

**THE REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**AERONAUTICAL TECHNCIAN (AVIONICS)**

**LEVEL 6**



TVET CDACC

P.O BOX 15745-00100

NAIROBI

First published 2019

© 2019, TVET CDACC

All rights reserved. No part of these Occupational Standards may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods without the prior written permission of the TVET CDACC, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law. For permission requests, write to the Council Secretary/CEO, at the address below:

**Council Secretary/CEO**

**TVET Curriculum Development, Assessment and Certification Council**

**P.O. Box 15745–00100**

**Nairobi, Kenya**

**Email:** [**info@tvetcdacc.go.ke**](mailto:info@tvetcdacc.go.ke)

# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement of Kenya’s development blueprint, Vision 2030 and sustainable development goals.

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted in the formulation of the Policy Framework for Reforming Education and Training (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the TVET training.

This policy document requires that training in TVET be competency based, curriculum development be industry led, certification be based on demonstration of competence and mode of delivery allows for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that these Occupational Standards were developed for the purpose of developing a competency-based curriculum for Aeronautical Engineering (Avionics Option)**.** These Occupational Standards will also be the basis for assessment of an individual for competence certification.

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform the country into a newly industrializing, “middle-income country providing a high-quality life to all its citizens by the year 2030”. Kenya intends to create a globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through life-long education and training. TVET has a responsibility of facilitating the process of inculcating knowledge, skills and attitudes necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency Based Education and Training (CBET).

The Technical and Vocational Education and Training Act No. 29 of 2013 and Sessional Paper No. 4 of 2016 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labor force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Aeronautical Engineering Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Aeronautical Technician (Avionic). These standards will be the bases for development of competency based curriculum for Aeronautical Engineering (Avionics Option) Level 6.

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

I am grateful to the Council Members, Council Secretariat, Aeronautical Engineering SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGMENT

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

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

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

**CHAIRPERSON**

**AERONAUTICAL ENGINEERING SECTOR SKILLS ADVISORY COMMITTEE**

# Table of Contents

[FOREWORD ii](#_Toc11249398)

[PREFACE iii](#_Toc11249399)

[ACKNOWLEDGMENT iv](#_Toc11249400)

[ACRONYMS v](#_Toc11249401)

[KEY TO UNIT CODE vi](#_Toc11249402)

[CONTENTS vii](#_Toc11249403)

[OVERVIEW ix](#_Toc11249404)

[BASIC UNITS OF COMPETENCY 1](#_Toc11249405)

[DEMONSTRATE COMMUNICATION SKILLS 2](#_Toc11249406)

[DEMONSTRATE DIGITAL LITERACY 6](#_Toc11249407)

[DEMONSTRATE ENTREPRENEURIAL SKILLS 11](#_Toc11249408)

[DEMONSTRATE EMPLOYABILITY SKILLS 16](#_Toc11249409)

[DEMONSTRATE ENVIRONMENTAL LITERACY 24](#_Toc11249410)

[DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES 29](#_Toc11249411)

[COMMON UNITS OF COMPETENCY 35](#_Toc11249412)

[PREPARE AND INTERPRET TECHNICAL DRAWINGS 36](#_Toc11249413)

[APPLY ENGINEERING MATHEMATICS 41](#_Toc11249414)

[PERFORM WORKSHOP PROCESSES AND PRACTICES 46](#_Toc11249415)

[APPLY ELECTRICAL AND ELECTRONICS PRINCIPLES 52](#_Toc11249416)

[APPLY AERODYNAMICS PRINCIPLES 56](#_Toc11249417)

[CORE UNITS OF COMPETENCY 60](#_Toc11249418)

[MAINTAIN AIRCRAFT ELECTRICAL SYSTEMS 61](#_Toc11249419)

[MAINTAIN AIRCRAFT AUTOFLIGHT, INSTRUMENTATION AND CONTROL SYSTEM 68](#_Toc11249420)

[MAINTAIN AIRCRAFT CABLE/HARNESS LOOMS AND FIBER OPTIC CABLES 74](#_Toc11249421)

[PERFORM ASSEMBLY OF AVIONICS COMPONENTS AND PRINTED CIRCUIT BOARDS (PCBS) 80](#_Toc11249422)

[MAINTAIN AIRCRAFT RADIO SYSTEMS (COMMUNICATION, NAVIGATION AND RADAR) 86](#_Toc11249423)

[MAINTAIN AIRCRAFT COMPASS COMPENSATION AND ADJUSTMENT SYSTEMS 92](#_Toc11249424)

[OPERATE AIRCRAFT ELECTRO-OPTICAL AND INFRARED SYSTEM 97](#_Toc11249425)

[PERFORM AIRCRAFT STORE PROCEDURES 102](#_Toc11249426)

[MANAGE AVIONIC MAINTENANCE PROJECTS 106](#_Toc11249427)

# ABBREVIATION AND ACRONYMS

A Control version

AC Air conditioning

AIDS Acquired Immunodeficiency Syndrome

AMM Aircraft Maintenance Manuals

AVN Avionics

BC Basic Competencies

BC Basic Competency

CBET Competency Based Education and Training

CC Common unit of Competency

CDACC Curriculum Development Assessment Certification Council

CEO Council Secretary

CMM Component Maintenance Manual

CPU Central Processing Unit

CR Core Unit of Competency

ENG Engineering

FOT Fixed orifice tube

GPS Global positioning system

HIV Human Immuno-Deficiency Virus

ICT Information Communication Technology

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualification Authority

KNQF Kenya National Qualification Framework

KPI King Pin inclination

OBD On-board diagnostics

OS Occupational Standard

OSH Occupational Safety and Health

PCB Printed Circuit Boards

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal protective equipment

SI Spark ignition

SOPStandard Operating Procedure

SSAC Sector Skills Advisory Committee

SWOT Strength Weakness Opportunity Threat

TQM Total Quality Management

TVET Technical and Vocational Education and Training

# **KEY TO UNIT CODE**

**ENG /OS/AVN /BC /01/ 6 /A**

Industry or sector

Occupational Standards

Occupational area

Type of competency

Competency number

Competency level

Control Version

# OVERVIEW

Aeronautical engineering (Avionics) level 6 qualifications consists of competencies that a person must achieve to enable him/her to work in aviation industry. It entails maintaining aircraft electrical systems, maintaining aircraft auto flight, instrumentation and control, maintaining aircraft cable/harness looms and fiber optic cables, performing assembly of avionics components and PCBS, maintaining aircraft radio systems (communication, navigation and radar), maintaining aircraft compass compensation and adjustment systems, operating aircraft electro-optical and infrared system, performing aircraft store procedures and managing avionic maintenance projects.

The units of competency comprising Aeronautical Technician (Avionics) level 6 qualifications include the following basic, common and core competency as shown below:

**Basic Units of Learning**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AVN/BC/01/6/A | Demonstrate Communication Skills |
| ENG/OS/AVN/BC/02/6/A | Demonstrate Digital Literacy |
| ENG/OS/AVN/BC/03/6/A | Demonstrate Entrepreneurial Skills |
| ENG/OS/AVN/BC/04/6/A | Demonstrate Employability Skills |
| ENG/OS/AVN/BC/05/6/A | Demonstrate Environmental Literacy |
| ENG/OS/AVN/BC/06/6/A | Demonstrate Occupational Health and Safety Practices |

**Common Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AVN/CC/01/6/A | Prepare And Interpret Technical Drawings |
| ENG/OS/AVN/CC/02/6/A | Apply Engineering Mathematics |
| ENG/OS/AVN/CC/03/6/A | Apply Aerodynamics Principles |
| ENG/OS/AVN/CC/04/6/A | Perform Workshop Processes and Practices |

**Core Units of Competency**

|  |  |
| --- | --- |
| **Unit Code** | **Unit Title** |
| ENG/OS/AVN/CR/01/6/A | Maintain Aircraft Electrical Systems |
| ENG/OS/AVN/CR/02/6/A | Maintain Aircraft Auto Flight, Instrumentation and Control |
| ENG/OS/AVN/CR/03/6/A | Maintain Aircraft Cable Looms and Fiber Optic Cables |
| ENG/OS/AVN/CR/04/6/A | Perform Assembly of Avionics Components And PCBS |
| ENG/OS/AVN/CR/05/6/A | Maintain Aircraft Radio Systems (Communication, Navigation and Radar) |
| ENG/OS/AVN/CR/06/6/A | Maintain Aircraft Compass Compensation and Adjustment Systems |
| ENG/OS/AVN/CR/07/6/A | Operate Aircraft Electro-Optical and Infrared System |
| ENG/OS/AVN/CR/08/6/A | Perform Aircraft Store Procedures |
| ENG/OS/AVN/CR/09/6/A | Manage Avionic Maintenance Projects |

# BASIC UNITS OF COMPETENCY

# DEMONSTRATE COMMUNICATION SKILLS

**UNIT CODE:** ENG/OS/AVN/BC/01/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Communication strategies may include but not limited to: | * Language switch * Comprehension check * Repetition * Asking confirmation * Paraphrase * Clarification request * Translation * Restructuring * Approximation * Generalization |
| 1. Effective group interaction may include but not limited to: | * Identifying and evaluating what is occurring within an interaction in a nonjudgmental 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 not limited to: | * Establishing rapport * Eliciting facts and information * Facilitating resolution of issues * Developing action plans * Diffusing potentially difficult situations |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

