Bed is disinfected as per work procedure 3. Delivery Bed Parts are inspected as per service manual 4. Delivery Bed Fault diagnosis is performed as per service manual. 5. Delivery Bed Movable parts are lubricated as per manufacturer’s specifications. 6. Delivery Bed Faulty parts are maintained as per manufacturer’s specifications. 7. Delivery Bed functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Delivery Bed service report is prepared as per work procedure |
| 1. Perform Weighing balance Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Weighing Balance parts*** are inspected as per service manual. 3. Weighing Balance Fault diagnosis is performed as per service manual. 4. Weighing Balance Faulty parts are maintained as per manufacturer’s specifications. 5. Weighing Balance Calibration is carried out as per service manual. 6. Weighing Balance functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. Weighing Balance service report is prepared as per work procedure. |
| 1. Perform Cardiotocography (CTG) Machine Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. CTG Machine is sanitized as per work procedure 3. ***CTG Machine*** ***Parts*** are inspected as per service manual. 4. CTG Machine Fault diagnosis is performed as per service manual. 5. CTG Machine faulty parts are maintained as per manufacturer’s specifications. 6. CTG Machine functionality check is performed as per service manual. 7. Equipment user training is carried out in line with the user manual. 8. CTG Machine service report is prepared as per work procedure. |
| 1. Perform Room Warmers Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Room Warmer*** ***parts*** are inspected as per service manual. 3. Room Warmer Fault diagnosis is performed as per service manual. 4. Room Warmer faulty parts are maintained as per manufacturer’s specifications. 5. Room Warmer functionality check is performed as per service manual. 6. Equipment user training is carried out in line with the user manual. 7. Room Warmers service report is prepared as per work procedure. |

**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.Infant Incubator partsinclude but not limited to: | * Hood/Canopy * Control valve * Heating element * Control panel * Distilled water reservoir * Air filter * Temperature probe * Fans |
| 2.Service kit components include but not limited to: | * Air filters * O-rings * Mask replacement |
| 3.Baby Weighing scale parts include but not limited to: | * Base * Platter * Strain Gauge * Load cell |
| ***4.***CTG Machine Partsinclude but not limited to: | * Transducer probes * Monitor * Doppler |
| ***5.***Room Warmer parts include but not limited to: | * Heating elements * Temperature regulator * Fan |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Installation
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Carried out health hazards and safety procedures as per work procedure.   2. Disinfected Maternity Equipment as per workplace procedures.   3. Inspected parts of Maternity Equipment as per service manual.   4. Performed fault diagnosis of Maternity Equipment as per workplace procedures and service manuals.   5. Cleaned parts of Maternity Equipment as per service manual.   6. Maintained faulty parts of Maternity Equipment as per manufacturer’s specifications.   7. Carried out calibration of Maternity Equipment as per manufacturer’s specifications.   8. Carried out Equipment user training in line with the user manual.   9. Performed functionality check of Maternity Equipment as per service manual.   10. Prepared Maternity Equipment service report as per work procedure. |
| 1. Resource Implications | The following resources should be provided:  2.1 Access to relevant workplace where assessment can take place   * 1. Access to Maternity Equipment which can be used for assessment   2. Access to relevant tools which can be used for installation and maintenance |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Observation   2. Oral questioning   3. Written test   4. Practical Demonstration   5. Interview   6. Third party report |
| 1. Context of Assessment | Competency may be assessed in a workplace or a simulated workplace. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM REFRIGERATION AND AIR CONDITIONING EQUIPMENT MAINTENANCE

**UNIT CODE:** 0914451 21A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to Perform Refrigeration and Air Conditioning Equipment Maintenance. Competencies include: maintaining refrigerator, cold room equipment, freezer and air conditioner.

**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 Refrigerator Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Refrigerator parts*** are inspected as per service manual. 3. Refrigerator Fault diagnosis is performed as per service manual. 4. Refrigerator parts are cleaned as per the work procedure. 5. Lowlevel compressorrefrigerantischarged as per manufacturer’s specifications. 6. Refrigerator Faulty parts are maintained as per manufacturer’s specifications. 7. Refrigerator functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Refrigerator service report is prepared as per work procedure. |
| 1. Perform Cold Room Equipment Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Cold Room Equipment*** ***parts*** are inspected as per service manual 3. Cold Room Equipment Fault diagnosis is performed as per service manual. 4. Cold Room Equipment parts are cleaned as per service manual 5. Low level compressor refrigerant is charged as per manufacturer’s specifications. 6. Clogged filter drier is replaced as per manufacturer’s specifications. 7. Cold Room Equipment Faulty parts are maintained as per manufacturer’s specifications. 8. Cold Room Equipment functionality check is performed as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Cold Room Equipment service report is prepared as per work procedure. |
| 1. Perform Freezer Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Freezer*** ***parts*** are inspected as per service manual. 3. Freezer Fault diagnosis is performed as per service manual. 4. Freezer parts are cleaned as per service manual. 5. Low level compressor refrigerant is charged as per manufacturer’s specifications. 6. Clogged filter drier is replaced as per manufacturer’s specifications. 7. Freezer Faulty parts are maintained as per manufacturer’s specifications. 8. Freezer functionality check is performed as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Cold Room Equipment service report is prepared as per work procedure. |
| 1. Perform Air Conditioner Maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Air Conditioner parts*** are inspected as per service manual. 3. Air Conditioner Fault diagnosis is performed as per service manual. 4. Air Conditioner parts are cleaned as per service manual 5. Low level compressor refrigerant is charged as per manufacturer’s specifications. 6. Air Conditioner Faulty parts are maintained as per manufacturer’s specifications. 7. Air Conditioner functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Air Conditioner service report is prepared as per work procedure. |