* Communication
* Active listening
* Interpretation
* Negotiation
* Writing

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

**DEMONSTRATE DIGITAL LITERACY**

**UNIT CODE:** ENG/OS/AVN/BC/02/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE** **GUIDE**

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

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

**DEMONSTRATE ENTREPRENEURIAL SKILLS**

**UNIT CODE :** ENG/OS/AVN/BC/03/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

# DEMONSTRATE EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/OS/AVN/BC/04/6/A

**UNIT DESCRIPTON**

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

# DEMONSTRATE ENVIRONMENTAL LITERACY

**UNIT CODE:** ENG/OS/AVN/BC/05/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

|  |  |
| --- | --- |
| **ELEMENT**  These describe the key outcomes which make up workplace function. | **PERFORMANCE CRITERIA**  These are assessable statements which specify the required level of performance for each of the elements.  ***Bold and italicized terms are elaborated in the Range*** |
| 1. Control environmental hazard | 1. Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 2. Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 3. ***PPE*** is used according to OSHS. |
| 1. Control environmental Pollution | * 1. Environmental pollution ***control measures*** are implemented in accordance with international protocols.   2. Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999   3. Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration Pollution and Control Regulations, 2009 |
| 1. Demonstrate sustainable resource use | * 1. Methods for minimizing wastage are complied with based on organizational waste management guide   2. Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle)   3. Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 . |
| 1. Evaluate current practices in relation to resource usage | * 1. Information on resource efficiency systems and procedures are collected and provided as per work groups/sector   2. Current resource usage is measured and recorded as per work group   3. Current purchasing strategies are analyzed and recorded according to industry procedures.   4. Current work processes to access information and data is analyzed following enterprise protocol. |
| 1. Identify environmental legislations/conventions for environmental concerns | 1. Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 2. Industrial standard/environmental practices are described according to the different environmental concerns |
| 1. Implement specific environmental programs | 1. Programs/Activities are identified according to organizations policies and guidelines. 2. Individual roles/responsibilities are determined and performed based on the activities identified. 3. Problems/constraints encountered are resolved in accordance with organizations’ policies and guidelines 4. Stakeholders are consulted based on company guidelines |
| 1. Monitor activities on Environmental protection/Programs | 1. Activities are periodically monitored and Evaluated according to the objectives of the environmental program 2. Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 3. Data gathered are analyzed based on Evaluation requirements 4. Recommendations are submitted based on the findings 5. Management support systems are set/established to sustain and enhance the program 6. Environmental incidents are monitored and reported to 7. concerned/proper authorities |
| 1. Analyze resource use | 1. All resource consuming processes are Identified as per the organizational work plan 2. Quantity and nature of resource consumed is determined based on processes 3. Resource flow is analyzed as per different parts of the process. 4. Wastes are classified according to NEMA regulations on waste management. |
| 1. Develop resource Conservation plans | 9.1. Efficiency of use/conversion of resources is determined according to industry protocol.  9.2. Causes of low efficiency of use of resources are Determined based on industry protocol.  9.3. Plans for increasing the efficiency of resource use are developed based on findings. |

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

# DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/OS/AVN/BC/06/6/A

**UNIT DESCRIPTION**

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

**ELEMENTS AND PERFORMANCE CRITERIA**

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

**RANGE**

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

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

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate the following skills:

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

**Required Knowledge**

The individual needs to demonstrate knowledge of:

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

**EVIDENCE GUIDE**

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

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

# COMMON UNITS OF COMPETENCY

# PREPARE AND INTERPRET TECHNICAL DRAWINGS

**UNIT CODE:** ENG/OS/AVN/CC/01/6/A

**Unit description**

This unit covers the competencies required to prepare and interpret technical drawings by avionic technician. It involves using and maintaining drawing equipment and materials, producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings of components, assembly drawings and application of CAD software.

**ELEMENTS AND PERFORMANCE CRITERIA**

| **ELEMENT** | **PERFORMANCE CRITERIA**  ***(Bold and italicized terms are elaborated in the Range)*** |
| --- | --- |
| 1. Use and maintain drawing equipment and materials | * 1. ***Drawing equipment*** are obtained according to task requirements   2. ***Drawing materials*** are obtained according to task requirements   3. Drawing equipment are used and maintained according to manufacturer instructions   4. Drawing materials are used according to task requirements   5. Waste materials are disposed in accordance with workplace procedures and ***environmental legislations***   6. ***Personal Protective Equipment*** is used according to occupational safety and health regulations |
| 1. Produce plain geometry drawings | * 1. Lettering and line work is done according to drawing rules   2. Sketches of ***geometric forms*** are interpreted according to standard conventions   3. Different types of angles are constructed according to principles of trigonometry   4. Different types of geometric forms are constructed according to standard drawing conventions   5. Constructed geometric forms are dimensioned according to drawing requirements |
| 1. Produce solid geometry drawings | * 1. ***Sketches of patterns*** e.g. are interpreted according to work requirements   2. Interpenetrating surface of solids and truncated solids are developed according to work requirements   3. ***Interpenetrations of solids*** of equal and unequal is done according to work requirements |
| 1. Produce pictorial and orthographic drawings of components | * 1. Different symbols and abbreviations are identified and their meaning interpreted according to standard drawing conventions   2. Isometric sketches and drawings of components are interpreted and produced in accordance with the standard conventions of isometric drawings   3. First and third angle orthographic sketches and drawings of components are produced in accordance with the standard conventions of orthographic drawings   4. Freehand sketching of different types of geometric forms, tools, equipment, diagrams and components is conducted |
| 1. Produce assembly drawings | * 1. Orthographic views are exploded according to standard conventions of orthographic drawings.   2. Pictorial views are exploded according to standard conventions of orthographic drawings.   3. Part lists are identified according to drawing specifications   4. Sectional views are produced according to standard conventions of drawing.   5. Produced drawing is hatched according to standard conventions of drawings. |
| 1. Apply CAD in technical drawing | * 1. ***CAD software*** are identified according to work requirements   2. 2-D models are produced according to work requirements   3. 3D models are produced according to work requirements   4. Produced models are annotated according to work requirements |

**RANGE**

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

| **Variable** | **Range** |
| --- | --- |
| 1. Drawing equipment may include but not limited to: | * Drawing boards * T-square * Set squares * Drawing set * French curves * Computers |
| 1. Drawing materials may include but not limited to: | * Drawing papers * Pencils * Erasers * Masking tapes * Paper clips |
| 1. Environmental legislations may include but not limited to: | * EMCA 1999 * NEMA Regulations |
| 1. Personal Protective Equipment may include but not limited to: | * Dust coats * Closed leather shoes * Goggles for CAD |
| 1. Geometric forms may include but not limited to: | * Circles * Triangles * Rectangles * Parallelogram * Polygons * Pyramids * Conic sections * Prisms * Loci |
| 1. Sketches of patterns may include but not limited to: | * Cylinders * Prisms * Pyramids |
| 1. Interpenetrations of solids may include but not limited to: | * Cylinder to cylinder * Cylinder to prism * Prism to prism |
| 1. CAD software may include but not limited to: | * AutoCAD * Inventor * Solid Works * Archi CAD * Electronic work bench * Circuit maker * Proteus |

**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
* Communication
* Inter personal relations
* Computer

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Drawing equipment and materials
* Freehand sketching
* Lettering
* Geometrical constructions
* Types of drawings
* Types of lines
* Engineering calculations
* 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. Applied and adhered to safety procedures   2. Cared and maintained drawing equipment   3. Interpreted circuit, assembly and lay out diagrams   4. Applied appropriate technical standards, used proper tools and equipment for a given task   5. Produced sketches and drawings   6. Applied CAD in production of drawings |
| 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. Practical tests   2. Observation |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

## APPLY ENGINEERING MATHEMATICS

**UNIT CODE: ENG/OS/AVN /CC/02/6/A**

**UNIT DESCRIPTION**

This unit describes the competencies required by a Mechatronics Engineering technician to apply a wide range of engineering mathematics in their work. This includes: applying algebraic functions, trigonometry and hyperbolic functions, complex numbers, coordinate geometry, carrying out binomial expansion, calculus, ordinary differential equations, Laplace transforms, power series, Statistics, Fourier series, Vector theory, Matrix, Numerical methods, probability, commercial calculations, estimations, measurements and calculations of quantities in solving problems.

|  |  |
| --- | --- |
| **ELEMENTS AND PERFORMANCE CRITERIAELEMENT**  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. Calculations involving Indices are performed as per the concept 2. Calculations involving Logarithms are performed as per the concept 3. Scientific calculator is used in solving mathematical problems in line with manufacturer’s manual 4. Simultaneous equations are performed as per the rules 5. Quadratic equations are calculated as per the concept 6. Arithmetic and geometric progression problems are solved |
| * 1. Apply Trigonometry and hyperbolic functions | 1. Calculations are performed using trigonometric rules 2. Calculations are performed using ***hyperbolic functions*** |
| * 1. Apply complex numbers | * 1. Complex numbers are represented using Argand diagrams   2. Operations involving complex numbers are performed   3. Calculations involving complex numbers are performed using De Moivre’s theorem |
| 1. Apply Coordinate Geometry | * 1. Polar equations are calculated using coordinate geometry   2. Graphs of given polar equations are drawn using the Cartesian plane   3. Normal and tangents are determined using coordinate geometry   4. Loci of points are determined for given mechanism |
| 1. Carry out Binomial Expansion | * 1. Roots of numbers are determined using binomial theorem   2. Errors of small changes are determined using binomial theorem   3. Power series are derived through Binomial expansion |
| 1. Apply Calculus | * 1. Derivatives of functions are determined using Differentiation   2. Derivatives of hyperbolic functions are determined using Differentiation   3. Derivatives of inverse trigonometric functions are determined using Differentiation   4. Rate of change and small change are determined using Differentiation.   5. Calculation involving stationery points of functions of two variables are performed using differentiation.   6. Integrals of algebraic functions are determined using integration   7. Integrals of trigonometric functions are determined using integration   8. Integrals of logarithmic functions are determined using integration   9. Integrals of hyperbolic and inverse functions are determined using integration |
| 1. Solve Ordinary differential equations | * 1. First order and second order differential equations are formed.   2. First order and second order differential equations are solved using the method of undetermined coefficients   3. First order and second order differential equations are solved from given boundary conditions |
| 1. Apply Laplace transforms | * 1. Laplace transforms are solved using initial and final value theorems   2. Inverse Laplace transforms are solved using partial fractions   3. Differential equations are solved using Laplace transforms |
| 1. Apply Power Series | * 1. Power series are obtained using Taylor’s Theorem   2. Power series are obtained using Maclaurin’s theorem |
| 1. Apply Statistics | 1. Identification, Collection and Organization of data is performed 2. Interpretation, analysis and presentation of data in appropriate format is performed 3. Mean, median, mode and Standard deviation are obtained from given data |
| 1. Apply Fourier Series | * 1. Fourier series coefficients are obtained using Fourier series techniques   2. Fourier series for 2π to T is are obtained using Fourier series techniques   3. Fourier series for odd and even functions are obtained using Fourier series techniques   4. Harmonic analysis is performed using numerical methods |
| 12.Apply Vector theory | * 1. Calculations involving vector algebra, dot and cross products using vector theory   2. Gradient, Divergence and Curl are obtained   3. Vector calculations are performed using Green’s theorem   4. Vector calculations are performed using Stoke’s theorem   5. Conservative vector fields and line and surface integrals are obtained using Gauss’s theorem |
| 1. Apply Matrix | * 1. Determinant and inverse of 3x3 matrix are obtained   2. Solutions of simultaneous equations are obtained   3. Calculation involving Eigen values and Eigen vectors are performed |
| 1. Apply Numerical methods | * 1. Roots of polynomials are obtained using iterative numerical methods   2. Interpolation and extrapolation are performed using numerical methods |
| 1. Apply concepts of probability for work | * 1. Calculations are performed based on Laws of probability   2. Calculation involving probability distributions, mathematical expectation sampling distributions are performed   3. Probability events are determined from dependent, independent and mutually exclusive   4. Counting is done using permutation, combination, tree diagrams and Venn diagrams techniques |
| 1. Perform commercial calculations | * 1. Exchange rate calculations are done using devaluation and revaluation   2. Sales, stock turnover and profit and loss are determined   3. Incomes, salaries and wages are calculated |
| 1. Perform estimations, measurements and calculations of quantities | * 1. Measurement information in workplace is extracted and interpreted   2. Appropriate workplace measuring tools and equipment are identified and selected   3. Conversions are performed between units of measurement   4. Measurements are estimated and taken   5. Length, width, height, perimeter, area and angles of ***figures*** are calculated   6. Volume and surface area of figures are calculated   7. Information is recorded using mathematical language and symbols appropriate for the task |

**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. Hyperbolic functions may include but not limited to: | * + Sinh x   + Cosh x   + Cosec x   + Coth x   + Tanh x   + Sech x |
| 1. Figures may include but not limited to: | * + Triangles   + Squares   + Rectangles   + Circles   + Spheres   + Cylinders   + Cubes   + Polygons   + Cuboids   + Pyramids |
| 1. Quantities may include but not limited to: | * + Weight,   + Mass   + Area   + Volume   + Length   + Width   + Depth   + Perimeter |

**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:

* 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 of:

* 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
* Vector operations
* Matrix operations

**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. Applied Trigonometry and hyperbolic functions   2. Applied complex numbers   3. Determined angles and length in triangles   4. Applied Calculus   5. Solved Ordinary differential equations   6. Applied Laplace transforms   7. Applied Power Series   8. Applied Fourier Series   9. Applied Vector theory   10. Applied Matrix   1.11 Identified and selected measuring equipment  1.12 Collected, Analyzed and presented data  1.13 Applied Numerical methods |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM WORKSHOP PROCESSES AND PRACTICES

**UNIT CODE:** ENG/OS/AVN/CC/03/6/A

**Unit description**

This unit describes the competencies required by avionic technician in order to apply a wide range of workshop processes and practice skills in their work. It involves use of different methods to produce work pieces using basic tools while observing occupational safety and health legislations, regulations and safe working practices, interpret working drawings, select appropriate techniques for a given task to achieve specified results, assemble of metal parts and sub-assemblies as well as perform housekeeping.

**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. Use technical drawing to plan work operations | * 1. Technical drawings are produced ***as*** per ***drawing standards***   2. Technical drawings and geometric symbols are read and interpreted as per drawing standards.   3. ***Operation plan*** is produced as per the technical drawings. |
| 1. Measure and mark out dimensions on work pieces | * 1. Measuring tools suitable for the work are selected according to task description   2. Measuring tools are inspected and calibrated as per requirements   3. Dimensions are marked on the work piece as per the working drawing. |
| 1. Use hand tools to cut and file parts | * 1. ***Hand tools*** are selected based on operation plan   2. Work piece is cut to specification based on job requirement   3. Work piece is filed to specification based on job requirement   4. Part are produced to ***specifications*** based on work requirement |
| 1. Use drills to make holes | * 1. Hole centers are marked and center-punched as per operation plan.   2. Drill bits are selected and mounted according to work requirements   3. Work piece is mounted and clamped according to workshop regulations   4. Hole is drilledto specification according to work requirements   5. Holes inspected to specification according to work requirements |
| 1. Thread using taps and dies | * 1. Taps and dies selected based on operation plan.   2. Taps and dies are set up on the work piece according to work specifications   3. Work piece is clamped according to work requirements   4. ***Threads*** are cut according to work specifications |
| 1. Assemble metal parts and sub-assemblies | * 1. ***Joining and assembly method*** is selected according to work requirements   2. Parts joined, fitted and assembled according to the specified assembly and joinery methods   3. Final assembly is inspected as per specification |
| 1. Perform housekeeping | * 1. Waste is segregated and disposed as per disposal guidelines.   2. Housekeeping is carried out as per workplace requirement   3. Tools and equipment are stored in accordance to manufacturer requirement |
| 1. Inspect finished work for accuracy and quality | * 1. Inspection tools and methods are selected as per operation plan   2. Finished work is inspected as per specification   3. Adjustments are made based on inspections results |
| 1. Maintenance of tools and equipment | * 1. Machines and tools are inspected in accordance to manufacturer specifications   2. Machines and tools are lubricated according to manufacturer manual   3. Tools are ground to manufacturer specification   4. Faults on machines and tools are identified and reported according to maintenance 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** |
| --- | --- |
| * Measuring tools may include but not limited to: | * + Steel rule   + Vernier calliper   + Micrometre screw gauge   + Vernier height gauge   + Combination set   + Bevels |
| * Drawing Standards may include but not limited to: | * + ISO   + BS   + ANSI |
| * Operation Plan may include but not limited to: | * + Sequence of operations   + Measuring tools   + Hand tools   + Cutting tools   + Inspection tools |
| * Marking out tools may include but not limited to: | * + Scribers   + Dividers   + Dot punch   + Centre punch   + Engineers square   + Straight edge   + Surface plate |
| * Work holding devices may include but not limited to: | * + Bench vice   + V-Block   + Angle plate   + G-clamp   + Jigs and fixtures   + Hand vice |
| * Hand tools may include but not limited to: | * + Files   + Saws   + Hammers   + Chisels   + Taps and dies |
| * Threads may include but not limited to: | * + Internal and external threads   + V-profile threads |
| * Surface finishing methods may include but not limited to: | * + Filing/deburring   + Tumbling   + Plating   + Painting |
| * Joining and assembly method may include but not limited to: | * + Riveting   + Fastening   + Soldering   + Brazing   + Welding |
| * Specifications may include but not limited to: | * + Dimensions   + Tolerances   + Geometry   + Surface finish   + Functionality |

**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:

* Technical drawing
* Using measuring and inspection tools
* Using hand tools
* Using portable and bench drilling machines
* Soldering and brazing
* Riveting and fastening
* Use of the lathe machine
* Use of milling machine
* Using grinding machine

**Required Knowledge**

The individual needs to demonstrate knowledge and understanding of:

* Occupational Health and Safety Act of Kenya laws 2007 with focus on personal safety, machine safety and workplace
* National Environment Management Authority Act, Kenya 2004
* OSH act
* Equipment manuals
* Basic technical drawing complyingto ISO, ANSI & BS standards
* ISO 1101 Geometrical tolerance and where to use the norm
* Work Planning and documentation
* Measuring tools
* Hand tools
* Bench work
* Portable and bench drilling machines
* Lathe machine
* Grinding machine
* Inspection and quality control
* Preventive maintenance of machine tools
* Metal cutting technology
* Materials and metallurgy
* WIBA act (2007)
* Report writing

**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 learner:   * 1. Observed rules and procedures in the workshop   2. Interpreted technical drawing   3. Produced operation plan   4. Produced holes on a work piece   5. Threaded using taps and dies   6. Assembled metal parts   7. Surface finished work piece   8. Maintained tools and equipment   9. Did housekeeping before, during and after operations |
| 1. Resource Implications | * 1. Hand measuring tools   2. Hand marking tools   3. Hand tools   4. Inspection tools and equipment   5. Hand drilling machine   6. Bench Drilling machine   7. Lathe machine   8. Grinding machine   9. Milling machines   10. Punching tools   11. Work benches |
| 1. Methods of Assessment | Competency may be assessed through:   * 1. Observing the behaviour of the learner   2. Oral presentations   3. Inspection of written operation procedures   4. Inspection of finished product   5. Observing housekeeping of the work area and/or machine tool |
| 1. Context of Assessment | Competency may be assessed individually in the actual workplace or through accredited institution |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY ELECTRICAL AND ELECTRONICS PRINCIPLES

**UNIT CODE:** ENG/OS/AVN/CC/04/6/A

**Unit description**

This unit describes the competencies required apply a wide range of electrical and electronics principles skills in work. It involves using the concept of basic electrical quantities, using the concepts of D.C and A.C circuits in electrical installation, using basic electrical machine, carrying out power rectification in electrical systems, using of earthing in electrical installations and using of electronic components.

**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. Use the concept of basic Electrical quantities | * 1. Basic ***SI unit***s in Electrical are identified according to specified procedures   2. ***Quantitie***s of Charge, force, work and power are identified according to specified procedures   3. Calculations involving various electrical quantities are performed according to specified procedures |
| * + 1. Use the concepts of D.C and A.C circuits in electrical installations | * 1. Perform calculations involving Ohm’s law that is Current, Resistance and voltage according to specified procedures   2. Calculations involving parallel and series circuits are performed according to specified procedures   3. Calculations involving DC and AC Network theorems are performed. E.g. Kirchhoff’s laws, Superposition, Thevinin’s, Norton’s according to specified procedures |
| * + 1. Use of basic electrical machine | * 1. Types of various electrical machines are identified according to work specifications   2. Calculations involving single phase and three phase AC and DC Motors are performed in accordance to electrical guidelines   3. Calculations involving single and three phase AC and DC transformers are performed according to electrical guidelines   4. Calculations involving single and three phase generators are performed in accordance to electrical guidelines |
| * + 1. Carry out power rectification in electrical systems | * 1. Power rectification is performed using various ***power rectification methods*** according to prescribed rectification methods   2. Power smoothing is done according to prescribed ***power smoothing methods***   3. Power regulation is performed according to selected power regulation methods   4. Power supply protection is carried out according to prescribed ***power supply protection methods*** |
| * + 1. Use of earthing in electrical installations | * 1. Earthing types are identified in accordance to Electric Power Act, 1997 standards   2. Earthing points on electrical installation are identified according to work requirements   3. Calculation involved in determining the earthing type is performed according to prescribed work   4. Test on an earthing system is performed in line with the Electric Power Act, 1997 standards |
| * + 1. Apply lightning protection measures | * 1. Types of lightening strokes are identified according to prescribed procedures   2. Components of lightening protection system are identified according to Electric Power Act, 1997 standards   3. Test to be carried out in lightening protection system are established in accordance Electric Power Act, 1997 standards   4. Application of lightening protection system is determined in accordance to system requirements |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. SI unit may include but not limited to: | * + Power – Watts (W)   + Current – Amperes (A)   + Resistance – Ohms(Ω)   + Voltage – Volts (V) |
| 1. Quantities may include but not limited to: | * + Charge   + Force   + Work   + Power |
| 1. Power rectification methods may include but not limited to: | * + Half wave   + Full wave   + Full wave bridge |
| 1. Power smoothing methods may include but not limited to: | * + Reservoir   + Capacitor filter   + R.C filter   + Pie filter |
| 1. Power supply protection methods may include but not limited to: | * + Circuits breakers   + Fuses   + Switches |

**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
* Electrical earthing
* Lightening arrestors
* 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
* Earthing testing
* Lightening arrestor testing
* 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. Stated, Calculate and relates the quantities in Ohm’s law   3. Identified the components of an earthing system   4. Stated and apply various laws in Electrical system   5. Differentiated between AC and DC network   6. Applied correct formulas in the calculation of AC and DC machines   7. Used power triangle in calculating power factor   8. Applied various methods in power factor correction   9. Identified types of lightening arrestors and their applications |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. on the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# APPLY AERODYNAMICS PRINCIPLES

**UNIT CODE:** ENG/OS/AVN/CC/05/6/A

**Unit description:**

This unit describes the competencies required by a technician in order to apply aerodynamics principles. It involves competencies required to uunderstand atmosphere, apply basic aerodynamics in relation to an aircraft in flight, apply principles of the theory of flight of an aircraft, and apply static and dynamic stability of an aircraft in flight.

**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. Understand atmosphere | * 1. The ***composition of air*** in the atmosphere is studied   2. How atmosphere is split into different layers.   3. ***Atmospheric conditions*** within the different layers and how change are studied.   4. International Standard Atmosphere is established, its values and how it is used to assist aircraft in flight.   5. Working of aircraft pressure altimeter and airspeed indicator works along with the different types of airspeeds is studied. |
| 1. Apply basic aerodynamics in relation to an aircraft in flight. | * 1. Pressure in flight is distribution around an aerofoil surface along with the different types of airflow over an aircraft’s surface both laminar and turbulent and how its boundary layer is formed.   2. The generation of lift and drag and how the movement of a surfaces centre of pressure and change in angle of attack affect the amount of lift or drag generated.   3. How the shape of a wing its camber, chord and washout along with its fineness and aspect ratio and aerofoil contamination affect the aerodynamic performance of an aerofoil in producing both lift and drag.   4. The stalling of an aircraft in flight and the relationship between the thrust, weight and aerodynamic resultant along with the aerodynamic couples of lift, weight, thrust and drag |
| 1. Apply principles of the theory of flight of an aircraft. | * 1. The steady state performance of an aircraft in level flight and the changes required that have to be made to maintain it.   2. How the different forces act on an aircraft in a turn and the corrections that must be made to maintain a level and steady turn.   3. The climbing and gliding performance of an aircraft, its glide and climb ratio and how their rates and ability are changed.   4. The flight envelope of an aircraft, the reasons for its limits with regards to an aircraft structural limitations and safety and how different manoeuvres and changes in load factor affect both the safety and structural limits of the envelope. |
| 1. Apply static and dynamic stability of an aircraft in flight | * 1. The definition of positive, negative and neutral stability.   2. The passive stability of an aircraft about its longitudinal, lateral and directional axis’s and the control surfaces that affect the aircrafts longitudinal, lateral and directional stability.   3. The active stability of an aircraft in flight about its longitudinal, lateral and directional axis’s.   4. How spiral instability and Dutch roll occurs and the effect of weather cocking on an aircraft’s directional stability. |

**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. Composition of air may include but not limited to: | * + Oxygen   + Carbon dioxide   + Nitrogen |
| 1. Atmospheric conditions may include but not limited to: | * + Pressure,   + Density,   + Temperature   + Humidity |

**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:

* Composition of the atmosphere and its layers
* Pressure, density, temperature and humidity
* International standard atmosphere
* Atmospheric instruments used within an aircraft
* Pressure distribution around an aerofoil surface
* Boundary layer, laminar and turbulent airflow
* Wing camber, chord, shape and washout
* Generation of lift and drag
* Centre of pressure and angle of attack
* Fineness and aspect ratio
* Relationship between thrust, weight and aerodynamic resultant
* Aerofoil contamination
* Relationship between lift, weight, thrust and drag
* Stalling in flight
* Steady state flight performance
* Climb performance
* Gliding performance
* Theory of forces in a turn
* Load factor, flight envelope and structural limitations
* Lift augmentation
* Passive stability about the longitudinal, lateral and directional axis’s of an aircraft
* Active stability of an aircraft in flight

**Required knowledge**

The individual needs to demonstrate knowledge of:

* Composition of the atmosphere and its layers
* Pressure, density, temperature and humidity
* International standard atmosphere
* Atmospheric instruments used within an aircraft
* Pressure distribution around an aerofoil surface
* Boundary layer, laminar and turbulent airflow
* Wing camber, chord, shape and washout
* Generation of lift and drag
* Centre of pressure and angle of attack
* Fineness and aspect ratio
* Relationship between thrust, weight and aerodynamic resultant
* Aerofoil contamination
* Relationship between lift, weight, thrust and drag
* Stalling in flight
* Steady state flight performance
* Climb performance
* Gliding performance
* Theory of forces in a turn
* Load factor, flight envelope and structural limitations
* Lift augmentation
* Passive stability about the longitudinal, lateral and directional axis’s of an aircraft
* Active stability of an aircraft in flight

**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. Understood atmosphere 2. Applied basic aerodynamics in relation to an aircraft in flight. 3. Applied principles of the theory of flight of an aircraft. 4. Applied static and dynamic stability of an aircraft in flight |
| 1. Resource Implications | The following resources should be provided:   1. Access to relevant workplace where assessment can take place 2. Appropriately simulated environment where assessment can take place |
| 1. Methods of Assessment | Competency in this unit may be assessed through:   * 1. Direct Observation   2. Demonstration with Oral Questioning   3. Written tests |
| 1. Context of Assessment | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# CORE UNITS OF COMPETENCY

# MAINTAIN AIRCRAFT ELECTRICAL SYSTEMS

**UNIT CODE:** ENG/OS/AVN/CR/01/6/A

**Unit description**

This unit describes the competencies required by a technician to maintain aircraft electrical systems. It involves observing occupational health and safety, ttroubleshooting/diagnosing aircraft electrical systems, rectifying aircraft electrical defects, performing electrical terminations, connections and interconnections, maintaining aircraft batteries, servicing/ repairing aircraft generators and controls, installing aircraft electrical components, modifying aircraft electrical systems and testing aircraft electrical system

**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. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007 and relevant aircraft manuals.   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. First aid is carried out according to safety standards. |
| 1. Troubleshoot/diagnose aircraft electrical systems | * 1. Information from maintenance documentation and inspection and test results is used, where necessary, to assist in fault determination.   2. Maintenance manual fault diagnosis guides and logic processes are obtained and used to ensure efficient and accurate troubleshooting.   3. ***Specialist tools*** is obtained, where required, to assist with the troubleshooting process according to organization policy   4. System faults are located and the causes of the faults are clearly identified and correctly recorded in maintenance documentation, where required and in accordance with standard organization procedures.   5. Rectification requirements are determined according to troubleshooting report. |
| 1. Rectify aircraft electrical defects | * 1. Component defect reports (removal tags) or customer order are correctly interpreted and matched by part and serial numbers.   2. Components are inspected and/or operated through prescribed test procedures to establish serviceability or confirm defects, as required.   3. Modification status is clearly established to assist in determining the overhaul requirements for the components.   4. Extent of overhaul or repair is correctly identified and documented.   5. Component parts are dismantled in accordance with maintenance manuals.   6. Component parts are assessed for serviceability in accordance with the relevant maintenance documentation.   7. Parts requiring specialist repair are tagged and repair instructions are accurately specified.   8. Component parts are repaired or replaced in accordance with the relevant maintenance documentation |
| 1. Perform electrical terminations, connections and interconnections | * 1. Appropriate materials, tools and equipment are selected and prepared for the particular task in accordance with applicable maintenance documentation, workplace procedures and under qualified appropriately approved person.   2. Aircraft harnesses are identified according to AMM chapter 20   3. Harnesses/wire are stripped according to harness/wire gauge/ AMM chapter 20.   4. Aircraft termination is carried out according to standard wiring practices manual(AMM chapter 20)   5. Under qualified person guidance test equipment are used, where applicable, to confirm serviceability of finished components.   6. Electrical termination process is documented according to organization procedures and aircraft maintenance manual (AMM) |
| 1. Maintain aircraft batteries | * 1. Aircraft ***batteries*** faults are identified according to manufacturer’s specifications.   2. Aircraft batteries are removed from the aircraft according to aircraft maintenance’s manual.   3. Aircraft battery are serviced according to manufacturer’s specifications.   4. Tests are performed on serviced aircraft battery according to manufacturer’s manual.   5. Aircraft battery are installed as per aircraft maintenance manual. |
| 1. Service/ repair aircraft generators and control units | * 1. Specifications are interpreted to determine the procedure for servicing/repairing generator and its control units.   2. Appropriate materials, tools and equipment are selected as per manufacturer’s publications and prepared for the particular task requirements.   3. Aircraft generator and control units are serviced according to aircraft maintenance manual.   4. Generator and control units servicing/repair is documented in accordance with AMM and company procedures. |
| 1. Install aircraft electrical components | * 1. System is made safe and prepared in accordance with the applicable aircraft maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Removal of electrical hardware is carried out in accordance with the applicable maintenance manual   3. Removed components are tagged, packaged or scrapped in accordance with specified procedures.   4. Electrical hardware components to be installed are checked to confirm correct part numbers,  modification status, serviceability and shelf life.   5. Physical installation of electrical hardware is carried out in accordance with the applicable aircraft  maintenance manual.   6. System is restored to correct physical condition in preparation for testing, as necessary.   7. Required maintenance documentation is completed and processed in accordance with company procedures and aircraft maintenance manual and KCAA regulations. |
| 1. Modify aircraft electrical systems | * 1. System is made safe and prepared in accordance with the applicable maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. ***Component parts*** are dismantled in accordance with component maintenance manuals (CMM).   3. Component parts are assessed for serviceability in accordance with the relevant maintenance documentation.   4. Modification of components or parts is undertaken where required by relevant manufacturer's bulletins or procedures.   5. Assembly of component parts is carried out in accordance with the appropriate maintenance documents.   6. Aircraft component modification documentation is carried in accordance to CMM |
| 1. Test aircraft electrical system | * 1. Components are adjusted or calibrated to operate in accordance with aircraft relevant manuals.   2. Unserviceable components are tagged, sealed and packaged in accordance with specified procedures.   3. Operational test of aircraft electrical system is carried out in accordance with aircraft maintenance 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. Personal protective equipment may include but is not limited to: | * Helmet * Ear plugs/ muffs * Overalls * Safety boots/ shoes * Reflectors * Gloves * Respirator filters * Safety glasses |
| 1. Tools and equipment may include but is not limited to: | * Tool box * Crimping tool * Soldering iron * Wire stripper * Heat gun |
| 1. Specialist tools may include but is not limited to: | * Avometer (Multimeter) * Meggar * Bonding tester |
| 1. Materials may include but is not limited to: | * Tool box * Spare parts * Consumables * Parts |
| 1. Components or parts may include but is not limited to: | * Alternator/generator * Battery * Master/battery switch * Alternator/generator switch * Bus bar, fuses, and circuit breakers * Voltage regulator * Ammeter/load meter * Associated electrical wiring |
| 1. Batteries may include but is not limited to: | * Nickel-cadmium (NiCd) batteries * Lead acid batteries * Lithium iron |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Design of aircraft Avionic systems
* Communication skills
* Problem solving and analytical thinking
* Model development
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing
* Repair of electrical components

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Component and system operation
* Aircraft wiring specifications and standards
* Standard repair methods
* Electrical cables
* Ignition harnesses
* Relevant AMM and ATA chapters
* Fire warning system harnesses
* Coaxial cables, such as antenna leads
* Aerial components
* Electrical plugs and connectors
* Soldering methods
* Wire marking methods
* Assembly of electrical cables into wiring looms
* Relevant OHS (Occupational Health and Safety) procedures
* How to obtain relevant MSDS (Material Safety data sheet)
* Relevant aircraft maintenance manuals
* Relevant regulatory requirements and standard procedures.
* Electrical circuit design
* Computer Aided Design
* Technical report writing
* PPE
* Data/wiring analysis
* Interpretation of technical drawings
* Simulation
* Documentation
* Types of tools and equipment
* Properties of materials and processes
* Electrical machine drives

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Observed occupational health and safety   2. Troubleshot/diagnosed aircraft electrical systems   3. Rectified aircraft electrical defects   4. Performed Electrical Terminations, Connections and interconnections   5. Maintained aircraft batteries   6. Performed cable crimping   7. Serviced/ repaired aircraft generators and controls   8. Installed aircraft electrical components   9. Modified aircraft electrical systems   10. Tested aircraft electrical system |
| 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. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN AIRCRAFT AUTOFLIGHT, INSTRUMENTATION AND CONTROL SYSTEM

**UNIT CODE:** ENG/OS/AVN/CR/02/6/A

**Unit description**

This unit describes the competencies required by a technician to maintain aircraft auto flight, instrumentation and control system. It involves troubleshooting/diagnosing aircraft auto flight, instrumentation and control system, rectifying aircraft instruments defects, installing aircraft instruments and control components, installing aircraft flight guidance and control systems (Auto flight), performing aircraft software uploading and downloading, servicing and repairing aircraft instrument components, installing inertial navigation system/inertial reference system and testing aircraft instruments and control systems

**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. Troubleshoot/diagnose aircraft auto flight, instrumentation and control system | * 1. Relevant maintenance documentation and modification status, including system defect reports where relevant, are used to identify system fault   2. Aircraft auto flight, instrumentation and control system is prepared in accordance with applicable maintenance manual for the application of power/system operation.   3. Instrument or display system is functionally tested in accordance with applicable maintenance manual.   4. System calibration or adjustments are performed in accordance with maintenance manual where applicable.   5. Maintenance manual fault diagnosis guides and logic processes are used to ensure efficient and accurate troubleshooting.   6. ***Specialist tools*** are used, where required, to assist with the troubleshooting process.   7. Instrument or display system faults are located and the causes of the faults are clearly identified and correctly recorded in maintenance documentation.   8. Rectification requirements are determined according to aircraft maintenance manuals. |
| 1. Rectify aircraft instruments defects | * 1. Component defect reports (removal tags) or customer order are correctly interpreted and matched by part and serial numbers.   2. ***Components*** are inspected and/or operated through prescribed test procedures to establish serviceability or confirm defects as required.   3. Modification status is clearly established to assist in determining the overhaul requirements for the components.   4. Extent of overhaul or repair is correctly identified and documented.   5. Component parts are disassembled in accordance with component maintenance manuals.   6. Parts requiring specialist repair are tagged and repair instructions are accurately specified.   7. Component parts are repaired or replaced in accordance with the relevant aircraft maintenance manual.   8. Rectified report is documented in accordance with company procedures, AMM and KCAA regulations. |
| 1. Install aircraft instruments and control components | * 1. Aircraft instrument components to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of instrument components is performed in accordance with the applicable maintenance manual and regulatory requirements,  ensuring appropriate adjustment/alignment is carried out.   3. System is restored to correct operational condition in preparation for testing in accordance with AMM.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, aircraft maintenance manuals and KCAA regulations. |
| 1. Install aircraft flight guidance and control systems (Auto flight) | * 1. System is made safe and prepared in accordance with the applicable aircraft maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Removal of aircraft flight guidance and control components are carried out in accordance with the applicable maintenance manual.   3. Removed components are tagged, packaged or scrapped in accordance with specified procedures.   4. Aircraft flight guidance and control components to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   5. Physical installation of aircraft flight guidance and control components is carried out in accordance with the applicable maintenance manual.   6. System is restored to correct physical condition in preparation for testing, as necessary.   7. Required maintenance documentation is completed and processed in accordance with company procedures, aircraft maintenance manual and KCCA regulations. |
| 1. Perform aircraft software uploading and downloading | * 1. Aircraft system software is analysed according to relevant maintenance documents   2. System software requirements are identified according to programmable hardware in use   3. Flow chart of activities is developed according to task requirements   4. ***Peripheral devices*** to be used are identified according to software operational requirements and AMM   5. ***Aircraft downloads*** are generated according to system requirements |
| 1. Service and repair aircraft instrument components | * 1. Specifications are interpreted to determine the procedure for servicing/repair aircraft instrument components according to AMM/CMM   2. Appropriate materials, tools and equipment are selected and prepared for the particular task requirements in accordance with AMM/CMM.   3. Aircraft instrument components are serviced according to aircraft maintenance manual.   4. Aircraft instrument components servicing/repair is documented in accordance with AMM, company procedures and KCAA regulations. |
| 1. Install inertial navigation system/inertial reference system | * 1. System is made safe and prepared in accordance with the applicable aircraft maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Removal of aircraft inertial navigation/inertial reference components are carried out in accordance with the applicable maintenance manual.   3. Required maintenance documentation is completed and processed in accordance with standard workplace procedures.   4. Removed components are tagged, packaged or scrapped in accordance with specified procedures.   5. Aircraft inertial navigation/inertial reference components to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   6. Physical installation of aircraft inertial navigation/inertial reference components is carried out in accordance with the applicable maintenance manual.   7. System is reinstated to correct physical condition in preparation for testing, as necessary.   8. Required maintenance documentation is completed and processed in accordance with company procedures, aircraft maintenance manual and KCAA regulations. |
| 1. Test aircraft instruments and control systems | * 1. Components are adjusted or calibrated to operate within prescribed specifications as per CMM/AMM.   2. Unserviceable components are tagged, sealed and packaged in accordance with specified procedures.   3. Operational test of aircraft instruments and control system is carried out in accordance with aircraft maintenance 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** |
| --- | --- |
| * Tools and equipment may include but not limited to: | * Pitot static leak tester |
| * Control parts may include but not limited to: | * Sensors * Actuators * Display units * Gauges * Computers |

**REQUIRED KNOWLEDGE**

***The individual needs to demonstrate knowledge of:***

* Component attachment methods
* Connection of hardware
* The basic layout (block diagram level), function and operation of inertial navigation and reference systems
* The operating principles of inertial navigation and reference systems:
* Terminology
* Fundamental principles of inertial navigation
* Two degree of freedom systems
* Semi-analytical systems
* Strap down systems
* Ring laser gyroscopes
* The various methods of navigation and how they are used by both aircraft conventional and electronic navigational instruments and systems.
* Maintenance requirements and troubleshooting procedures
* Relevant OHS practices
* Relevant maintenance manuals
* Relevant regulatory requirements and standard procedures

**REQUIRED SKILLS**

***The individual needs to demonstrate skills in:***

* Applying relevant OHS practices
* Using approved maintenance documentation and aircraft publications relating to inertial navigation and reference systems being maintained
* Recognition of system and component defects/external damage, correct installation, connection of plugs, terminations, attaching hardware (including cabling/harnesses) and security of attachment in inertial navigation and reference system components
* Applying logic processes, take and interpret system measurements, use test equipment and appropriate wiring diagrams and manuals to isolate system malfunctions
* Performing system functional tests and checks to isolate system faults and assess post-maintenance serviceability

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | * 1. Troubleshot/diagnosed aircraft auto flight, instrumentation and control system   2. Rectified aircraft instruments defects   3. Installed aircraft instruments and control components   4. Installed aircraft flight guidance and control systems (Auto flight)   5. Perform aircraft software uploading and downloading   6. Serviced and repaired aircraft instrument components   7. Installed inertial navigation system/inertial reference system   8. Tested aircraft instruments and control systems |
| 1. Resource Implications. | * 1. Computers   2. Software   3. Projectors   4. Tools and equipment |
| 1. Methods of Assessment. | ***Competency may be assessed through:***   * 1. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | 4.1 Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions. |
| 1. Guidance information for assessment. | * 1. This unit may be assessed on an integrated basis with others within this occupational sector. |

# MAINTAIN AIRCRAFT CABLE/HARNESS LOOMS AND FIBER OPTIC CABLES

**UNIT CODE:** ENG/OS/AVN/CR/03/6/A

**Unit description**

This unit covers the competencies required to maintain aircraft cable looms and fibre optic cables. It involves observing occupational health and safety, troubleshooting aircraft cable looms, rectifying aircraft cable looms, modifying aircraft cable looms, installing aircraft cable looms and testing aircraft cable looms.

**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. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007 and relevant aircraft maintenance manuals   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. First aid is carried out in accordance with safety standards. |
| 1. Troubleshoot aircraft cable/harness looms | * 1. ***Relevant maintenance documentation*** and modification status, including system defect reports where relevant, are used to identify system fault   2. ***Aircraft cable/harness looms*** system is prepared in accordance with applicable maintenance manual for the application of power.   3. Aircraft cable looms system is functionally tested in accordance with applicable maintenance manual.   4. Insulation resistance test is carried out in accordance with maintenance manual.   5. Maintenance manual fault diagnosis guides and logic processes are used to ensure efficient and accurate troubleshooting according to AMM.   6. ***Specialist tools*** are used, where required, to assist with the troubleshooting process.   7. Aircraft cable/harness looms system faults are located and the causes of the faults are clearly identified and correctly recorded in maintenance documentation.   8. Rectification requirements are determined according to aircraft maintenance manuals. |
| 1. Rectify aircraft cable/harness looms | * 1. Aircraft cable/harness loom reports are correctly interpreted and matched by part number and serial number.   2. Aircraft cables/harnesses looms are inspected and/or operated through prescribed test procedures to establish serviceability or confirm defects as required in accordance with AMM.   3. Cable/harness looms requiring specialist repair are tagged and repair instructions are accurately specified.   4. Cable/harness looms are repaired or replaced in accordance with the relevant maintenance documentation   5. Rectified cable/harness loom report is generated in accordance with company procedures and AMM and KCAA regulations |
| 1. Modify aircraft cable looms | * 1. Cable/harness loom is made safe and prepared in accordance with the applicable maintenance manual where necessary to ensure personnel safety.   2. Cable/harness looms are assessed for serviceability in accordance with the relevant maintenance documentation.   3. Modification of cable/harness looms is undertaken where required by relevant manufacturer's bulletins or procedures.   4. Aircraft cable/harness loom modification documentation is carried in accordance to aircraft wiring manual. |
| 1. Install aircraft cable looms | * 1. Aircraft cable/harness loom to be installed are checked to confirm correct part numbers and serviceability   2. Physical installation of cable loom is performed in accordance with the applicable aircraft wiring manual and regulatory requirements/KCCA   3. System is reinstated to correct operational condition in preparation for testing in accordance with aircraft maintenance manual and wiring manual.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, aircraft maintenance manuals and KCCA regulations. |
| 1. Test aircraft cable looms | * 1. Cable/harness looms are adjusted or calibrated in accordance with wiring manual.   2. Unserviceable cable/harness looms are tagged, sealed and packaged in accordance with manufacturer’s specifications and organizational procedures.   3. Operational test of aircraft cable loom is carried out in accordance with aircraft maintenance 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. Personal protective equipment may include but not limited to: | * Gloves * Helmets * Reflectors * Safety shoes/boots |
| 1. Tools and equipment may include but not limited to*:* | * Tool box * Testers * Multimeter |
| 1. Relevant maintenance documentation may include but not limited to: | * KCAA regulations * Aircraft maintenance manual (AMM) * Aircraft wiring manual |
| 1. Aircraft cable/harness looms may include but not limited to: | * Split * Spiral * Expandable * Braided sleeving * Woven wire * High temperature protection |
| 1. Specialist tools may include but not limited to: | * Meggar * Avometer * Heat gun * Crimping tool |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Applying relevant OHS practices
* Using approved fabrication procedures and processes relating to electrical looms, cables and harnesses
* Recognising the integrity/security of electrical component crimps, joints and plug/connector pins
* Fabrication of cables, harnesses and looms, including wire marking, to approved industry standards
* Under qualified person guidance performing testing to assess post construction serviceability according to company procedures
* Design of aircraft Avionic systems
* Communication skills
* Problem solving
* Analytical thinking
* Model development
* Creativity and innovation
* Data collection and analysis
* Use of tools and equipment
* Technical presentation
* Technical drawing
* Repair of electrical components

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Electrical wire gauges and standards
* Wire marking conventions and procedures
* Wire terminations, soldering and crimping
* Component and system operation
* Aircraft wiring specifications and standards
* Standard repair methods
* Electrical cables
* Ignition harnesses
* Fire warning system harnesses
* Coaxial cables, such as antenna leads
* Aerial components
* Electrical plugs and connectors
* Soldering methods
* Wire marking methods
* Assembly of electrical cables into wiring looms
* Relevant OHS procedures
* How to obtain relevant MSDS
* Relevant aircraft maintenance manuals
* Relevant regulatory requirements and standard procedures.
* Electrical circuit design
* Computer Aided Design
* Technical report writing
* PPE
* Data/wiring analysis
* Interpretation of technical drawings
* Documentation
* Types of tools and equipment
* Properties of materials
* Electrical machine drives

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Observed occupational health and safety   2. Troubleshot aircraft cable/harness looms   3. Rectified aircraft cable/harness looms   4. Modified aircraft cable/harness looms   5. Installed aircraft cable/harness looms   6. Tested aircraft cable/harness looms |
| 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. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM ASSEMBLY OF AVIONICS COMPONENTS AND PRINTED CIRCUIT BOARDS (PCBS)

**UNIT CODE:** ENG/OS/AVN/CR/04/6/A

**Unit description**

This unit describes the competencies required by a technician to perform assembly of avionic components and PCBs. It involves inspecting, troubleshooting, dissembling and assembling multi-layer printed circuit cards and associated components.

**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. Observe occupational health and safety | * 1. ***Personal protective equipment (PPE)*** are used according to OSHA 2007 and CMM   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. First aid is carried out in accordance with safety standards. |
| 1. Inspect multi-layer printed circuit cards and associated components | * 1. Relevant maintenance documentation, including component defect reports where applicable, is interpreted and matched by part number and serial number   2. Preparation of work area and circuit card assemblies is appropriate to allow for effective detailed inspection of all substrate, circuit tracks, edge connectors and attached components, considering any static discharge procedures   3. Circuit card assemblies are visually or physically inspected for physical integrity of substrate, circuit tracks, edge connectors and attached components   4. Modification status is established to assist in determining repair requirements   5. Defects are correctly identified and reported |
| 1. Test multi-layer printed circuit cards and associated components | * 1. Circuit card assemblies are correctly prepared and connected to the appropriate test facility in accordance with approved procedures, or circuit card assemblies are correctly prepared and connected in situ to allow required test procedures to be performed in accordance with relevant CMM   2. Circuit card assemblies are functionally tested in accordance with CMM and approved maintenance documentation for evidence of serviceability or malfunction   3. Circuit card assemblies, attached hardware and electronic components are electronically and/or physically adjusted/aligned in accordance with maintenance manuals or other prescribed procedures and KCAA regulations. |
| 1. Troubleshoot multi-layer printed circuit cards and associated components | * 1. Maintenance documentation, physical inspection and test results are used, where applicable, to assist in fault determination   2. Maintenance manual fault diagnosis guides, logical processes and test equipment are used appropriately to ensure efficient and accurate troubleshooting   3. Component faults are located, and the causes of the faults are clearly identified and recorded in maintenance documentation in accordance with KCAA regulations and company procedures.   4. Rectification requirements are determined in accordance with CMM |
| 1. Disassemble multi-layer printed circuit cards and associated components | * 1. Conformal/protective coatings are removed from the circuit card assembly to the extent required to effect necessary repairs and in accordance with maintenance manuals, industry standards as applicable   2. Appropriate OHS precautions are observed always during maintenance procedure in accordance with CMM   3. Circuit card assembly is disassembled to the extent necessary to allow repair of all identified faults   4. Parts for processing are correctly tagged and despatched   5. Parts for retention and re-fitment are correctly packaged and stored in accordance with approved procedures to avoid physical and electrostatic damage   6. Parts for disposal are correctly packaged and processed to accord with statutory requirements pertaining to dangerous goods |
| 1. Assemble multi-layer printed circuit cards and associated components | * 1. Parts removed and replacement parts are inspected and part number confirmed in accordance with CMM   2. Any conformal/protective coatings removed are replaced to the approved standard of the equipment manufacturer, or industry standard   3. Rework techniques are done in accordance with industry approval procedures and relevant OHS requirements are observed in accordance with CMM   4. Printed circuit card and associated components are assembled in accordance with maintenance manuals, and all electrical joints meet the approved standard of the equipment manufacturer, or industry standard, as appropriate   5. Circuit substrate material, circuit tracks, edge connectors and through-hole eyelets are reworked, as necessary, to restore printed circuit card to a serviceable condition |

**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. Personal protective equipment (PPE) may include but not limited to: | * Wrist strap * Electrostatic mat |
| 1. Tools and equipment may include but not limited to: | * Heat gun * Heat shrink * Soldering gun * Soldering wire * Solder sucker * Multimeter * ESD tester |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Applying relevant OHS practices
* Using approved repair procedures and processes relating to multi-layer circuit cards
* Recognizing unacceptable soldered connections, damage circuit card components, circuit tracks integrity, substrate damage and edge connector condition
* Applying static-safe work area practices
* Reworking unacceptable PCB soldered connections, via acceptable de-soldering and soldering techniques
* Disassembling and assembling PCB cards to approved industry standards and prescribed specifications
* Performing PCB tests using relevant test equipment and processes to isolate PCB track faults and assess serviceability state post repair

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Component operation
* Basic principles/functions relating to electrical and electronic components on PCBS
* Substrate materials
* Types of conformal coating
* Types of soldering equipment and solders used in track repair and component assembly
* De-soldering techniques
* Optical equipment and tools used in multi-layer PCB repair
* How to obtain MSDS
* OHS procedures
* Relevant maintenance manuals
* Relevant regulatory requirements and standard procedures
* Correctly disassembling, preparing repair area, reworking the card to industry standards, replacing faulted components and assembling card for post-repair inspection and testing

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Inspected multi-layer printed circuit cards and associated components   2. Tested multi-layer printed circuit cards and associated components   3. Troubleshot multi-layer printed circuit cards and associated components   4. Dismantled multi-layer printed circuit cards and associated components   5. Assembled multi-layer printed circuit cards and associated components |
| 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. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

# MAINTAIN AIRCRAFT RADIO SYSTEMS (COMMUNICATION, NAVIGATION AND RADAR)

**UNIT CODE:** ENG/OS/AVN/CR/05/6/A

**Unit description**

This unit covers the competencies required to maintain aircraft radio system. It involves observing occupational health and safety, troubleshooting/diagnosing aircraft radio systems, rectifying aircraft radio defects, installing aircraft communication systems, installing aircraft navigation systems, installing aircraft radar system, reducing radio interference, servicing and repairing aircraft radio components and testing aircraft radio systems.

**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. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007 and AMM   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. First aid is carried out in accordance with safety standards |
| * 1. Troubleshoot/diagnose aircraft radio systems | * 1. Available information from maintenance documentation, inspection and test results is used, where necessary to assist in fault determination according to defects   2. Maintenance manual fault diagnosis guides and logic processes are used to ensure efficient and accurate troubleshooting to line replacement level   3. Specialist tools are used, where required, to assist with the troubleshooting process in accordance with AMM   4. Communication and radio navigation system faults are located and are correctly recorded in maintenance documentation in accordance with aircraft maintenance manual, company procedures and KCAA. |
| * 1. Rectify aircraft radio defects | * 1. System is made safe and prepared in accordance with the applicable maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Communication and navigation system component removal is carried out in accordance with the applicable maintenance manual.   3. Required maintenance documentation is completed and processed in accordance with standard company procedures and AMM.   4. Removed components are tagged and packaged in accordance with specified procedures. |
| * 1. Install aircraft communication systems | * 1. ***Communication system components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out.   3. System is restored to correct operational condition in preparation for testing in accordance with AMM.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, AMM and KCAA regulations. |
| * 1. Install aircraft navigation systems | 1. ***Navigation system components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life. 2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out. 3. System is restored to correct operational condition in preparation for testing in accordance with AMM. 4. Required maintenance documentation is completed and processed in accordance with standard company procedures, AMM and KCAA regulations. |
| * 1. Install aircraft radar system | * 1. ***Aircraft radar components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out.   3. System is restored to correct operational condition in preparation for testing in accordance with AMM.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, AMM. |
| * 1. Reduce radio interference | 7.1 Static wick dischargers are checked in accordance with configuration deviation list.  7.2 Aircraft bonding test is carried out using bonding tester in accordance with AMM.  7.3 Approved aircraft shielded cables are used in accordance with applicable aircraft maintenance manuals. |
| * 1. Service and repair aircraft radio components | * 1. Specifications are interpreted to determine the procedure for servicing/repair of aircraft radio components according to CMM   2. Appropriate materials, tools and equipment are selected and prepared for the particular task requirements in accordance with AMM.   3. Aircraft radio components are serviced according to aircraft maintenance manual.   4. Aircraft radio components servicing/repair is documented in accordance with AMM, company procedures and KCAA. |
| * 1. Test aircraft radio systems | * 1. Aircraft radio components are adjusted or calibrated in accordance with AMM.   2. Finished components are tagged, sealed and packaged in accordance with company procedures and AMM.   3. Aircraft radio system is tested according to system operation and KCAA approved procedures. |

**RANGE**

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

|  |  |
| --- | --- |
| **Variable** | **Range** |
| 1. Personal protective equipment may include but not limited to: | * Wrist strap * Electrostatic mat * Dummy load |
| 1. Tools and equipment may include but not limited to: | * Bonding tester * Multimeter |
| 1. Communication system components may include but not limited to: | * VHF – Very High Frequency * HF – High Frequency * SELCAL |
| 1. Navigation system components may include but not limited to: | * DME (Distance measuring equipment) * VOR (Omni-Directional Range) * Glideslope * Localiser * Marker beacon * GPS – Global Positioning System * SATCOM – Satellite Communication * ADF – Automatic Direction Finder |
| 1. Aircraft radar components may include but not limited to: | * Weather radar * Radar altimeter * TCAS – Traffic Collision Avoidance System * EGPWS – Enhanced Ground Proximity Warning 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 skills in:

* Applying relevant OHS practices
* Using approved maintenance documentation and aircraft publications relating to the primary radar system being maintained
* Recognition of system and component defects/external damage, correct installation, connection of plugs, terminations, attaching hardware (including cabling/harnesses/transmission lines/wave guides) and security in radar (navigation/weather) system components and interface
* Applying logic processes, taking and interpreting system measurements, to accurately and effectively isolate malfunctions within the system and system components
* Performing system testing to isolate system malfunctions and assess system s post-maintenance serviceability

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Component attachment methods
* Connection of hardware and plugs
* Handling precautions for electrostatic sensitive devices
* Relevant OHS practices
* The use of approved maintenance documentation and aircraft publications relating to radio communication and navigation systems and components
* Basic layout and working principles to block diagram level of:
* HF communication systems
* VHF communication systems
* ADF navigation systems
* VOR navigation systems
* SATCOM
* GPS
* SELCOM
* ILS
* ELT systems
* Relevant regulatory requirements and standard procedures.
* Printed circuit boards
* Semiconductors
* Fiber optics
* The use of approved maintenance documentation and aircraft publications relating to radio communication and navigation systems and components
* The general working principles of communication and navigation systems
* Radio frequency and communication system maintenance requirements and basic troubleshooting procedures
* Relevant maintenance manuals
* Relevant regulatory requirements and standard procedures.

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Troubleshot/diagnosed aircraft radio systems   2. Rectified aircraft radio defects   3. Installed aircraft communication systems   4. Installed aircraft navigation systems   5. Installed aircraft radar system   6. Reduced radio interference   7. Serviced and repaired aircraft radio components   8. Tested aircraft radio systems |
| 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. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# MAINTAIN AIRCRAFT COMPASS COMPENSATION AND ADJUSTMENT SYSTEMS

**UNIT CODE:** ENG/OS/AVN/CR/06/6/A

**Unit description**

This unit covers the competencies required to maintain aircraft compass compensation and adjustment systems. It involves observing occupational health and safety, troubleshooting aircraft direct and remote reading compass, rectifying aircraft compass compensation and adjustment systems, install direct reading compass and remote reading compass and testing aircraft compass compensation and adjustment systems.

**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. Observe occupational health and safety | * 1. ***Personal protective equipment*** (PPE) are used according to OSHA 2007 and relevant AMM   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications. |
| 1. Troubleshoot aircraft direct and remote reading compass | * 1. Available information from maintenance documentation, inspection and test results is used, where necessary to assist in fault determination according to defects   2. Maintenance manual fault diagnosis guides and logic processes are used to ensure efficient and accurate troubleshooting to line replacement level   3. Special tools are used, where required, to assist with the troubleshooting process in accordance with relevant AMM   4. Aircraft direct and remote reading compass faults are located and are correctly recorded in maintenance documentation in accordance with standard operating procedures and KCAA regulations. |
| 1. Rectify aircraft compass compensation and adjustment systems | * 1. System is rendered safe and prepared in accordance with the applicable maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Aircraft compass compensation and adjustment system component removal is carried out in accordance with the applicable maintenance manual.   3. Required maintenance documentation is completed and processed in accordance with standard enterprise procedures.   4. Removed components are tagged and packaged in accordance with specified procedures. |
| 1. Install direct reading compass | * 1. ***Direct reading compass components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out.   3. System is restored to correct operational condition in preparation for testing in accordance with AMM   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, AMM and KCAA regulations. |
| 1. Install remote reading compass | * 1. ***Remote reading compass components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out.   3. System is reinstated to correct operational condition in preparation for testing and AMM.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures, AMM and KCAA regulations. |
| 1. Test aircraft compass compensation and adjustment systems | * 1. Components are adjusted or calibrated in accordance with AMM.   2. Finished components are tagged, sealed and packaged in accordance with AMM.   3. Aircraft compass compensation and adjustment system is tested according to AMM. |

**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. Personal protective equipment may include but not limited to: | * Non-magnetic clothing and jewellery * Safety boot/shoes |
| 1. Tools and equipment may include but not limited to: | * Multimeter * Nonmagnetic tools |
| 1. Direct reading compass components may include but not limited to: | * Compass card * Gyros * Gimbal rings * Luber line |
| 1. Remote reading compass components may include but not limited to: | * Compass rose * Directional Gyros * Gimbal rings * Heading bug |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Applying relevant OHS practices
* Using approved maintenance documentation and aircraft publications relating to the compass system being maintained
* Recognition of system and component defects/external damage, correct installation, connection of plugs, terminations, attaching hardware (including cabling/harnesses/transmission lines) and security in compass (navigation) system components and interface
* Applying logic processes, taking and interpreting system measurements, to accurately and effectively isolate malfunctions within the system and system components
* Performing system testing to isolate system malfunctions and assess system s post-maintenance serviceability

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Component attachment methods
* Connection of hardware and plugs
* Handling precautions for electromagnetic sensitive devices
* Relevant OHS practices
* The use of approved maintenance documentation and aircraft publications relating to compass navigation systems and components
* Basic layout and working principles to block diagram level of compass system
* Relevant regulatory requirements and standard procedures.
* The use of approved maintenance documentation and aircraft publications relating to compass navigation systems and components
* The general working principles of compass navigation systems
* Compass system maintenance requirements and basic troubleshooting procedures
* Relevant maintenance manuals
* Relevant regulatory requirements and standard procedures.

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Troubleshot aircraft direct and remote reading compass   2. Rectified aircraft compass compensation and adjustment systems   3. Installed direct reading compass   4. Installed remote reading compass   5. Tested aircraft compass compensation and adjustment systems |
| 1. Resource Implications. | * 1. Computers   2. Projectors   3. Markers   4. Whiteboards   5. Tools and equipment |
| 1. Methods of Assessment. | Competency may be assessed through:   * 1. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# OPERATE AIRCRAFT ELECTRO-OPTICAL AND INFRARED SYSTEM

**UNIT CODE:** ENG/OS/AVN/CR/07/6/A

**Unit description**

This unit covers the competencies required to operate aircraft electro-optical and infrared system. It involves observing occupational health and safety, troubleshooting aircraft electro-optical and infrared system, rectifying aircraft electro-optical and infrared components, installing electro-optical and infrared components, repairing aircraft infrared sources, testing aircraft electro-optical and infrared systems and operating aircraft electro-optical and infrared system

**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. Observe occupational health and safety | * 1. Personal protective equipment (PPE) are used according to OSHA 2007 and relevant AMM   2. ***Tools and equipment*** are stored and maintained correctly according to manufacturer’s specifications   3. Tools and equipment are used correctly according to designated purpose   4. Workspace housekeeping is maintained according to Standard operating procedures (SOPs)   5. Workplace is planned according to design specifications.   6. First aid is carried out according to safety standards |
| 1. Troubleshoot aircraft electro-optical and infrared system | * 1. Available information from maintenance documentation, inspection and test results is used, where necessary to assist in fault determination according to defects   2. Maintenance manual fault diagnosis guides and logic processes are used to ensure efficient and accurate troubleshooting to line replacement level   3. Special tools are used, where required, to assist with the troubleshooting process in accordance with relevant maintenance publications   4. Aircraft electro-optical and infrared system faults are located and are correctly recorded in maintenance documentation in accordance with standard operating procedures |
| 1. Rectify aircraft electro-optical and infrared components | * 1. System is made safe and prepared in accordance with the applicable maintenance manual and isolation tags are fitted where necessary to ensure personnel safety.   2. Electro-optical and infrared system component removal is carried out in accordance with the applicable maintenance manual.   3. Required maintenance documentation is completed and processed in accordance with standard company procedures.   4. Removed components are tagged and packaged in accordance with relevant maintenance manual. |
| 1. Install electro-optical and infrared components | * 1. Electro-optical and infrared system components to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual System is restored to correct operational condition in preparation for testing in accordance with applicable maintenance manual.   3. Required maintenance documentation is completed and processed in accordance with standard company procedures. |
| 1. Repair aircraft infrared sources | * 1. ***Electro-optical and infrared components*** to be installed are checked to confirm correct part numbers, modification status, serviceability and shelf life.   2. Physical installation of components is performed in accordance with the applicable maintenance manual and regulatory requirements, ensuring appropriate adjustment/alignment is carried out.   3. System is restored to correct operational condition in preparation for testing in accordance with.   4. Required maintenance documentation is completed and processed in accordance with standard company procedures and applicable maintenance manual. |
| 1. Test aircraft electro-optical and infrared systems | * 1. Components are adjusted or calibrated to operate within prescribed specifications.   2. Finished components are tagged, sealed and packaged in accordance with specified procedures as stipulated in maintenance manual.   3. Electro-optical and infrared system is tested according to system operation. |
| 1. Operate aircraft electro-optical and infrared system | * 1. Operation manuals are obtained according to company procedures.   2. Aircraft electro-optical and infrared parts are understood according to operation manual.   3. Operation safety is observed according to safety standards.   4. Electro-optical and infrared system is operated according to manufacturer’s specifications.   5. Basic maintenance is performed on the system according to operation manuals. |

**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. Tools and equipment may include but not limited to: | * Splice * Pig tail assembly * Optical time domain reflectometer (OTDR) |
| 1. Electro-optical and infrared components may include but not limited to: | * Fibre optic cables * Camera |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Applying relevant OHS practices
* Using approved maintenance documentation and aircraft publications relating to the Electro-optical and infrared Electro-optical and infrared system being maintained
* Recognition of system and component defects/external damage, correct installation, connection of plugs, terminations, attaching hardware (including cabling/harnesses/transmission lines/wave guides) and security in radar (navigation/weather) system components and interface
* Applying logic processes, taking and interpreting system measurements, to accurately and effectively isolate malfunctions within the system and system components
* Performing system testing to isolate system malfunctions and assess system s post-maintenance serviceability

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Component attachment methods
* Connection of hardware and plugs
* Handling precautions for fiber optic sensitive devices
* Relevant OHS practices
* The use of approved maintenance documentation and aircraft publications relating to Electro-optical and infrared systems and components
* Basic layout and working principles to block diagram level of Electro-optical and infrared components
* Relevant regulatory requirements and standard procedures.
* Fibre optics
* The use of approved maintenance documentation and aircraft publications relating to Electro-optical and infrared systems and components
* The general working principles of Electro-optical and infrared systems
* Electro-optical and infrared system maintenance requirements and basic troubleshooting procedures
* Relevant maintenance manuals
* Relevant regulatory requirements and standard procedures.

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Troubleshot aircraft electro-optical and infrared system   2. Rectified aircraft electro-optical and infrared components   3. Installed electro-optical and infrared components   4. Repaired aircraft infrared sources   5. Tested aircraft electro-optical and infrared systems   6. Operated aircraft electro-optical and infrared system |
| 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. Practical   2. Observation   3. Case studies   4. Written examinations   5. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |

# PERFORM AIRCRAFT STORE PROCEDURES

**UNIT CODE:** ENG/OS/AVN/CR/08/6/A

**Unit description**

This unit covers the competencies required to perform aircraft store procedures. It involves requesting aircraft parts from the store, inspecting received aircraft parts, monitoring and ensure smooth flow of parts and maintaining organization’s technical library.

**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. Requisite aircraft parts from the store | * 1. Work instructions are received according to nature of job to be done and organizational policy.   2. Requisition forms are filled and signed according to organizational policy.   3. ***Aircraft parts and materials (spares)*** are requested from the store according to requisition form.   4. Received aircraft materials utilised according to nature of job to be accomplished. |
| 1. Inspect received aircraft parts | * 1. Delivery note is obtained according to organizational policy.   2. Quantity of delivered materials are checked according to order placed, CRS (Certificate of release to service) and delivery note   3. Quality of delivered materials is inspected according to manufacturer’s specifications and job requirements.   4. Aircraft delivered parts are accepted/ rejected according to requisition needs. |
| 1. Monitor and ensure smooth flow of parts | * 1. Aircraft parts database is created according to organizational setup.   2. Store terms and conditions are generated according to organizational setup.   3. Requisition forms are generated according to organizational setup.   4. Distribute requested materials according to work to be done.   5. Distributed materials are checked and inspected for their utilization according to nature of job. |
| 1. Maintain organisation’s technical library | * 1. ***Maintenance reports and documentation*** are compiled and despatched in accordance with regulatory requirements and organisational policy and procedures   2. ***Maintenance records and associated documentation*** are maintained in accordance with organisational policy, procedures and KCAA regulations   3. Deficiencies in documentation are remedied in accordance with organizational policy, procedures and KCAA regulations |

**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. Aircraft parts and materials may include but not limited to: | * Spare parts * Manuals * Software * Consumables |
| 1. Maintenance reports and documentation may include but not limited to: | * Reports and documents that must be forwarded to the KCAA * Continuing airworthiness documentation and reports * Computer maintenance database reports * Stores forms * Articles in use accounts * Aircraft/equipment cross-reference records |
| 1. Maintenance records and associated documentation may include but not limited to: | * Management * Auditing * Documentation of maintenance activities |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Research
* Utilisation of international document standards, such as IATA
* Oral communication
* Management
* Auditing
* Documentation of maintenance activities
* Written communication
* Problem solving
* Use of word processing software and graphics packages

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Modification of documentation and recording
* Weight and balance documentation and recording
* Role/alternate mission changes and related maintenance actions
* Deviations/modifications
* Local manufacture of components
* Types of stores
* Quarantine
* Bonded
* Store procedures
* Aircraft components
* Procedures for determining authenticity of components
* Cannibalisation procedures

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Requested aircraft parts from the store   2. Inspected received aircraft parts   3. Monitored and ensured smooth flow of parts   4. Maintained organisation’s technical library |
| 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. Practical   2. Observation   3. Questionnaire   4. Case studies   5. Written examinations   6. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended |

# MANAGE AVIONIC MAINTENANCE PROJECTS

**UNIT CODE:** ENG/OS/AVN/CR/09/6/A

**Unit description**

This unit describes the competencies required by a technician in order to manage avionic maintenance projects. It involves planning for avionic maintenance project, implementing avionic maintenance activities, providing avionic maintenance guidance, monitoring and certifying avionic maintenance quality, managing human resource activities and performing workplace avionic training tasks and generating aviation technical report and publications.

**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. Plan for avionic maintenance project | 1. Maintenance tasks are identified and analysed from available maintenance data or schedule according to organisational procedures 2. Team workload is organised in order of priority taking into consideration required maintenance tasks and specified timeframes 3. ***Required resources*** are identified and obtained according to available maintenance tasks 4. ***Tools and support equipment*** are checked for serviceability and currency of calibration, where applicable |
| 1. Implement avionic maintenance activities | * 1. Allocate maintenance tasks to team members after consideration of individual experience, qualifications and task authorisations   2. Team members are briefed on their responsibility and function in the team according to their qualification and task assigned   3. Team members are authorised to operate required items of ground support and test equipment |
| 1. Provide avionic maintenance guidance | * 1. Provide guidance to team members appropriate to complexity or criticality of maintenance task and experience level of individual   2. Provide guidance in determining cause of complex faults or faults not covered in maintenance manual fault diagnosis guides |
| 1. Monitor and certify avionic maintenance quality | * 1. Check maintenance activities and guide personnel to ensure that maintenance is performed and certified according to required documentation, policies, and procedures   2. Perform check inspections on completed work or work stages and certify the work according to regulatory requirements, policies and procedures |
| 1. Manage human resource activities | * 1. Identify and address ***human factors*** affecting job performance   2. Minimise the possibility of maintenance errors   3. Maintain sound teamwork by supporting the identification of contributing factors   4. Support sound employment relations |
| 1. Perform workplace avionic training tasks | * 1. Deliver on-the-job training according to organization policy   2. Complete Supervisor’s Verification section of the Workplace History Sheets of the Log of Industrial Experience and Achievement/appraisal   3. Provide expert witness verification of competency for workplace assessors, when required   4. Provide opportunities for individuals to develop competencies according to human resource manual. |
| 1. Generate aviation technical report and publications | * 1. The required medium, style and layout are determined   2. Relevant data is obtained or accessed   3. Potential problems are identified, and relevant experts are identified and consulted   4. Problem resolution strategies are determined   5. The publication or amendment is drafted using relevant guidelines and specified software package   6. Copyright legislation is observed   7. Completed graphics are inserted into the draft and annotations/labels added   8. The draft is prepared for publishing and is submitted for editorial review   9. Publication or amendment is published   10. The publication management database is updated, and the completed publication is delivered or distributed |

**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. Required resources may include but not limited to: | * Human resource * Machines * Tools and equipment * Capital |
| 1. Tools and support equipment may include but not limited to: | * Avionic tool box * Consumables * Pitot static leak tester * Time domain reflectometer * Heat gun |
| 1. Human factors may include but not limited to: | * Behaviour * Fatigue * Knowledge * Experience * Performance * Age |

**REQUIRED SKILLS AND KNOWLEDGE**

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

**Required Skills**

The individual needs to demonstrate skills in:

* Measurements
* Equipment inspection and testing
* Communication skills
* Problem solving
* Data collection and analysis
* Documentation
* Management
* Project development
* Attention to details

**Required Knowledge**

The individual needs to demonstrate knowledge of:

* Principles of supervision
* High level technical knowledge applicable to the job
* Fault diagnosis techniques
* Key features and uses of maintenance data and documentation applicable to maintenance activities described in the performance evidence
* Operating manuals
* Maintenance manuals
* Organizational policy manuals
* Quality manuals
* Safety manuals
* Procedures manuals
* Safety data sheets (SDS)
* Work instructions
* Standing instructions
* Regulations, policies and procedures relating to supervision and certification of maintenance, including:
* Human factors with the potential to affect job performance in aviation maintenance activities, and associated guidelines
* Key principles of employment relations and conditions relating to the work described in the performance evidence, including:
* Relevant sections of industrial awards
* Content of enterprise agreements
* Conditions of employment and service that apply to the particular workplace
* Equity, diversity and fraud requirements set out in organizational code of conduct specific to the work described in the performance evidence
* Factors to consider when determining resource requirements for maintenance activity plan, including:
* Personnel in required numbers with applicable experience, qualifications and task authorization
* Spares
* Consumables
* Tools
* Special equipment
* Ground support equipment
* PPE
* Use of PPE
* Use and procedures for obtaining confined space entry permits
* Techniques to avoid maintenance errors
* Key features of the log of industrial experience and achievement, including responsibility for making entries and responsibility for certifying entries
* Role of supervisors in assisting workplace competency assessors
* Techniques for delivering on-the-job training.

**EVIDENCE GUIDE**

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

|  |  |
| --- | --- |
| 1. Critical Aspects of Competency. | Assessment requires evidence that the candidate:   * 1. Planned for avionic maintenance project   2. Checked tools and support equipment are for serviceability and currency of calibration.   3. Implemented avionic maintenance activities   4. Allocated maintenance tasks to team members after consideration of individual experience, qualifications, and task authorisations   5. Briefed team members on their responsibility and function   6. Authorised team members are to operate required items of ground support and test equipment   7. Monitored and certified avionic maintenance quality   8. Checked maintenance activities and guided personnel to ensure that maintenance is performed and certified according to required documentation, policies, and procedures   9. Performed check inspections on completed work or work stages and certified the work according to regulatory requirements, and policies and procedures   10. Managed human resource activities   11. Performed workplace avionic training tasks |
| 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. Practical   2. Observation   3. Questionnaire   4. Case studies   5. Written examinations   6. Oral presentation |
| 1. Context of Assessment. | Competency may be assessed   1. Off the job 2. On the job 3. During industrial attachment |
| 1. Guidance information for assessment. | Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended. |