**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. Refrigerator partsinclude but not limited to: | * Evaporator * Condenser * Compressor * Expansion valve * Reservoir * Funs * Ducts * Filters |
| 1. Cold Room Equipment parts include but not limited to: | * Evaporator * Condenser * Compressor * Expansion valve * Reservoir * Funs * Ducts * Filters |
| 1. Freezer parts include but not limited to | * Evaporator * Condenser |
| 1. Air Conditioner partsinclude but not limited to: | * Evaporator * Condenser * Compressor * Expansion valve * Reservoir * Funs * Ducts * Filters |

**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:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Installation
* Calibration
* Problem solving
* Critical thinking
* Report writing
* Record keeping
* Interpersonal skills
* Numeracy skills
* Leadership skills

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* Standards of calibration

**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. Carried out health hazards and safety procedures as per work procedure.   2. Cleaned parts of Refrigeration and Air Conditioning Equipment as per service manual.   3. Inspected all parts of Refrigeration and Air Conditioning Equipment as per service manual.   4. Carried out fault diagnosis of Refrigeration and Air Conditioning Equipment as per service manuals.   5. Maintained faulty parts of Refrigeration and Air Conditioning Equipment as per manufacturer’s specifications.   6. Carried out calibration of Refrigeration and Air Conditioning Equipment as per manufacturer’s specifications.   7. Carried out equipment user training as per user manual.   8. Carried out functionality check of Refrigeration and Air Conditioning Equipment as per service manual.   9. Prepared Refrigeration and Air Conditioning Equipment service report as per work procedure. |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Access to Refrigeration and Air Conditioning Equipment which can be used for assessment 3. Access to relevant tools which can be used for installation and maintenance |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   1. Observation 2. Written test 3. Practical Demonstration 4. Oral questioning 5. Interview 6. Third party report |
| 1. Context of Assessment | Competency may be assessed in a work place or a simulated work place. |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM HOSPITAL PLANT AND BUILDING SERVICES EQUIPMENT MAINTENANCE I

**UNIT CODE:** 0914451 22A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to perform hospital hygiene and sanitation Systems. Competencies include: performing hospital hygiene and sanitation equipment maintenance, performing water systems maintenance and performing steam systems maintenance.

|  |  |
| --- | --- |
| **ELEMENTS**  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 hospital hygiene and sanitation equipment maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Hospital hygiene and sanitation equipment*** parts are inspected as per service manual. 3. Hospital hygiene and sanitation equipment are cleaned as per service manual 4. Hospital hygiene and sanitation equipment Fault diagnosis is performed as per service manual. 5. Hospital hygiene and sanitation equipment Faulty parts are maintained as per manufacturer’s specifications. 6. Hospital hygiene and sanitation equipment software is calibrated as per manufacturer’s specifications. 7. Hospital hygiene and sanitation equipment functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Hospital hygiene and sanitation Service report is prepared as per work procedure. 10. sanitation and environmental protection measures are carried out. |
| 1. Perform water systems maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Water system components*** are inspected as per work procedure. 3. Water systems equipment are cleaned as per work procedure. 4. Water system Fault diagnosis is performed as per service manual. 5. Water system Faulty parts are maintained as per manufacturer’s specifications. 6. Water systems are calibrated as per manufacturer’s specifications. 7. Water system functionality check is performed all performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Water systems Service report is prepared as per work procedure. |
| 1. Perform steam systems maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Steam systems equipment parts*** are inspected as per service manual. 3. **Steam system** equipment is cleaned as per service manual 4. Steam system Fault diagnosis is performed as per service manual. 5. Steam system Faulty parts are maintained as per manufacturer’s specifications. 6. Steam systems equipment is calibrated as per manufacturer’s specifications. 7. Steam system functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Steam systems Service report is prepared as per work procedure. |

**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. Hospital hygiene and sanitation equipment include but not limited to: | * Incinerator * Microwave shredder |
| 1. Sterilization and disinfection activities include but not limited to: | * Chemical * Heat * Radiation * Filtration |
| 1. Sanitation systems include but not limited to: | * Drainage systems * Natural sewage treatment systems * Hospital waste system * Toxic gas system |
| 1. Water system equipmentinclude but not limited to: | * Reciprocating pumps * Hand pumps * Centrifugal pumps * Electric heaters * Gas heaters * Solar heaters * Steam calorifiers * instant hot water heater |
| 1. Steam system equipmentinclude but not limited to: | * Furnace * Burner * Heat source * Valves * Feed water pump |
| 1. Steam systemsinclude but not limited to: | * Pressure control * Water level control * Blow down * Start-up procedure * Feed water treatment * Steam traps * Strainers * Steam separators * Shut-off valves * Pressure reducing valves |

**Required Skills**

The individual needs to demonstrate the following skills:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Problem solving
* Critical thinking
* Report writing
* Record keeping

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* plumbing

**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. Carried out health hazards and safety procedures as per work procedure. 2. Inspected Hospital Plant and building services equipment as per service manual. 3. Cleaned Hospital Plant and building services equipment as per service manual 4. Identified sterilization and disinfection activities as per work procedure 5. Identified medical gasses and vacuum systems production as per work procedure 6. Carried out Hospital Plant and building services fault diagnosis as per service manual. 7. Maintained faulty parts as per manufacturer’s specifications. 8. Calibrated Hospital Plant and building services equipment software as per manufacturer’s specifications. 9. Carried out Hospital Plant and building services equipment Functionality check as per service manual. 10. Carried out equipment user training as per user manual. 11. Prepared Hospital Plant and building services equipment Service report as per work procedure |
| 1. Resource Implications | 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:   1. Observation 2. Oral presentation 3. Projects 4. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or Simulated workplace. |
| 1. Guidance information for assessment | H Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## PERFORM HOSPITAL PLANT AND BUILDING SERVICES EQUIPMENT MAINTENANCE II

**UNIT CODE:** 0914451 23A

**UNIT DESCRIPTION:**

This unit specifies the competencies required to Perform Hospital Plant and Building Services Equipment Maintenance II. It involves performing laundry equipment maintenance, medical gases equipment maintenance and vacuum systems equipment maintenance.

|  |  |
| --- | --- |
| **ELEMENTS**  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 laundry equipment maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Laundry equipment parts*** are inspected as per service manual. 3. Laundry equipment is cleaned as per service manual 4. Laundry equipment Fault diagnosis is performed as per service manual. 5. Laundry equipment Faulty parts are maintained as per manufacturer’s specifications. 6. Laundry equipment is calibrated as per manufacturer’s specifications. 7. Laundry equipment functionality check is performed as per service manual. 8. Equipment user training is carried out in line with the user manual. 9. Laundry equipment Service report is prepared as per work procedure. |
| 1. Perform Medical Gases Equipment maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. ***Medical Gases Equipment*** are inspected as per service manual. 3. Vacuum systemsare inspected as per service manual 4. Medical Gases and vacuum systems Fault diagnosis is performed as per service manual. 5. Medical Gases Equipment and vacuum systems and Oil and Filters are changed as per manufacturer’s specifications. 6. Medical Gases Equipment and vacuum systems Faulty parts are maintained as per manufacturer’s specifications. 7. Medical Gases Equipment and vacuum systems are calibrated as per manufacturer’s specifications. 8. Medical Gases Equipment Plant functionality check is performed as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Medical Gases Equipment and Plant service report is prepared as per work procedure. |
| 1. Perform vacuum systems Equipment maintenance | 1. Health hazards and safety procedures are carried out as per work procedure. 2. Vacuum systems are inspected as per service manual. 3. Vacuum systemsare inspected as per service manual 4. Vacuum systems Fault diagnosis is performed as per service manual. 5. Vacuum systems Oil and Filters are changed as per manufacturer’s specifications. 6. Vacuum systems Faulty parts are maintained as per manufacturer’s specifications. 7. Vacuum systems are calibrated as per manufacturer’s specifications. 8. Vacuum systems functionality check is performed as per service manual. 9. Equipment user training is carried out in line with the user manual. 10. Vacuum systems service report is prepared as per work procedure. |

**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.

|  |  |
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| **Variable** | **Range** |
| 1. Laundry equipmentinclude but not limited to: | * Washing machine * Driers * Pressing boxes * Hydro-extractors |
| 1. Medical Gases Equipment include but not limited to: | * Oxygen Plant * Vacuum Plant * Oxygen Concentrator * Piping System * Medical Air * gas manifold |

**Required Skills**

The individual needs to demonstrate the following skills:

* Use of tools and equipment
* Communication skills
* Troubleshooting skills
* Mechanical skills
* ICT skills
* Problem solving
* Critical thinking
* Report writing
* Record keeping

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Safety precautions
* Fault diagnosis
* Electrical principles
* Electronics
* Hospital hygiene
* plumbing

**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 medical gasses and vacuum systems production as per work procedure 2. Carried out Hospital Plant and building services fault diagnosis as per service manual. 3. Maintained faulty parts as per manufacturer’s specifications. 4. Calibrated Hospital Plant and building services equipment software as per manufacturer’s specifications. 5. Carried out Hospital Plant and building services equipment Functionality check as per service manual. 6. Carried out equipment user training as per user manual. 7. Prepared Hospital Plant and building services equipment Service report as per work procedure |
| 1. Resource Implications | 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:   1. Observation 2. Oral presentation 3. Projects 4. Written tests |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or Simulated workplace. |
| 1. Guidance information for assessment | H Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |