

**THE REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM**

**FOR**

**AUTOBODY TECHNOLOGY**

**LEVEL 6**



****



TVET CDACC

P.O BOX 15745-00100

NAIROBI

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# FOREWORD

The provision of quality education and training is fundamental to the Government’s overall strategy for social economic development. Quality education and training will contribute to achievement Kenya’s development blue print 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 provisions of the Constitution and this resulted in the formulation of the Policy Framework for Reforming Education and Training. 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 this Curriculum has been developed.

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

**PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING**

**MINISTRY OF EDUCATION**

# PREFACE

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

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

TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) in conjunction with Autobody Sector Skill Advisory Committee, GIZ- Kenya, Delegation of German Industry and Commerce in Kenya (AHK) have developed) have developed Occupational Standards for Autobody Technician. These standards will be the basis for development of competency-based curriculum for Automotive Engineering Level 6.

This curriculum has been developed following the CBET framework policy; the CBETA Standards and guidelines provided by the TVET Authority and the Kenya National Qualification framework designed by the Kenya National Qualification Authority.

This curriculum is designed and organized with an outline of learning outcomes; suggested delivery methods, training/learning resources and methods of assessing the trainee’s achievement. The curriculum is competency-based and allows multiple entry and exit to the course.

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

**CHAIRPERSON, TVET CDACC**

# ACKNOWLEDGEMENT

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

I recognize with appreciation the role of the Autobody Sector Skills Advisory Committee (SSAC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Engineering Sector for their valuable input, Consultants in particular the GFA Consultants and Africa Vocational Education Researchers and Consultants (AVERC) and all those who participated in the process of developing this curriculum,

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

**COUNCIL SECRETARY/CEO**

**TVET CDACC**

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# ABBREVIATIONS AND ACRONYMS

A Control version

ABT Auto body Technology

AC Alternating Current

AHK Delegation of German Industry and Commerce in Kenya

AIDS Acquired Immunodeficiency Syndrome

ANSYS Analysis System

BC Basic Unit of Learning

CAD Computer-Aided Design

CAE Computer-Aided Engineering

CAM Computer-Aided Manufacturing

CBET Competency Based Education and Training

CC Common Unit of Learning

CDACC Curriculum Development Assessment Certification Council

CEO Council Secretary

CNC Computer Numerical Control

CR Core Unit of Learning

DC Direct Current

EMS Environmental Management System

FMEA Failure Moods and Effects Analysis

GIZ Deutsche Gesellschatt für Internationale Zusammenarbeit

HIV Human Immunodeficiency Virus

I/O Input/Output

ICT Information Communication Technology

ISO International Organization of Standardization

KEBS Kenya Bureau of Standards

LAN Local Access Network

MIG Metal Inert Gases

OBD On-board Diagnostics

OSH Occupational Safety and Health

OSHA Occupational, Health and Safety Act

OSHS Occupational Safety and Health Standards

PC Personal Computer

PESTEL Political Environmental Social Technological Economic Legal

PLC Programmable Logic Controller

PPE Personal Protective Equipment

RTD Resistance Temperature Nature

SOPStandard Operating Procedure

SSAC Sector Skill Advisory Committee

SWOT Strength Weakness Opportunity Threat

TIG Tungsten Inert Gas

TVET Technical and Vocational Education and Trainin

TVET Technical and Vocational Education and Training

# **KEY TO UNIT CODE**

**ENG/CU/ABT/BC /01/ 6/ A**

Industry or sector

Curriculum

Occupational area

Type of competency

Competency number

Competency level

Version control

# **COURSE OVERVIEW**

Autobody Technology level 6 qualifications consists of competencies that an individual must achieve including design vehicle body, fabricate automotive structure, weld vehicle body parts, panel vehicle structure, repair vehicle body, spray paint vehicle body, trim vehicle body, assemble vehicle body parts, perform vehicle preventive maintenance and drive motor vehicle.

The course qualification consists of the following basic, common and core units of learning as shown below:

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| ENG/CU/ABT/BC/01/6/A | Communication Skills | 40 | 4.0 |
| ENG/CU/ABT/BC/02/6/A | Digital Literacy | 60 | 6.0 |
| ENG/CU/ABT/BC/03/6/A | Entrepreneurial Skills | 100 | 10.0 |
| ENG/CU/ABT/BC/04/6/A | Employability Skills | 80 | 8.0 |
| ENG/CU/ABT/BC/05/6/A | Environmental Literacy | 40 | 4.0 |
| ENG/CU/ABT/BC/06/6/A | Occupational Safety and Health Practices | 40 | 4.0 |
| **Subtotal 1** | | **360** | **36.0** |

**Common Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| ENG/CU/ABT/CC/01/6/A | Engineering Mathematics | 120 | 12.0 |
| ENG/CU/ABT/CC/02/6/A | Engineering Mechanics Principles | 80 | 8.0 |
| ENG/CU/ABT/CC/03/6/A | Workshop Technology Principles | 160 | 16.0 |
| ENG/CU/ABT/CC/04/6/A | Computer Aided Drawing | 150 | 15.0 |
| ENG/CU/ABT/CC/05/6/A | Thermodynamics Principles | 100 | 10.0 |
| ENG/CU/ABT/CC/06/6/A | Fluid Mechanics Principles | 70 | 7.0 |
| ENG/CU/ABT/CC/07/6/A | Material Science Principles | 70 | 7.0 |
| ENG/CU/ABT/CC/08/6/A | Electrical And Electronics Principles | 130 | 13.0 |
| **Subtotal 2** | | **880** | **88.0** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit factor** |
| ENG/CU/ABT/CR/01/6/A | Designing Vehicle Body | 120 | 12.0 |
| ENG/CU/ABT/CR/02/6/A | Fabricating Automotive Structure | 150 | 15.0 |
| ENG/CU/ABT/CR/03/6/A | Welding Vehicle Body Parts | 360 | 36.0 |
| ENG/CU/ABT/CR/04/6/A | Panelling Vehicle Structure | 400 | 40.0 |
| ENG/CU/ABT/CR/05/6/A | Vehicle Body Repair | 120 | 12.0 |
| ENG/CU/ABT/CR/06/6/A | Vehicle Spray Painting | 360 | 36.0 |
| ENG/CU/ABT/CR/07/6/A | Trimming Vehicle Body | 120 | 12.0 |
| ENG/CU/ABT/CR/08/6/A | Motor Vehicle Assembling | 120 | 12.0 |
| ENG/CU/ABT/CR/09/6/A | Vehicle Preventive Maintenance | 240 | 24.0 |
| ENG/CU/ABT/CR/10/6/A | Motor Vehicle Driving | 120 | 12.0 |
|  | Industrial Attachment | 480 | 48.0 |
| **Subtotal 3** | | 2590 | 259.0 |
| **GRAND TOTAL** | | **3830** | **383.0** |

The total duration of the course for an average trainee is **3,830** hours which is equivalent to 128 weeks at 30 hours of learning per week, inclusive 12 weeks industrial attachment.

**Industrial Attachment**

It is envisaged that the trainee will have undergone a field training and assessment with a recognized Autobody firm. At least 480 hours (12 weeks) will be spent on a supervised and assessed field attachment.

**Entry Requirements**

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

1. Attained KCSE Mean Grade of C-(minus)

**Or**

1. Autobody Technician craft Certificate Qualification (Level 5)

**Or**

1. Equivalent qualifications in related fields as determined by Kenya National Qualifications Authority (KNQA)

**Trainer qualification**

The trainer of this qualification must have a qualification higher than this course

**Assessment**

The course will be assessed at two levels: internally and externally. Internal assessment is continuous and is conducted by the trainer who is monitored by an accredited internal verifier while external assessment is conducted by an accredited external assessor appointed by TVET CDACC.

**Certification**

A candidate will be issued with a National Certificate of competency on demonstration of competence in a unit of competency. To attain the National Autobody Technician Certificate Level 6, the candidate must demonstrate competence in all the units of competency as given in qualification pack. These certificates will be issued by TVET CDACC in conjunction with training provider and Level “C” Certification issued by German chamber of Commerce AHK.

# BASIC UNITS OF LEARNING

# COMMUNICATION SKILLS

**UNIT CODE:** ENG./CU/ABT/BC/01/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Communication Skills

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required 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.

**Summary of Learning Outcomes**

1. Meet communication needs of clients and colleagues
2. Develop communication strategies
3. Establish and maintain communication pathways
4. Promote use of communication strategies
5. Conduct interview
6. Facilitate group discussion
7. Represent the organization

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Meet communication needs of clients and colleagues | * Communication process * Modes of communication * Medium of communication * Effective communication * Barriers to communication * Flow of communication * Sources of information * Organizational policies * Organization requirements for written and electronic communication methods * Report writing * Effective questioning techniques (clarifying and probing) * Workplace etiquette * Ethical work practices in handling communication * Active listening * Feedback * Interpretation * Flexibility in communication * Types of communication strategies * Elements of communication strategy | * Interview * Written texts |
| 1. Develop communication strategies | * Dynamics of groups * Styles of group leadership * Openness and flexibility in communication * Communication skills relevant to client groups | * Interview * Written texts |
| 1. Establish and maintain communication pathways | * Types of communication pathways | * Interview * Written texts |
| 1. Promote use of communication strategies | * Application of elements of communication strategies * Effective communication techniques | * Interview * Written texts |
| 1. Conduct interview | * Types of interview * Establishing rapport * Facilitating resolution of issues * Developing action plans | * Interview * Written texts |
| 1. Facilitate group discussion | * Identification of communication needs * Dynamics of groups * Styles of group leadership * Presentation of information * Encouraging group members participation * Evaluating group communication strategies | * Interview * Written texts |
| 1. Represent the organization | * Presentation techniques * Development of a presentation * Multi-media utilization in presentation * Communication skills relevant to client groups | * Interview * Written texts |

**Suggested Methods of Instruction**

* Discussion
* Role playing
* Simulation
* Direct instruction

**Recommended Resources**

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

# DIGITAL LITERACY

**UNIT CODE:** ENG/CU/ABT/BC/02/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Digital Literacy

**Duration of Unit:** 60 hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Identify computer software and hardware
2. Apply security measures to data, hardware, software in automated environment
3. Apply computer software in solving tasks
4. Apply internet and email in communication at workplace
5. Apply desktop publishing in official assignments
6. Prepare presentation packages

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify computer hardware and software | * Concepts of ICT * Functions of ICT * History of computers * Components of a computer * Classification of computers | * Written tests * Oral presentation |
| 1. Apply security measures to data, hardware, software in automated environment | * Data security and control * Security threats and control measures * Types of computer crimes * Detection and protection against computer crimes * Laws governing protection of ICT | * Written tests * Oral presentation * Project |
| 1. Apply computer software in solving tasks | * Operating system * Word processing * Spread sheets * Data base design and manipulation * Data manipulation, storage and retrieval | * Oral questioning * Project |
| 1. Apply internet and email in communication at workplace | * Computer networks * Network configurations * Uses of internet * Electronic mail (e-mail) concept | * Oral questioning * Written report |
| 1. Apply desktop publishing in official assignments | * Concept of desktop publishing * Opening publication window * Identifying different tools and tool bars * Determining page layout * Opening, saving and closing files * Drawing various shapes using DTP * Using colour pellets to enhance a document * Inserting text frames * Importing and exporting text * Object linking and embedding * Designing of various publications * Printing of various publications | * Oral questioning * Written report * Project |
| 1. Prepare presentation packages | * Types of presentation packages * Procedure of creating slides * Formatting slides * Presentation of slides * Procedure for editing objects | * Oral questioning * Written report * Project |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Demonstration by trainer
* Practical work by trainee
* Viewing of related videos
* Project
* Group discussions

**Recommended Resources**

* Computers
* Printers
* Storage devices
* Internet access

# ENTREPRENEURIAL SKILLS

**UNIT CODE:** ENG/CU/ABT/BC/03/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Entrepreneurial Skills

**Duration of unit:** 100 hours

**Unit Description**

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

**Summary of Learning Outcomes**

* 1. Demonstrate understanding of who an entrepreneur
  2. Demonstrate knowledge of entrepreneurship and self-employment
  3. Identify entrepreneurship opportunities
  4. Create entrepreneurial awareness
  5. Apply entrepreneurial motivation
  6. Develop business innovative strategies
  7. Develop Business plan

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Demonstrate knowledge of entrepreneurship and self-employment | * Importance of self-employment * Requirements for entry into self-employment * Role of an Entrepreneur in business * Contributions of Entrepreneurs to National development * Entrepreneurship culture in Kenya * Born or made entrepreneurs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report |
| 1. Identify entrepreneurship opportunities | * Business ideas and opportunities * Sources of business ideas * Business life cycle * Legal aspects of business * Assessment of product demand * Business environment * Factors to consider when evaluating business environment * Technology in business | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Create entrepreneurial awareness | * Forms of businesses * Sources of business finance * Factors in selecting source of business finance * Governing policies on Small Scale Enterprises (SSEs) * Problems of starting and operating SSEs | * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Apply entrepreneurial motivation | * Internal and external motivation * Motivational theories * Self-assessment * Entrepreneurial orientation * Effective communications in entrepreneurship * Principles of communication * Entrepreneurial motivation | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 1. Develop business innovative strategies | * Innovation in business * Small business Strategic Plan * Creativity in business development * Linkages with other entrepreneurs * ICT in business growth and development | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |
| 6. Develop Business Plan | * Business description * Marketing plan * Organizational/Management * plan * Production/operation plan * Financial plan * Executive summary * Presentation of Business Plan | * Case studies * Individual/group assignments * Projects * Written tests * Oral questions * Third party report * Interviews |

**Suggested Methods of Instruction**

* Direct instruction
* Project
* Case studies
* Field trips
* Discussions
* Demonstration
* Question and answer
* Problem solving
* Experiential
* Team training

**Recommended Resources**

* Case studies
* Business plan templates
* Computers
* Overhead projectors
* Internet
* Mobile phone
* Video clips
* Films
* Newspapers and Handouts
* Business Journals
* Writing materials

# EMPLOYABILITY SKILLS

**UNIT CODE:** ENG/CU/ABT/BC/04/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Employability Skills

**Duration of Unit:** 80 hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Conduct self-management
2. Demonstrate interpersonal communication
3. Demonstrate critical safe work habits
4. Lead a workplace team
5. Plan and organize work
6. Maintain professional growth and development
7. Demonstrate workplace learning
8. Demonstrate problem solving skills
9. Manage ethical performance

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Conduct self-management | * Self-awareness * Formulating personal vision, mission and goals * Strategies for overcoming life challenges * Managing emotions * Emotional intelligence * Assertiveness versus aggressiveness * Expressing personal thoughts, feelings and beliefs * Developing and maintaining high self-esteem * Developing and maintaining positive self-image * Setting performance targets * Monitoring and evaluating performance * Articulating ideas and aspirations * Accountability and responsibility * Good work habits * Self-awareness * Values and beliefs * Self-development * Financial literacy * Healthy lifestyle practices * Adopting safety practices | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate interpersonal communication | * Meaning of interpersonal communication * Listening skills * Types of audience * Public speaking * Writing skills * Negotiation skills * Reading skills * Meaning of empathy * Understanding customers’ needs * Establishing communication networks * Assertiveness * Sharing information | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate critical safe work habits | * Stress and stress management * Time concept * Punctuality and time consciousness * Leisure * Integratingpersonal objectives into organizational objectives * Resources mobilization * Resources utilization * Setting work priorities * Developing healthy relationships * HIV and AIDS * Drug and substance abuse * Managing emerging issues | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Lead a workplace team | * Leadership qualities * Power and authority * Team building * Determination of team roles and objectives * Team parameters and relationships * Individual responsibilities in a team * Forms of communication * Complementing team activities * Gender and gender mainstreaming * Human rights * Developing healthy relationships * Maintaining relationships * Conflicts and conflict resolution * Coaching and mentoring skills | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Plan and organize work | * Functions of management * Planning * Organizing * Time management * Decision making concept * Task allocation * Developing work plans * Developing work goals/objectives and deliverables * Monitoring work activities * Evaluating work activities * Resource mobilization * Resource allocation * Resource utilization * Proactive planning * Risk evaluation * Problem solving * Collecting, analysing and organising information * Negotiation | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Maintain professional growth and development | * Avenues for professional growth * Training and career opportunities * Assessing training needs * Mobilizing training resources * Licenses and certifications for professional growth and development * Pursuing personal and organizational goals * Managing work priorities and commitments * Recognizing career advancement | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate workplace learning | * Managing own learning * Mentoring * Coaching * Contributing to the learning community at the workplace * Cultural aspects of work * Networking * Variety of learning context * Application of learning * Safe use of technology * Taking initiative/proactivity * Flexibility * Identifying opportunities * Generating new ideas * Workplace innovation * Performance improvement * Managing emerging issues * Future trends and concerns in learning | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Demonstrate problem solving skills | * Critical thinking process * Data analysis tools * Decision making * Creative thinking * Development of creative, innovative and practical solutions * Independence in identifying and solving problems * Solving problems in teams * Application of problem-solving strategies * Testing assumptions * Resolving customer concerns | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |
| 1. Manage ethical performance | * Meaning of ethics * Ethical perspectives * Principles of ethics * Ethical standards * Organization code of ethics * Common ethical dilemmas * Organization culture * Corruption, bribery and conflict of interest * Privacy and data protection * Diversity, harassment and mutual respect * Financial responsibility/accountability * Etiquette * Personal and professional integrity * Commitment to jurisdictional laws * Emerging issues in ethics | * Written tests * Oral questioning * Interviewing * Portfolio of evidence * Third party report |

**Suggested Methods of Instruction**

* Demonstrations
* Simulation/Role play
* Group Discussion
* Presentations
* Assignments
* Q&A

**Recommended Resources**

* Computers
* Stationery
* Charts
* Video clips
* Audio tapes
* Radio sets
* TV sets
* LCD projectors

# ENVIRONMENTAL LITERACY

**UNIT CODE**:ENG/CU/ABT./BC/05/6/A

**Relationship to Occupational Standards**:

This unit addresses the Unit of Competency: Demonstrate Environmental Literacy

**Duration of Unit:** 40 hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Control environmental hazard
2. Control environmental Pollution
3. Demonstrate sustainable resource use
4. Evaluate current practices in relation to resource usage
5. Identify Environmental legislations/conventions for environmental concerns
6. Implement specific environmental programs
7. Monitor activities on Environmental protection/Programs
8. Analyze resource use
9. Develop resource conservation plans

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Control environmental hazard | * Purposes and content of Environmental Management and Coordination Act 1999 * Storage methods for environmentally hazardous materials * Disposal methods of hazardous wastes * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) | * Written questions * Oral questions |
| 1. Control environmental Pollution control | * Types of pollution * Environmental pollution control measures * Types of solid wastes * Procedures for solid waste management * Different types of noise pollution * Methods for minimizing noise pollution | * Written questions * Oral questions * Role play |
| 1. Demonstrate sustainable resource use | * Types of resources * Techniques in measuring current usage of resources * Calculating current usage of resources * Methods for minimizing wastage * Waste management procedures * Principles of 3Rs (Reduce, Reuse, Recycle) * Methods for economizing or reducing resource consumption | * Written questions * Oral questions * Role play |
| 1. Evaluate current practices in relation to resource usage | * Collection of information on environmental and resource efficiency systems and procedures, * Measurement and recording of current resource usage * Analysis and recording of current purchasing strategies. * Analysis of current work processes to access information and data * Identification of areas for improvement | * Written questions * Oral questions * Role play |
| 1. Identify Environmental legislations/conventions for environmental concerns | * Environmental issues/concerns * Environmental legislations /conventions and local ordinances * Industrial standard /environmental practices * International Environmental Protocols (Montreal, Kyoto) * Features of an environmental strategy | * Written questions * Oral questions |
| 1. Implement specific environmental programs | * Community needs and expectations * Resource availability * 5s of good housekeeping * Identification of programs/Activities * Setting of individual roles /responsibilities * Resolving problems /constraints encountered * Consultation with stakeholders | * Written questions * Oral questions * Role play |
| 1. Monitor activities on Environmental protection/Programs | * Periodic monitoring and Evaluation of activities * Gathering feedback from stakeholders * Analyzing data gathered * Documentation of recommendations and submission * Setting of management support systems to sustain and enhance the program * Monitoring and reporting of environmental incidents to concerned /proper authorities | * Oral questions * Written tests * Practical test |
| 1. Analyze resource use | * Identification of resource consuming processes * Determination of quantity and nature of resource consumed * Analysis of resource flow through different parts of the process. * Classification of wastes for possible source of resources. | * Written tests * Oral questions * Practical test |
| 1. Develop resource Conservation plans | * Determination of efficiency of use/conversion of resources * Causes of low efficiency of use of resources * Plans for increasing the efficiency of resource use | * Written tests * Oral questions * Practical test |

**Suggested Methods of Instruction**

* Instructor led facilitation of theory
* Practical demonstration of tasks by trainer
* Practice by trainees
* Observations and comments and corrections by trainers

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Environmental Management and Coordination Act 1999
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE)
* ISO standards
* Company environmental management systems (EMS)
* Montreal Protocol
* Kyoto Protocol

# OCCUPATIONAL SAFETY AND HEALTH PRACTICES

**UNIT CODE:** ENG/CU/ABT/BC/06/6/A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Demonstrate Occupational Safety and Health Practices

**Duration of Unit:** 40 hours

**Unit Description**

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

**Summary of Learning Outcomes**

1. Identify workplace hazards and risk
2. Control OSH hazards
3. Implement OSH programs

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Identify workplace hazards and risks | * Identification of hazards in the workplace and/or the indicators of their presence * Evaluation and/or work environment measurements of OSH hazards/risk existing in the workplace * Gathering of OSH issues and/or concerns | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Control OSH hazards | * Prevention and control measures e.g. use of PPE * Risk assessment * Contingency measures | * Oral questions * Written tests * Portfolio of evidence * Third party report |
| 1. Implement OSH   programs | * Company OSH program, evaluation and review * Implementation of OSH programs * Training of team members and advice on OSH standards and procedures * Implementation of procedures for maintaining OSH-related records | * Oral questions * Written tests * Portfolio of evidence * Third party report |

**Suggested Methods of Instruction**

* Assigments
* Discussion
* Q&A
* Role play
* Viewing of related videos

**Recommended Resources**

* Standard operating and/or other workplace procedures manuals
* Specific job procedures manuals
* Machine/equipment manufacturer’s specifications and instructions
* Personal Protective Equipment (PPE) e.g.
* Mask
* Face mask/shield
* Safety boots
* Safety harness
* Arm/Hand guard, gloves
* Eye protection (goggles, shield)
* Hearing protection (ear muffs, ear plugs)
* Hair Net/cap/bonnet
* Hard hat
* Face protection (mask, shield)
* Apron/Gown/coverall/jump suit
* Anti-static suits
* High-visibility reflective vest

**COMMON UNITS OF LEARNING**

## ENGINEERING MATHEMATICS

**UNIT CODE: ENG/CU/AUT/CC/02/6/A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Engineering Mathematics

Duration of Unit: 150 hours

**Unit Description**

This unit describes the competencies required by a Mechatronics 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, binomial expansion, calculus, ordinary differential equations, Laplace transforms, power series, Statistics, Fourier series, vector theory, matrix, numerical methods, probability, commercial calculations, estimations and measurements in solving problems

**Summary of Learning Outcomes**

1. Apply Algebra
2. Apply Trigonometry and hyperbolic functions
3. Apply complex numbers
4. Apply Coordinate Geometry
5. Carry out Binomial Expansion
6. Apply Calculus
7. Solve Ordinary differential equations
8. Apply Laplace transforms
9. Apply Power Series
10. Apply Statistics
11. Apply Fourier Series
12. Apply Vector theory
13. Apply Matrix
14. Apply Numerical methods
15. Apply concept of probability for work
16. Perform commercial calculations
17. Perform Estimations, Measurements and calculations of quantities

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Apply Algebra | * Base and Index * Law of indices * Indicial equations * Laws of logarithm * Logarithmic equations * Conversion of bases * Use of calculator * Reduction of equations * Solution of equations reduced to quadratic form * Solutions of simultaneous linear equations in three unknowns * Solutions of problems involving AP and GP | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Trigonometry and hyperbolic functions | * Half -angle formula * Factor formula * Trigonometric functions * Parametric equations * Relative and absolute measures * Measures calculation * Meaning of hyperbolic equations * Properties of hyperbolic functions * Evaluations of hyperbolic functions Hyperbolic identities * Osborne’s Rule * Ashx+bshx=C equation * One-to-one relationship in functions * Inverse functions for one-to-one relationship * Inverse functions for trigonometric functions * Graph of inverse functions * Inverse hyperbolic functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply complex numbers | * Meaning of complex numbers * Stating complex numbers in numbers in terms of conjugate argument and * Modulus * Representation of complex numbers on the Argand diagram * Arithmetic operation of complex numbers * Application of De Moivre’s theorem * Application of complex numbers to engineering | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Coordinate Geometry | * Polar equations * Cartesian equation * Graphs of polar equations * Normal and tangents * Definition of a point * Locus of a point in relation to a circle * Loci of points for given mechanism | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Carry out Binomial Expansion | * Binomial theorem in determination of Roots of numbers * Estimation of errors of small changes using binomial theorem. * Binomial Expansion in   deriving power series | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Calculus | * Meaning of derivatives of a function * Differentiation from first principle i.e sin x, cos x, xn and ln x * Tables of some common derivatives * Rules of differentiation i.e. product, chain, quotient, sum, implicit * Rate of change and small change * Derivative of inverse functions * Stationery points of functions of two variables * Meaning of integration * Indefinite and definite integral * Methods of integration, application of integration i.e., Integration by parts, Substitution, polynomials, inverse functions * Integrals of hyperbolic and inverse functions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Solve Ordinary differential equations | * Types of first order differential equations * Linear Differential Equations * Homogeneous Equations * Exact Equations * Separable Equations * Integrating Factor * Formation of first order differential equation * Solution of first order differential equations * Application of first order differential equations * Formation of second order differential equations for various systems * Solution of second order differential equations * Application of second order differential equations | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Laplace transforms | * Meaning of Laplace transforms * Deriving Laplace transforms from first principles * State properties of Laplace transform * Determination of inverse LT of simple transforms and partial fractions * Solution of differential equation by LT * Solution of simultaneous differential equation by given initial conditions | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Power Series | * Meaning of the term power series * Taylor’s theorem * Deduction of Maclaurin’s theorem to obtain power series * Application of Taylor’s theorem and Maclaurin’s theorems in numerical work | * Written tests * Oral questioning * Assignments * Supervised exercises |
| * 1. Apply Statistics | * Classification of data * Grouped data * Ungrouped data * Data collection * Importance of sampling * Errors in sampling * Types of sampling and their limitations * Tabulation of data   + Class intervals   + Class boundaries   + Frequency tables   + Cumulative frequency * Diagrammatic and graphical presentation of data e.g.   + Histograms   + Frequency polygons   + Bar charts   + Pie charts   + Curves * Measures of central tendency (mean, mode and median) * Measures of dispersion * Variance and standard deviation | * Assignments * Oral questioning * Supervised exercises * Written tests * Simulation * Data modelling |
| * 1. Apply Fourier Series | * Determination of the Fourier series as a periodic function of the period 2π and extend to π * Determination of Fourier series of non-periodic functions over a given range * Determination of Fourier series for even and odd functions and the half-range series for a given function * Determination of Fourier series over any range | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Vector theory | * Definition of dot and cross product of vectors * Solution of problems involving dot and cross production of cross * Definition of operators * Definition of vector field * Solutions of problems involving vector fields * Definition of Gradient, Divergence and curl * Solutions of involving Gradient, Divergence and curl * Application of vectors * Green’s, Gauss’s and Stoke’s theorem and their application | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Matrix methods | * Matrix operation * Determinant of 3x3 matrix * Inverse of 3x3 matrix * Solutions of linear simultaneous equations in three unknowns * Calculations of Eigen values and Eigen vectors * Application of matrices | * Assignments * Oral questioning * Supervised exercises * Written tests |
| * 1. Apply Numerical methods | * Meaning of interpolation and extrapolation * Application of interpolation * Application of interactive methods to solve equations * Application of interactive methods to areas and volumes | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Apply concepts of probability in work | * Probability * Laws of probability * Expectation variance and S.D. * Types of distributions * Mean, variance and S.D of probability distributions   + Types of probability events * Dependent * Independent * Mutually exclusive   + Counting techniques * Permutation * Combination * Tree diagrams * Venn diagrams   + Application of probability distributions | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 1. Perform commercial calculations | * + Product pricing   + Average sales determination   + Stock turnover   + Calculation of incomes   + Profit and loss calculations   + Salaries * Gross * Net   + Wages * Time rate * Flat rate * Overtime * Piece rate * Commission * Percentage * Bonus   + Conversion of one currency to another   + Exchange rates calculation * Devaluation * Revaluation | * Oral questioning * Written tests * Assignments * Supervised exercises |
| 1. Perform estimations, measurements and calculations of quantities | * Units of measurements and their symbols * Conversion of units of measurement * Calculation of length, width, height, perimeter, area and angles of figures * Measuring tools and equipment * Measurements and estimations of quantities e.g., Areas and volumes using Pappus theorem | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Rulers, pencils, erasers
* Charts with presentations of data
* Graph books
* Dice
* Computers with internet connection
* Standard mathematical tables

**ENGINEERING MECHANICS PRINCIPLES**

**UNIT CODE: ENG/CU/ABT/CC/02/6/A**

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Engineering Mechanics Principles.

**Duration of unit:** 80 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply engineering mechanics principles in their work. It includes determining forces in a system, determining effects of loads in mechanical systems, analysing mechanical properties of materials, determining nature of friction in mechanical systems, solving problems related to motion, solving mechanical problems relating to simple machines and performing rotor dynamic machines.

**Summary of Learning Outcomes**

1. Determine forces in a system
2. Determine effects of loads in mechanical systems
3. Analyse mechanical properties of materials
4. Determine nature of friction in mechanical systems
5. Solve problems related to motion
6. Solve mechanical problems relating to simple machines
7. Perform rotor dynamic machines

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Determine forces in a system | * Definition of terms * Types of forces * Theorems related to forces * Resolve forces acting on a system * Application of forces in systems | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Determine effects of loads in mechanical systems | * Forces on a plane * Resultant forces * Point load * Distributed load * Moments | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Analyse mechanical properties of materials | * Definition of terms * Identification of engineering materials * Metals * Metal alloys * Polymers * Composites * Ceramics * Determination of physical properties of engineering materials * Determination of mechanical properties of engineering materials * Ductility * Malleability * Elasticity * Toughness * Hardness * Brittleness * Plasticity * Strength * Stress * Shear * Torsion | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Determine nature of friction in mechanical systems | * Friction force * Performance of calculations involving friction * Application of friction in mechanical systems | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Solve problems related to motion | * Newton’s Laws of motion * Equations of motion * Momentum * Performance of calculations involving parameters of motion | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Solve mechanical problems relating to simple machines | * Simple machines * Design of simple machines * Application of simple machines in mechanical systems | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Perform rotor dynamic machines | * Rotating machines * Rotating shafts * Bearings * Seals * Out of balance systems * Instability and condition monitoring * Coordinate systems * Gyroscopic couples * Vibration of linear and nonlinear dynamical system * Definition of vibration * Classification of vibration * Free and forced * Damped and undamped * Linear and nonlinear * Deterministic and Random * Vibration analysis * Conversion of physical system to simplified mathematical model * Determination of equation of motion of the system * Solve equation of motion to obtain the response * Interpretation of the result for the physical system * Forced response * Balancing | * Observation * Oral questioning * Written assessments * Practical assessments |

**Suggested Methods of Instruction**

* Direct instruction method
* Practical exercises
* Demonstration with oral presentation
* Case study

**Recommended Resources**

**Institutional resources**

**Tools**

* Spring balance
* Assorted weights
* Pulleys
* Lever
* Assorted screw driver sets
* Allen key set

**Equipment**

* Mechanisms and linkages training module
* Mechanical drive system trainings module
* Projector

**Materials and Supplies**

* White board and marker
* Practical consumables
* Computer with internet connection

**Trainee requirements**

* Writing materials
* Scientific calculator
* Overall
* Pair of safety boots

**Reference Materials**

* Appropriate engineering mechanisms textbooks
* Other relevant materials

**WORKSHOP TECHNOLOGY PRINCIPLES**

**UNIT CODE: ENG/CU/ABT/CC/03/6/A**

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Workshop Technology Principles.

**Duration of unit:** 160 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply a wide range of workshop processes and practice skills in their work. It involves using technical drawing to plan work operations, choosing appropriate tools and materials, measuring and marking-out dimensions on work pieces, using hand tools to cut and file part, using drills to make holes, thread using taps and dies, producing components using a lathe machine, a milling machine and a grinding machine, demonstrate material workshop processes, assembling metal parts and sub-assemblies, polishing finished work and performing housekeeping.

**Summary of Learning Outcomes**

1. Use technical drawing to plan work operations
2. Choose appropriate tools and materials
3. Measure and mark-out dimensions on work pieces
4. Use hand tools to cut and file parts
5. Use drills to make holes
6. Thread using taps and dies
7. Produce components using a lathe machine
8. Produce components using a milling machine
9. Produce components using a grinding machine
10. Demonstrate material workshop processes
11. Assemble metal parts and sub-assemblies
12. Polish finished work
13. Perform housekeeping

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use technical drawing to plan work operations | * Reading and extraction of information from the drawing which includes; * Dimensions * Tolerances * BS/ANSI drawing standards * Geometric ISO symbols & abbreviations) * Development of working procedure and operational plan * Development of operational plan * Sequence of operations * Measuring tools * Hand tools * Cutting tools * Inspection tools | * Oral questioning * Written assessments |
| 1. Choose appropriate tools and materials | * Hand tools * Machine tools * Selection of tools as per the specific operation * Inspection and/or recalibration of tools * Demonstration of correct handling of tools * Selection of material for the given component | * Oral questioning * Trainee presentation * Observation * Oral question |
| 1. Measure and mark-out dimensions on work pieces | * Measuring tools * Steel rule * Vernier caliper * Micrometer screw gauge * Vernier height gauge * Combination set * Bevels * Marking out tools * Scribers * Dividers * Dot punch * Centre punch * Engineers square * Straight edge * Surface plate * Laying out work piece(s) * Transfer of dimensions onto the work piece(s) | * Oral question * Observation * Written assessment * Supervisor report |
| 1. Use hand tools to cut and file parts | * Types hand cutting tools * Chisels * Saws * Files * Selection of cutting tools as per the specific operation * Inspection of cutting tool * Demonstration of correct handling of cutting and filling tools | * Oral questions * Observation * Written assessment |
| 1. Use drills to make holes | * Marking and centre punching the hole * Selecting and mounting drill bits * Mounting and clamping work pieces * Bench vice * V-Block * Angle plate * G-clamp * Jigs and fixtures * Hand vice * Drilling hole to specification * Inspecting the hole | * Observation * Practical assessment * Written assessment |
| 1. Thread using taps and dies | * Selecting taps and dies based on operation plan * Setting up the taps and dies * Cutting threads to specifications * Internal and external threads * V-profile threads | * Oral questioning * Observation * Practical assessment |
| 1. Produce components using a lathe machine | * Lathe machine processes include * Facing * Turning * Threading * Drilling * Boring * Cleaning and storing of lathe machine tools. * Servicing and maintenance of machine of lathe machine | * Simulation * On-the-job assessment * Observation * Written assessments * Supervisor’s report |
| 1. Produce components using a milling machine | * Parameters of a milling machine * Classification of milling machine * Working principle of a milling machine * Accessories of a milling machine * Milling machine operations * Accuracy of a milling machine | * Simulation * On-the-job assessment * Observation * Written assessments * Supervisor’s report |
| 1. Produce components using a grinding machine | * Classification of grinding machine * Parts of grinding machine * Working principle of grinding machine * Grinding machine operation * Finished product accuracy | * Simulation * On-the-job assessment * Observation * Written assessments * Supervisor’s report |
| 1. Demonstrate material workshop processes | * Fitting * Sheet metal work fabrication and processes * Types of chips * Beaten metal work * Casting processes * Metal cutting * Welding * Perform forging * Operate riveting * Heat treatment processes * Maintain polymer adhesives | * Oral questioning * Practical assessments * Written assessments |
| 1. Assemble metal parts and sub-assemblies | * Joining methods * Riveting * Fastening * Soldering * Brazing * Welding * Quality control * Dimensions * Tolerances * surface finishing * Alignment | * Observation * Practical assessments * Supervisor’s report |
| 1. Polish finished work | * Polishing * Cleaning | * Oral questioning * Practical assessments * Written assessments |
| 1. Perform housekeeping | * Cleaning of work environment * Waste sorting * Waste disposal * Cleaning and storing of tools and equipment * Servicing and maintenance of machines * Lubrication * Inspection * Alignment * Adjustment | * Observation * Supervisor’s report |

**Suggested Methods of Instruction**

* Direct instruction
* Use of projects
* Workplace Experiential Learning
* Discussion
* Demonstration Method
* Practical exercises
* Simulation

**Recommended Resources**

**Institutional resources**

**Tools**

* Punching tools
* Work benches
* Welding
* Vices
* Cutting tools
* Combination square
* Centre punch
* Centre lathe
* Scribers
* Hammers
* Tin snips
* Mallets
* Forming stakes
* Calipers
* Dies and taps
* Surface plate
* V-blocks
* Dial gauge
* Die stock
* Engineer’s square
* File card
* Assorted files
* Clamps
* Assorted hand tools
* Hammers
* Measuring tools
* Drill bits
* Assorted inspection tools and equipment
* Inspection and measuring tools, go/no-go gauges
* Jigs and fixture
* Pliers
* Rotary disc abrasive grinder
* Reamers
* Saw
* Screwdrivers
* Spiral lowering
* Tap wrench
* Vacuum cleaners
* Workbenches
* Vacuum cleaners

**Equipment**

* Firefighting equipment
* First aid kit
* Grinding machine
* Milling machines
* Drilling machines
* Burnishing machine
* Hand drilling machine
* Bench drilling machine
* Lathe machine

**Materials and Supplies**

* Projectors
* White board and markers
* Angle line
* Mops/brooms and buckets
* Rectangular tubes
* Channel bars
* Flat bars
* Circular tubes
* Round bars
* Welding rods
* Electrode wires
* Cutting disc
* Grinding disc
* Ferrous materials
* Non-ferrous materials
* Drawing papers
* Raw materials
* Mild steel plate
* Sheet metal
* Brass sheets
* Zinc sheets
* Aluminum sheets
* Bright drawn mild steel
* Carbon steel
* Brass rods
* Aluminum rods
* Abrasive materials
* Grinding paste
* Cotton wastes
* Cleaning detergent

**Trainee requirements**

* Writing materials
* Overall
* Pair of safety boots
* Goggles
* Earmuffs
* Helmet
* Safety mask

**Reference Materials**

* Workshop SOPs
* Manufacturer’s manuals
* Appropriate workshop technology textbooks

## COMPUTER AIDED DRAWING

**UNIT CODE:** ENG/CU/ABT/CC/04/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Perform Computer Aided Drawing.

**Duration of unit:** 150 hours

**Unit Description**

This unit covers the competencies required to perform Computer Aided Drawing. It involves establishing drawing requirements, identifying key features of Computer-Aided Design (CAD) software, navigating CAD software, producing geometric drawings, producing pictorial drawings of components, producing orthographic drawings of top, font and side views, producing assembly drawings, finalising CAD operations, applying the computer aided drawings in computer aided design, designing a mechanical system using CAD and interpreting the engineering drawings.

**Summary of Learning Outcomes**

1. Establish drawing requirements
2. Identify key features of CAD Software
3. Navigate CAD software
4. Produce geometric drawings
5. Produce pictorial drawings of components
6. Produce orthographic drawings of top, front and side views
7. Produce assembly drawings
8. Finalize CAD operations
9. Apply computer aided drawing in computer aided design
10. Design a mechanical system using CAD
11. Interpret the engineering drawings

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Establish drawing requirements | * Engineering drawing practices * Introduction to technical drawing   + Types and methods   + Tools and equipment   + Materials   + Engineering diagrams, illustrations, signs and symbols (electrical, mechanical, plumbing, pneumatic, hydraulic)   + Measurement and scaling * Introduction to computer aided design   + Terminologies   + Application   + Design software | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Identify key features of CAD software | * CAD software tools and elements * 3D illustrations using isometric and oblique projection * Dimensioning principles * Parallel, running, staggered, angular dimensioning * Dimensioning for manufacture * Scaling (division of lines, diagonal scales, plain scales) * Abbreviation and indexing * Limits and fits | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Navigate CAD software | * Templates * Accessing files * Libraries * Codes and standards * Drawing elements * Editing tools | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Produce geometric drawings | * Geometric construction (forms, angles, etc.) * Geometrical tolerancing and datums * Linework and lettering * Tangency * Loci application * Drawing an ellipse, involute, spirals, helix, cycloids | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Produce pictorial drawings of components | * Conic sections and interpenetration of solids * Drawing nuts, bolts, screws and washers * Drawing keys and keyways * Drawing cams, gears, bearings and springs * Development of patterns from sheet materials * Perspective * Pictorial sketching | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Produce orthographic drawings of top, front and side views | * First angle projection * Third angle projection * Projection symbols * Drawing procedure | * Observation * Oral questioning * Trainee presentation * Written assessment |
| 1. Produce assembly drawings | * Collective single-part drawing * Combined detail and assembly drawing * Exploded assembly drawing * Machine drawing * Sectioning (half, revolved, removed, successive sections) * Part listing | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Finalize CAD operations | * Technical drawing file formats * Communicating design concepts * Care and storage of original drawings | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Apply the computer aided drawing in computer aided design, | * Application of CAD * Photo simulations creation * 2D and 3D drawings * Potential blockage analyses * Uses of CAM | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Design a mechanical system using CAD | * Uses of CAE in the manufacturing design * Wastage time and raw materials * Accuracy analyses * Database creation * Design documentation | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Interpret engineering drawings | * First angle and third angle * Scale of drawing * Symbols of drawing * Abbreviations of drawing | * Observation * Oral questioning * Trainee presentation * Written assessments |

**Suggested Methods of Instruction**

* Direct instruction method
* Group discussions
* Presentations, practical demonstrations and exercises
* Workplace experimental learning
* Supervised activities and projects
* Case studies
* Simulation
* Guided learner activities and research

**Recommended Resources**

**Institutional resources**

* Drawing room with tables
* CAD software

**Trainee Requirements**

* Computing machines: Desktop computers, laptops, tablets etc.
* Drawing tools and equipment: Rulers, draftsman drawing sets

**References**

May include but not limited to:

* Component and equipment manuals
* Appropriate Computer aided drawing books and other reference materials (journals, past papers, etc.)

**THERMODYNAMICS PRINCIPLES**

**UNIT CODE:** ENG/CU/ABT/CC/05/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Thermodynamics Principles.

**Duration of unit:** 100 hours

**Unit description**

This unit describes the competencies required by a technician in order to apply thermodynamics principles in their work. It involves interpreting fundamentals of thermodynamics, performing steady and non-steady flow processes, understanding gas law and steam cycle, performing thermodynamics reversibility and entropy, analysing ideal gas cycle, demonstrating understanding of fuel and combustion, performing heat transfer, using heat exchangers in fluid temperature control, safely operating air compressors, assessing stability and operation of gas turbine combustion systems, describing steam turbines, applying heating and cooling system, applying negative temperature coefficient (NTC), applying thermistors on temperature measurements and applying heat sinks on semiconductors.

**Summary of Learning Outcomes**

1. Interpret fundamentals of thermodynamics
2. Perform steady flow processes
3. Perform non steady flow processes
4. Understand gas laws
5. Understand steam cycle
6. Perform thermodynamics reversibility and entropy
7. Analyse ideal gas cycle
8. Demonstrate understanding of fuel and combustion
9. Perform heat transfer
10. Use heat exchangers in fluid temperature control
11. Operate air compressors
12. Assess stability and operation of gas turbine combustion systems
13. Describe steam turbines
14. Apply heating and cooling system
15. Apply negative temperature coefficient (NTC)
16. Apply thermistors on temperature measurements
17. Apply heat sinks on semiconductors

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Interpret fundamentals of thermodynamics | * Definition of terms * Thermodynamics processes and cycles * First law of thermodynamics | * Observation * Oral questioning * Written assessment * Practical |
| 1. Perform steady flow processes | * Steady flow energy equation * Application of steady flow energy equation in utilities * Utilities include; * Boiler * Turbine * Compressor * Throttling process * Nozzle * Condenser | * Observation * Oral questioning * Written assessment * Practical |
| 1. Perform non-steady flow processes | * Non flow energy equation * Application of non-flow energy equation | * Observation * Oral questioning * Written assessment * Practical |
| 1. Understand gas laws | * Perfect gas laws * Application of gas laws | * Observation * Oral questioning * Written assessment * Practical |
| 1. Understand steam cycle | * Dryness fraction * Pressure * Boiling point * Energy balance | * Observation * Oral questioning * Written assessment * Practical |
| 1. Perform thermodynamics reversibility and entropy | * Thermodynamics reversibility * Principles of heat engine * Second law of thermodynamics * Entropy | * Observation * Oral questioning * Written assessment * Practical |
| 1. Analyse ideal gas cycle | * Ideal gas cycle * Standard and actual efficiency | * Observation * Oral questioning * Written assessment * Practical |
| 1. Demonstrate fuel and combustion | * Fuel classification * Combustion equation * Application of combustion equation | * Observation * Oral questioning * Written assessment * Practical |
| 1. Perform heat transfer | * Fourier law * Conduction equation * Newton’s law of cooling * Heat transfer equation | * Observation * Oral questioning * Written assessment |
| 1. Use heat exchangers in fluid temperature control | * Heat exchangers * Types of heat exchangers include; * Parallel-flow * Counter-flow * Finned tubular * Un-finned tubular * U-tube * Single pass straight * Plate-and-frame * Pate-fin * Micro-channel * Recuperative heat exchanger * Application of heat equations to heat exchanger | * Observation * Oral questioning * Written assessment * Practical |
| 1. Operate air compressors | * Classification of air compressors * Reciprocating air compressors | * Observation * Oral questioning * Written * Practical |
| 1. Assess stability and operation of gas turbine combustion systems | * Theoretical cycle for gas turbines * Open cycle gas turbine * Closed cycle gas turbine * Gas turbine equations | * Observation * Oral questioning * Written assessment * Practical |
| 1. Describe steam turbines | * Determining reaction and impulse * Performing staging of steam turbines * Performing velocity calculations * Calculation of ideal, thermal and mechanical efficiencies * Determining factors affecting efficiencies * Performing condensing arrangements of steam turbines | * Observation * Oral questioning * Written assessment * Practical |
| 1. Apply heating and cooling system | * Heat pump installation * Air conditioning installation * Ventilation construction | * Observation * Oral questioning * Written assessment * Practical |
| 1. Apply negative temperature coefficient (NTC) | * Classification of thermistors * NTC thermistors installation * Application of thermistors | * Observation * Oral questioning * Written assessment * Practical |
| 1. Apply thermistors on temperature measurements | * Operation of thermistor * Determination of resistance * Relationship between temperature and resistance * Conversion of resistance change into measurable data | * Observation * Oral questioning * Written assessment * Practical |
| 1. Apply heat sinks on semiconductors | * Heat sinks connection * Heat sinks calculation * Heat sinks selection * Thermal resistance value determination * Application of heat sinks | * Observation * Oral questioning * Written assessment * Practical |

**Suggested Methods of Instruction**

* Direct instruction method
* Practical assessment
* Case study
* Demonstration method
* Practical exercises and presentations
* Workplace experiential learning
* Projects
* Discussions
* Working portfolios
* Cooperative strategies/Group method

**Recommended Resources**

**Institutional resources**

**Tools**

* Thermometer
* Barometer
* Calorimeter
* Digital tachometer
* Assorted screw driver sets
* Allen key set

**Equipment**

* Equipped thermodynamics laboratory
* Thermo-process control training module
* Mechanical drive system trainings module
* Jet-engine training module
* Projector

**Materials and Supplies**

* White board and marker
* Assorted connecting pipes
* Practical consumables
* Computer with internet connection

**Trainee requirements**

* Writing materials
* Scientific calculator
* Overall
* Pair of safety boots

**Reference Materials**

* Appropriate thermodynamics textbooks
* Journals
* Other relevant materials

**FLUID MECHANICS PRINCIPLES**

**UNIT CODE:** ENG/CU/ABT/CC/06/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Fluid Mechanics Principles.

**Duration of unit:** 70 hours

**Unit description**

This unit describes the competencies required by a technician in order to apply a wide range of fluid mechanics principles in their work. It involves analysing the basic concepts of fluid mechanics, demonstrating knowledge in viscous flow, performing dimensional analysis and operating fluid pumps.

**Summary of Learning Outcomes**

1. Analyse basic concepts of fluid mechanics
2. Demonstrate knowledge in viscous flow
3. Perform dimensional analysis
4. Operate Fluid pumps

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Analyse basic concepts of fluid mechanics | * Types of fluid flow states * Laminar * Turbulent * Properties of a fluid * Density, specific gravity, specific volume * Viscosity * Surface tension * Compressibility * Incompressible * Features of turbulence * onset of turbulence * heat and momentum transfer * concepts of compressible flow * Mach number, wave motion and sonic speed * One dimensional flow * Converging-diverging laval nozzles * Maximum achievable velocity of a gas * Isentropic flow mach number relationships * Achieving supersonic flow * Non-isentropic 1D channel flow of a gas- incorporated under basic concepts of fluid mechanics as it is a type of flow * Flow rate in pipes * Losses in pipes * Causes of losses in pipes * Application of flow loss equations | * Written assessments * Observation * Oral questioning * Trainee presentation |
| Demonstrate knowledge in viscous flow | * Viscous flow between parallel surfaces * Viscous flow equations * Application of viscous flow equations | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Perform dimensional analysis | * Dimensional analysis definition * Principle of dimensional homogeneity * Fundamental dimensions and units * Physical quantities * Application of dimensional analysis | * Observation * Oral questioning * Trainee presentation * Written assessments |
| 1. Operate Fluid pumps | * Principle of operation of pumps * Reciprocating pump equation * Centrifugal pump equation * Application of pump equations in problem solving | * Observation * Oral questioning * Trainee presentation * Written assessments |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Practical exercises and presentations of findings
* Workplace experiential learning
* Projects
* Discussions
* Working portfolios
* Case studies
* Cooperative strategies/group method

**Recommended Resources**

**Institutional Resources**

**Tools**

* Set of screwdrivers
* Set of wrenches
* Set of pliers
* Clamps (screw, quick-release, bar, locking, angle, flooring etc.
* Set of Allen keys
* Hydraulic and pneumatic presses and jacks
* Pipe benders
* Bernoulli kit
* Capillary tubes
* Barometers
* Cylinders
* Manometer
* Pressure gauge
* Venturi tube
* Pitot tube
* Valves i.e. gate, spool
* Flow meter

**Equipment**

* Projectors
* Whiteboard
* Vortices
* Reservoirs, tanks and accumulators
* Pumps (centrifugal, submersible, diaphragm, gear, peristaltic, piston, etc.)
* Motors (AC, DC, linear, servo, stepper etc.)
* Actuators and cylinders
* Gauges (limit, pressure etc.)
* Compressors (reciprocating, ionic liquid, rotary screw, rotary vane, rolling piston, diaphragm, etc.)
* Drills (benchtop, breast, cordless, corded, floor drill press, impact, hammer, air angle, etc.)
* Modular digital hydraulic bench

**Materials and Supplies (Consumables)**

* Hydraulic fluids and lubricants
* Filters and purifiers (oil, air, etc.)
* Pipes and hoses (fixed, flexible)
* Gaskets and seals
* Thread tapes
* Valves (pressure relief, pressure reducing, etc.)
* Switches (mechanical, electronic, etc.)
* Connectors, joints and junctions
* Bolts, nuts and washers
* Fasteners
* Bearings, gears and rollers

**Trainee Requirements**

* Computing machines: desktop computers, laptops, tablets, etc.
* Protective clothing: dust coat, safety gloves, safety boots, safety goggles, etc.

**References**

May include but not limited to:

* Component and equipment manuals
* Health and safety manuals
* Appropriate material science books and other reference materials (journals, past papers, etc.)

**MATERIAL SCIENCE PRINCIPLES**

**UNIT CODE:** ENG/CU/ABT/CC/07/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Material Science Principles.

**Duration of unit:** 70 hours

**Unit description**

This unit describes the competencies required by a technician in order to apply material science principles. It involves analysing engineering materials properties, applying of material science to engineering, performing heat treatment, performing material testing and preventing material corrosion.

**Summary of Learning Outcomes**

1. Analyse engineering materials properties
2. Apply material science to engineering
3. Perform heat treatment
4. Perform material testing
5. Prevent material corrosion

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Analyse engineering materials properties | * Classification of engineering materials * Metals and alloys * Ceramic materials * Organic polymers * Composites * Semiconductors * Characteristics of engineering materials * Physical * Chemical * Mechanical * Thermal * Optical * Electrical * Physical properties of engineering materials * Density * Color * Size and shape (dimensions) * Specific gravity * Porosity * Luster * Mechanical properties of engineering materials * Strength * Stiffness * Elasticity * Plasticity * Ductility * Malleability * Toughness * Brittleness * Hardness * Creep * Formability * Electrical properties of engineering materials * Conductivity * Temperature coefficient of resistance * Dielectric strength * Resistivity * Crystal structures of materials | * Oral questioning * Written assessment * Observation * Reflective essays |
| 1. Apply of material science to engineering | * Choice of materials for engineering applications * Development of operation plan * Machine setup procedures * Setting of production parameters * Production methods and procedures | * Oral questioning * Observation * Written assessment * Supervisor report |
| 1. Perform heat treatment | * Observation of safety procedures and practices * Classification of heat treatment processes * Annealing * Tempering * Normalizing * Hardening * Case hardening * Identification of heat treatment method * Heat treatment defects * Performing heat treatment | * Oral questioning * Written * Observation * Supervisor’s report * Trainee’s report |
| 1. Perform material testing | * Observation of safety procedures and practices * Identification of material testing methods * Compression test * Hardness tests * Tensile tests * Brinel hardness tests * Rockwell hardness test * Impact tests * Creep tests * Bending tests * Fatigue tests * Torsional tests * Sharing tests * Non-destructive testing * Visual examination * Radiographic tests * Ultrasound test * Liquid penetrating test * Magnetic particle testing * Preparation of work-piece for testing * Setting up of equipment and work-piece * Carrying out testing * Tabulation, analysis and presentation of results * Maintenance of the testing equipment | * Portfolio/ Projects * Oral questioning * Written assessment * Observation * Supervisor’s report * Trainee’s report * Reflective essays |
| 1. Prevent material corrosion | * Identification of corrosion types * Corrosion prevention methods * Application of corrosion prevention on work piece | * Oral questioning * Written assessment * Observation * Supervisor’s report |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Practical exercises and presentations
* Workplace experiential learning
* Projects
* Discussions
* Working portfolios
* Case studies
* Cooperative strategies/group method

|  |
| --- |
| **Recommended Resources**  **Institutional Resources**  **Tools**   * Set of screwdrivers * Set of wrenches * Set of pliers * Clamps (screw, quick-release, bar, locking, angle, flooring, etc.) * Guillotine * Shears * Paint brushes * Hammers * Measuring tools * Vices   **Equipment**   * Projectors * Whiteboards * Universal testing machine * Drills (benchtop, breast, cordless, corded, floor drill, impact, hammer, air angle, etc.) * Furnaces and kilns * Work benches   **Materials and Supplies (Consumables)**   * Whiteboard markers * Tensile test specimen * Iron sheets * Aluminium sheets * Paint * Metal alloys |
| **Trainee Requirements**   * Computing machines – desktop computers, laptops, tablets, etc. * Protective clothing – dust coat, safety gloves, safety boots, safety googles, etc. |
| **References**  May include but not limited to:   * Component and equipment manuals * Health and safety manuals * Appropriate material science books and other reference materials (journals, past papers, etc.) |

**ELECTRICAL AND ELECTRONICS PRINCIPLES**

**UNIT CODE:** ENG/CU/ABT/CC/08/6/A

**Relationship to occupational standards**

This unit addresses the unit of competency: Applying Electrical and Electronics Principles.

**Duration of unit:** 130 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply electrical and electronics principles in their work. It involves using the concept of basic electrical quantities, applying the concepts of DC and AC circuits in electrical installation, carrying out power rectification in electrical systems, using earthing in electrical installations, using basic electrical machine, applying lightning protection measures, applying safety requirements for electricity, applying principle of electrical measurements, applying principles of electrical/electronic devices and their application and applying principles of digital electronics.

**Summary of Learning Outcomes**

1. Use the concept of basic electrical quantities
2. Apply the concepts of DC and AC circuits in electrical installations
3. Carry out power rectification in electrical systems
4. Use earthing principles in electrical installations
5. Use basic electrical machine
6. Apply lightning protection measures
7. Apply safety requirements for electricity
8. Apply principle of electrical measurements
9. Apply principle of electrical/electronic devices and their application
10. Apply principles of digital electronics

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use the concept of basic electrical quantities | * SI unit of various types of electrical parameters * Calculations involving various electrical parameters e.g. power, current, voltage, resistance * Instruments used in measuring various types of electrical parameters | * Observation * Oral questioning * Written assessments * Practical assessments * Case studies |
| 1. Apply the concepts of DC and AC circuits in electrical installations | * Definition of terms * Ohm’s law * Parallel and series circuits * AC and DC network theorems | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Carry out power rectification in electrical systems | * Definition of terms * Single-phase and three-phase controlled and uncontrolled power rectification methods * Half wave rectifiers * Full wave rectifiers * Full wave bridge * Smoothening capacitor * Diodes * Power regulation methods * Power protection methods and devices * Switches * Fuses * Circuit breakers | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Use earthing principles in electrical installations | * Terms in earthing * Meaning of earthing * Earthing points in electrical installation * Methods of earthing * Factors to consider in selecting an earthing method * Testing an earthing system | * Observation * Oral questioning * Written assessments * Practical on testing * Case studies |
| 1. Use basic electrical machine | * Types of electrical machines * AC single and three phase motors, generators and transformers * DC machines * Application of AC and DC machines | * Observation * Oral questioning * Written assessments * Practical assessments * Case studies |
| 1. Apply lightning protection measures | * Meaning of lightening * Lightening strokes and their types * Lightening protection components * Testing a lightening system * Application of lightening system * Maintenance of lightening system | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Apply safety requirements for electricity | * Electrical hazards * PPEs * National colour code * Principles of electrical hazards | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Apply principle of electrical measurements | * Measurement of voltage * Current recording * Calculation of resistance | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Apply principle of electrical/ electronic devices and their application | * Identification of semiconductors * Resistors connection * Capacitors * Inductors * Comparators and operational amplifiers (Op-amps) * Microprocessors * Transducers * Actuators and sensors * Rechargeable batteries * Solar panels | * Observation * Oral questioning * Written assessments * Practical assessments |
| 1. Apply principles of digital electronics | * Number system * Logic gates symbols * Types of logic gates * Boolean functions * Truth table * Gate inputs and outputs value determining * Digital systems construction | * Observation * Oral questioning * Written assessments * Practical assessments |

**Suggested Methods of Instruction**

* Direct instruction method
* Practical assessments
* Demonstration with oral presentation
* Case study

**Recommended Resources**

**Institutional resources**

**Tools**

* Digital multimeter
* Digital tachometer
* Assorted screw driver sets
* Allen key set

**Equipment**

* Electrical workshop
* Power and control electronics trainings module
* AC/DC electronics training module
* AC/DC machines control training module
* Projector

**Materials and Supplies**

* White board and marker
* Assorted power connecting cables
* Rated fuses
* Practical consumables
* Computer with internet connection

**Trainee requirements**

* Writing materials
* Scientific calculator
* Overall
* Pair of safety boots

**Reference Materials**

* Appropriate electrical and electronics textbooks
* Other relevant materials

# CORE UNIT OF LEARNING

## DESIGNING VEHICLE BODY

**UNIT CODE:** ENG/CU/ABT/CR/01/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Design Vehicle Body.

**Duration of Unit:** 120 hours

**Unit Description**

This unit describes the competencies required by an Autobody Technician to design a vehicle body. It involves creation of vehicle structure sketches, bill of materials, analysis of job specification sheet, vehicle body design simulation, documentation of vehicle structure design and obtain design approval process.

**Summary of Learning Outcomes**

1. Draw vehicle structure
2. Create bill of materials
3. Analyse job specification sheet
4. Simulate vehicle design.
5. Document vehicle design
6. Obtain design approval

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Draw vehicle structure | * Drawing instruments and materials * Free-hand sketch of vehicle structure * Vehicle structure include: * Body-on-frame structure * Unitary body structure * Space structure * Backbone structure * Triangulated tube structure * Monocoque structure * Punt structure * Perimeter space frame structure * Design bus structure as per material specifications defined by KS 372 * Design truck body and auxiliary devices (hydraulic and pneumatic systems) as defined by KS 1515 standards * Vehicle ergonomics * Anthropometrics and its relation to vehicle ergonomics * Driver and passenger comfort-visibility, seating position. * Dust and fume prevention * Vibrations * Ventilation and temperature control * Interior features and conveniences * Interpreting designs and developing working/shop drawings * Application of Computer-Aided Design (CAD) software package * Generation of 2-dimension (2D) vehicle diagrams | * Oral questioning * Written assessment * Observation * Practical assessment |
| 1. Create bill of materials | * Identifying vehicle components * Obtaining knowledge on vehicle component design standards. Vehicle component standards include: KS 372, passenger vehicle body construction * KS ISO 898, mechanical properties of fasteners * KS 376, specification for flexible polyurethane (polyester) foams * KS 649, specification for automobile windscreens and glass * KS 664, specification for seat belt assemblies for motor vehicles * KS 822, specification for anchorages for seat belts for automobiles * Developing list of part assemblies from CAD drawings * Production cost of components and part assemblies. Part assemblies include: * Service doors * Emergency doors * Floor deck * Gangway * Roof * Window planes and windscreen * Handrails and handholds * Ventilators * Passenger seats * Seatbelt anchorage * Interior lights * Passenger entry steps * Door locks, window locks and boot locks * Electrical wiring * Luggage carriers | * Oral questioning * Written assessment * Observation * Practical assessment |
| 1. Analyse job specification sheet | * Identification of vehicle components * Determination of completion timelines for assembly * Estimation of labour cost | * Observation method * Oral questioning * Written assessment |
| 1. Simulate vehicle design | * Creation of 3-dimension (3D) model from 2-dimension (2D) by use of CAD software * Rendering and clay modelling of vehicle designs * Generation of interior sketches and models | * Observation * Oral. questioning * Projects * Practical assessment |
| 1. Document vehicle design | * Finalising complete vehicle designs and sketches * Filing of Completed vehicle designs * Compilation of complete vehicle designs, bill of materials, job specification sheets and protocol book manuals * Documentation of the designs | * Oral questioning * Observation * Written assessment |
| 1. Obtain design approval | * Government regulatory bodies of approving vehicle designs * Filling of vehicle patent application form | * Oral questioning * Written assignments * Practical assignments |

**Suggested Methods of Instruction**

* Practical exercises
* Direct Instructions
* Discussions
* Cooperative strategies
* Problem solving
* Simulations
* Case Studies
* Projects
* Workplace experiential learning

**Recommended Resources**

**Institutional Resources**

**Equipment**

* Projector
* CAD software package
* Draughtsman table
* Whiteboard
* Computer with internet connection

**Materials and Supplies**

* Whiteboard marker
* CAD software manuals
* Vehicle body design textbooks
* Industrial magazines on vehicle designs
* Modelling clay

**Trainee Requirements**

* Drawing papers
* Drawing books
* Draughtsman set
* Drawing instruments
* Pencils and erasers
* Storage devices

**Relevant Reference Materials**

* Appropriate engineering drawing and design books
* Engineering drawing and design manuals
* Vehicle design manuals

## FABRICATING AUTOMOTIVE STRUCTURE

**UNIT CODE:** ENG/CU/ABT/CR/02/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Fabricate Automotive Structure.

**Duration of Unit:** 150 hours

**Unit Description**

This unit describes the competencies required by an Autobody technician to fabricate automotive structure. It involves interpreting engineering drawings, observing occupational health and safety, collecting fabrication materials, cutting work pieces, bending work pieces, constructing fabrication jigs, joining jigged parts, levelling the structure, mounting the fabricated structure, fabricating ancillary units and obtaining structure approvals.

**Summary of Learning Outcomes**

1. Interpret engineering drawing
2. Observe occupational health and safety
3. Collect fabrication materials
4. Cut workpieces
5. Bend workpieces
6. Construct fabrication jigs
7. Join jigged workpieces
8. Level vehicle structure
9. Mount fabricated structure
10. Fabricate ancillary units
11. Obtain structure approval

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Interpret engineering drawing | * Measurements * Identification of work pieces from working drawings * Generation of work piece from working drawings * Work pieces include; * Angle sections * Rectangular tubes * Channel bars * Flat bars * Circular tubes * Round bars * Generation of bill of materials from working drawings * Bill of materials include; * Welding rods * Electrode wires * Cutting disc * Grinding disc * Work pieces * Identification of structure rigs * Structure rigs include * Under structure * Left side structure * Right side structure * Roof structure * Front structure * Rear structure * Cross member | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Observe Occupational Health and Safety | * Workshop safety * Use of personal protective equipment (PPE) * PPE include; * Overall * Safety boots * Goggles * Earmuffs * Gloves * Helmet * Safety mask * Fabrication workshop tools and equipment * Use and maintenance of tools and equipment * Tools and equipment include; * Drilling machine * Impact gun * Tape-measure * Scriber * Try-square * Vernier caliper * Ball pein hammer | * Observation * Oral questioning * Written assessment * Case studies |
| 1. Collect fabrication materials | * Selection of materials, tools and equipment as per job specifications * Material handling equipment include; * Hoist * Chain * Conveyor belt * Forklift * Isolation of fabrication materials from the store using bill of materials * Identification of materials according to size and shape | * Observation. * Oral questioning * Written tests * Case studies * On-the-job assessment |
| 1. Cut work pieces | * Identification of cutting tools and equipment according to the production protocol book * Cutting tools and equipment include; * Hacksaw * Circular saw * Angle grinder * Laser cutting machine * Plasma cutting machine * Gas cutting equipment * Preparation and marking out of materials using appropriate tools * Inspection of equipment performance * Verification of cut-pieces measurements against measurements on the working drawing | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Bend work pieces | * Selection of bending machines as per the metal sizes and sections * Bending machines include; * Hydraulic bending machine * Pneumatic bending equipment * Mechanical pipe bender * Preparation of work pieces as per the working drawings * Bending of work pieces as per the working drawing | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Construct fabrication jigs | * Design of fabrication jigs as per the working drawings * Fabrication jigs include; * Template jig * Plate jig * Diameter jig * Channel jig * Ring jig * Box jig * Joining of work pieces as per the working drawings * Mounting of jigs as per the structure design | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Join jigged work pieces | * Selection of electrodes and welding machine settings as per SOPs * Tack-welding of joint as per working drawings * Inspection of tacked structure using designed drawings * Performance of complete welding on a structure | * Observation * Oral questioning * Written assessment * On-the-job assessment |
| 1. Level vehicle structure | * Levelling of vehicle structure * Verification of structure diagonals as per the working drawings | * Observation * Oral questioning * Written assessment * On-the-job assessment |
| 1. Mount fabricated structure | * Inspection of fabricated structure as per SOPs * Positioning of fabricated structures onto vehicle chassis * Mounting of fabricated structures to the vehicle chassis | * Observation * Oral questioning * Written assessment * On-the-job assessment * Simulation exercise |
| 1. Fabricate ancillary units | * Selection and preparation of ancillary materials as per the working drawings * Ancillary units include; * Tail lifts * Cranes * Drawbars * Sleeper pods * Inspection of ancillary units | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Obtain structure approval | * Inspection of vehicle body structure as per workshop SOPs * Inspection of vehicle structure as per ISO standards * Inspection of vehicle body structure as per KS 372 standards | * Observation * Oral questioning * Written assessment * On-the-job assessment |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Practical exercises
* Workplace experiential learning
* Projects method
* Case study
* Simulation
* Discussion

**Recommended Resource**

**Institutional Resources**

**Tools**

* Impact gun
* Tape-measure
* Scriber
* Try-square
* Bench grinder
* Vernier caliper
* Vernier height gauge
* Marking table
* Ball pein hammer
* Laser leveller
* Hydro-pneumatic jack
* Rivet gun
* Hacksaw

**Equipment**

* Drilling machine
* Angle grinder
* Hoist
* Chain
* Conveyor belt
* Forklift
* Circular saw
* Laser cutting machine
* Plasma cutting machine
* Gas cutting equipment
* Hydraulic bending machine
* Pneumatic bending equipment
* Mechanical pipe benders
* guillotine machine

**Materials and Supplies**

* Projectors
* White board and markers
* Angle line
* Rectangular tubes
* Channel bars
* Flat bars
* Circular tubes
* Round bars
* Welding rods
* Electrode wires
* Cutting disc
* Grinding disc
* Access to relevant workplace or appropriately simulated environment where assessment can take place
* Ferrous materials
* Non-ferrous materials

**Trainee Requirements**

* Writing materials
* Overall
* Pair of safety boots
* Goggles
* Earmuffs
* Helmet
* Safety mask

**Relevant Reference Materials**

* Workshop SOPs
* Manufacturer’s manuals
* Appropriate automotive structure fabrication textbooks

## WELDING VEHICLE BODY PARTS

**UNIT CODE:** ENG/CU/ABT/CR/03/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Weld Vehicle Body Parts.

**Duration of Unit:** 360 hours

**Unit Description**

This unit specifies competencies required by an Autobody technician to weld vehicle body parts. It involves levelling vehicle chassis, Arc welding cross members, performing MIG welding, performing TIG welding, performing spot welding and carrying out quality control checks.

**Summary of Learning Outcomes**

1. Level vehicle chassis
2. Arc-weld vehicle cross members
3. Perform MIG welding
4. Perform TIG welding
5. Perform Spot welding
6. Carry-out Welding quality control

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Level vehicle chassis | * Observation of safety as per work procedure and OSHA * Interpretation of working drawings * Chassis diagonals checking * Chassis midpoint, front and end points checking * Chassis levelling | * Observation * Case study * Oral questioning * Written assessment * Practical performance |
| 1. Arc-weld vehicle cross members | * Selection of materials, tools and equipment * Observation of safety in arc welding cross members * Joint preparation   + Butt   + Lap   + Edge   + Tee   + Corner joints * Setting up MMA welding equipment * MMA welding process (ISO 9606-1 standard) * Welding joints, symbols and positions * Post weld treatment   + Heat treatment   + Peening   + Dressing * Weld joint examination ISO 17637 standard) | * Oral questioning * Practical performance * Projects * Written assessment |
| 1. Perform MIG welding | * Setting up MIG welding equipment * MIG welding process * Documentation of weld joints results | * Observation * Oral questioning * Written assessment * Supervisor report * Practical assessment * Projects |
| 1. Perform TIG welding | * Selection of materials, tools and equipment * Setting up TIG equipment * Principle of TIG welding process * Factors affecting quality of weld   + Arc length   + Travel speed   + Current setting/ amperage   + Angle of welding gun * TIG welding defects, causes and remedies | * Observation * Oral questioning * Written assessment * Projects * Supervisor report |
| 1. Perform spot welding | * Steps of setting up spot equipment * Surface joint preparation * Spot welding process * Post weld treatment * Factors affecting quality of weld   + Current setting/amperage   + Time   + Pressure | * Observation * Oral questioning * Written assessment * Supervisor report * projects |
| 1. Carry-out welding quality control | * Common weld faults (ISO Standards) * Non-destructive weld tests;   + Hydrostatic   + Magnetic   + X-ray   + Gamma   + Fluorescent penetrant tests * Destructive weld tests;   + Tensile strength   + Nick break   + Guided bend/free bend * Documentation of test results * Care, storage and maintenance of test tools and equipment * Welding workplace housekeeping;   + Workstation cleaning   + Care and storage of tools and equipment | * Oral questioning * Written assessment * Portfolio of evidence * Trainer/facilitator report * Trainee presentation * Practical assessment |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Project/practical exercises
* Simulation
* Case study
* Discussion method
* Work place learning

**Institutional Resources**

**Tools**

* Laser levelling kit
* Digital angle gauge with level
* Smart tool angle sensor
* Digital protector
* Measuring and marking out tools
* Forming tool
* Shaping tool
* Rolling tool
* Cutting tool
* Finishing tool

**Equipment**

* Fully equipped welding workshop meeting OSHA standards
* Metal arc welding equipment
* Metal inert gas welding machines
* Tungsten inert gas welding equipment
* Resistance spot welding equipment
* Jigs and fixtures
* Portable grinder
* Electric hand drills
* Welding booth
* Destructive tests equipment
* Non-destructive tests equipment

**Materials and Supplies (Consumables)**

* Personal Protective Equipment (PPE)
  + Welding helmets
  + Hand shields
  + Welding goggles
  + Respirator
  + Fire resistant clothing and apron
  + Earmuffs/ear plug
  + Insulated gloves
* MAG weldable materials
  + Mild steel
* TIG weldable materials
  + Mild steel
  + Alloy steel
* MMA weldable materials
  + Mild steel
* MMA consumables
  + MMA electrodes
* Spot and seam welding materials
* Mild steel

**Trainee Requirements**

* Pair of safety boot
* Apron/overall
* Writing materials
* Drawing tools and equipment
* Gloves
* Ear plugs

**Relevant Reference Materials**

* Manufacturers service manuals for vehicles chassis that are being fabricated;
* Digital instructional material including DVDs and CDs
* Appropriate automotive engineering chassis design and welding and fabrication engineering text books

## PANELLING VEHICLE STRUCTURE

**UNIT CODE:** ENG/CU/ABT/CR/04/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Panel Vehicle Structure.

**Duration of Unit:** 400 hours

**Unit Description**

This unit describes the competencies required by an Autobody technician in order to panel vehicle body structure. It involves observing occupational safety and health, grinding vehicle structure, aligning vehicle structure, constructing vehicle boot compartment, vehicle floor panel and vehicle exterior panel, installing wire harness, constructing vehicle interior compartment and documenting and updating protocol book.

**Summary of Learning Outcomes**

1. Observe occupational health and safety
2. Grind vehicle structure
3. Align vehicle structure
4. Construct vehicle boot compartment
5. Construct vehicle floor panel
6. Construct vehicle exterior panel
7. Install wire harness
8. Construct vehicle interior compartment
9. Document and update protocol book

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe occupational health and safety | * Utilization of personal protective equipment * Maintenance and storage of tools and equipment * Use of tools and equipment * Maintenance of workplace housekeeping * Workplace plan * Motor vehicle governing regulations * Specification sheet | * Observation * Written tests * Oral questioning |
| 1. Grind vehicle structure | * Vehicle structure inspection methods * Types of grinding tools * Vehicle structure ground finish methods | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Align vehicle structure | * Inspection methods of frame alignment on vehicle structure * Identification of alignment areas | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Construct vehicle boot compartment | * Vehicle boot compartment inspection * Boot compartment material requirement * Selection of material and equipment for construction * Panel fitting and welding methods | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Construct vehicle floor panel | * Vehicle floor panel material inspection * Types of material used and sizing in floor panel * Floor panel material cutting and shaping * Floor panel fitting and welding | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Construct vehicle exterior panel | * Vehicle exterior inspection * Exterior panel material identification and sizing * Methods of cutting and bending panel sheets * Panel joining and fitting methods * Inspection of panel fitting and spacing | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Install wire harness | * Inspection of vehicle wiring system * wire requirement identified and checked * Installation of electrical cables and insulators | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Construct vehicle interior compartment | * Inspection for vehicle interior compartment * Types of material used for vehicle interior * Identification and measurement of material * Corrosion prevention methods * Fitting of heat insulation materials * Riveting and spot welding for interior panel | * Observation * Written tests * Practical assessment * On the job assessment |
| 1. Document and update protocol book | * Specification sheet review * Recording of service work done * Recording work done on workshop job card | * Observation * Written tests |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Practical exercises
* Discussion method
* Workplace experiential learning
* Cooperative strategies/group method

**Recommended Resources**

**Institutional resources**

**Tools**

* G-clamp
* Chain block
* Ball pein hammer
* Sikaflex gun
* Riveting gun
* Goggles and helmet
* Measuring tools (steel rule, tape measure, callipers and engineers blue)
* Marking tools (engineers square, scribers, dot punch, centre punch and dividers)
* Cutting tools (hack saw, snips)

**Equipment**

* Drilling machine
* Laser cutting machine
* MIG welding machine
* Arc welding machine
* Grinding machine
* Metal bending machine
* Model vehicle frame
* Model vehicle body panel
* Computers
* Whiteboards
* Projectors

**Materials and supplies (consumables)**

* Galvanised sheet
* Black sheet
* Aluminium sheet
* Checkered sheet
* Circuit breaker
* Electromagnetic bell
* Interior lights
* Exterior lights
* Electrical accessory components
* Sikaflex
* Styrofoam
* Hood liner
* Fibre glass
* Red-oxide
* Aluco board
* Formica
* Rivets
* Welding rods
* Cutting discs
* Grinding discs
* Drilling bits
* Earplug
* Safety mask
* A pair of safety gloves
* Whiteboard markers

**Trainee Requirements**

* A pair of safety boots
* Overall
* gloves
* ear plugs

**Relevant Reference Materials**

* Health and safety manual
* Motor vehicle regulations manual
* Vehicle electrical circuit manual
* Autobody text books
* Journals and website

## VEHICLE BODY REPAIR

**UNIT CODE:** ENG/CU/ABT/CR/05/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Repair Vehicle Body.

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required by an autobody technician to repair vehicle body. It involves observing occupational health and safety, performing damage analysis and estimation, panel beating, plastic welding, fibre glass repair, and vehicle body surface preparation, applying filling material, performing vehicle dent repairs, vehicle body jacking and vehicle chassis pulling, applying undercoat, performing vehicle rust repairs and vehicle welded repairs, documenting and updating protocol book.

**Summary of Learning Outcomes**

1. Observe occupational health and safety
2. Perform damage analysis and estimation
3. Perform panel beating
4. Perform plastic welding
5. Perform fibre glass repairs
6. Perform vehicle body surface preparation
7. Apply filling material
8. Perform vehicle dent repairs
9. Perform vehicle body jacking
10. Perform vehicle chassis pulling
11. Apply undercoat
12. Perform vehicle rust repairs
13. Perform vehicle welded repairs
14. Document workshop protocol book

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe Occupational Health and Safety | * Observation of health and safety in vehicle body repair * Selection and use of tools and equipment’s used in vehicle body repair * Maintenance of tools and equipment’s * Maintenance of workshop * Selection of work place and tools | * Observation * Oral questioning * Written assessments |
| 1. Perform damage analysis and estimation | * Fundamentals of damage analysis * Visual inspection of damage * Damage indicators * Measuring * Uses of diagnosing concepts * Primary * Secondary * Mechanical * Inertia * Interior * Exterior trim * Blueprinting * Procedures for diagnosing frame and unibody structures Visually inspect for signs of damage: * Pulled welds * Split sealers * Cracked paint * Buckles * Panel misalignment * Measure vehicle for: * Length * Width * Height * Upper body misalignment * Tolerances * Structural and frame damage * Side sway * Sag * Mash * Diamond * Twist * Steering and suspension inspection * Tire pressure and size * Wheel assembly * Jounce-rebound test * Steering lock-to-lock * Strut rotation * Costing, estimating guides and software | * Observation * Oral questioning * Written assessments * Practical assessment |
| 1. Perform panel beating | * Inspection of vehicle body * Identification the damaged vehicle body * Straightening of vehicle body panel * Application of body fillers | * Observation * Oral questioning * Written assessments |
| 1. Perform plastic welding | * Inspection of plastic parts of the vehicle * Identification of damaged vehicle body parts * Plastic panel welding procedures and materials | * Observation * Oral questioning * Written assessments * Practical exercise |
| 1. Perform fibre glass repairs | * Inspection of vehicle body repair * Cleaning procedures * Application of fiber glass materials * Methods of surface spray painting | * Observation. * Oral questioning * Written assessments * Project Assignments * Case study |
| 1. Perform vehicle body surface preparation | * Cleaning of vehicle body * Sanding of the vehicle body * Selection of resin and hardener mixer * Application of resin and hardener mixer * Selection of tools and materials * Work space preparations * Cleaning of work area | * Observation * Written assessments * Practical exercise * Case study |
| 1. Apply filling material | * Inspection of vehicle body * Body filler application * Material application * Application of blended filler | * Observation * Oral questioning * Written assessments * Project assignment * Case study |
| 1. Perform vehicle dent repairs | * Observation of vehicle body * Identification of dents * Removal of dents | * Observation * Oral questioning * Written assessments * Project Assignment * Case study |
| 1. Perform vehicle body jacking | * Inspection of vehicle body * Confirmation of body panel * Identification and positioning of body jack * Safety of body jack operation | * Observation * Oral questioning * Written assessments * Project Assignment * Practical exercise * Case study |
| 1. Perform vehicle chassis pulling | * Inspection of vehicle body chassis * Identification of chassis fault * Confirmation of the chassis position | * Observation * Oral questioning * Written assessments * Project Assignment * Practical exercise * Case study |
| 1. Apply undercoat | * Inspection of the vehicle body * Application of under coat * Confirmation Primers and thinner * Application of undercoat | * Observation * Oral questioning * Written assessments * Project Assignment * Case study |
| 1. Perform vehicle rust repairs | * Inspection of vehicle body * Identification rusted parts * Methods of sandblasting and their application * Application of antirust chemical * Checking the appropriate cleaning agent | * Observation * Oral questioning * Written assessments * Assign project * Product checklist * Case study |
| 1. Perform vehicle welded repairs | * Inspection underlying structures * Identification of panel marks * Aluminum panel repair * Identify welding equipment and processes for aluminum * Gas Metal Arc Welding (GMAW) * Pulse welder * Clean vehicle body | * Observation Oral questioning * Written assessments * Product checklist * Case study |
| 1. Document workshop protocol book | * Report writing * Service book * Job card * Service card * Computing | * Oral questioning * Observation * Written assessment * Portfolio of evidence * Trainer/facilitator * Supervisor report |

**Suggested Methods of Instruction**

* Practical/project exercise
* Industrial attachment
* Written examinations
* Oral presentation
* Case study
* Simulation
* Work place learning

**Recommended Resources**

* Equipped workshop
* Painting booth
* Repair materials
* Tools and equipment

**Institutional Resources**

**Tools**

* Panel beating tools (spoons, hammers, dollies)
* Cutting tools
* Sanding tools (body sanders, buffers)
* Sharpening tools

**Equipment**

* Air compressor
* Hydraulic tool
* Pneumatic tool
* Welding machine
* Gas Metal Arc Welding (GMAW) equipment
* Spray paint gun
* Power tools
* Electric hand tools
* Sandblasting equipment
* Vehicle body workshop meeting OSHA standards

**Materials and Supplies (consumables)**

* Personal Protective Equipment (PPEs)

Goggles

Helmet

Overalls

Dust coat

Safety boots

Ear plugs

Safety mask

Rubber gloves

A pair of welding gloves

Cotton waste

* Digital instruction materials like CDs and DVDs
* Rust cleaner
* Chemicals
* Filler consumables
* Filler
* Mixer hardener
* Resin

**Trainee Requirements**

* Overall
* A pair of safety boots
* Gloves
* Ear plugs

**Relevant Reference Materials**

* Manufacturers service manuals for vehicles body that are being spray painted
* Digital instructional material including DVDs and CDs
* Estimating software and estimating guides
* Appropriate automotive engineering vehicle body repair text books

## VEHICLE SPRAY PAINTING

**UNIT CODE:** ENG/CU/ABT/CR/06/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Spray Paint Vehicle Body.

**Duration of Unit:** 360 hours

**Unit Description**

This unit describes the competencies required by an auto body technician in order to spray paint vehicle body parts. It involves observing occupational health and safety, performing vehicle body surface preparation, applying vehicle body primer and body bond seal, performing body sanding, spraying paint vehicle body, performing surface refinishing, and documenting and updating protocol book.

**Summary of Learning Outcomes**

1. Observe occupational health and safety
2. Perform vehicle body surface preparation
3. Apply vehicle body primer
4. Apply body bond seal
5. Perform body sanding
6. Spray paint vehicle body
7. Perform surface refinishing
8. Document and update protocol book

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe occupational health and safety | * Personal protective equipment (PPE) * Storage and maintenance of tools and equipment * Usage of tools and equipment * Maintenance of workspace housekeeping * Planning of workplace | * Practical performance * Case study * Oral questioning |
| 1. Perform vehicle body surface preparation | * Vehicle body inspection * Vehicle body cleaning * Covering of unpainted vehicle parts | * Practical assessment |
| 1. Apply vehicle body primer | * Mixing and applying of etching and activator on the metal surface * Application of first primer * Application of bond seal on the joints * Spot putty application * Body primer application | * Demonstration * Practical assessment |
| 1. Apply body bond seal | * Types of bond seal * Preparatory work and application of bond seal | * Oral questioning * Simulation of performance * Project assignment * Practical Assessment |
| 1. Perform body sanding | * Sanding methods and materials * Sanding of vehicle surfaces | * Oral questioning. * Practical assessment * Project |
| 1. Spray paint vehicle body | * Preparatory work on the body before painting identification of automotive paints * Appropriate colour matching and mixing * Spraying equipment selection and preparation * Spraying of first coat paint * Spraying of second coat paint * Spraying of final coat paint * Vehicle paint drying procedures | * Simulation * Practical assessment * Oral questioning |
| 1. Perform surface refinishing | * Selection of buffing materials * Vehicle body preparation for buffing * Body buffing * Body vehicle cleaning | * Practical performance * Practical assessment * Supervisor report |
| 1. Document and update protocol book | * Reviewing of specification sheet * Defining the work to be performed * Recording of Service work done on the protocol book * Recording of work done on the workshop job card * Scheduling of next service | * Observation * Trainer/facilitator report * Practical exercise |

**Suggested Methods of Instruction**

* Practical assessment
* Observation
* Written examinations
* Questionnaires
* Case studies

**Recommended Institutional Resources**

**Tools**

* Measuring and marking tools
* Mixing and matching tools
* Sanding tools
* Forming tools
* Spreading tools
* Sealer gun
* Scraping tools
* Finishing tools
* Polishing tools

**Equipment**

* Spray painting equipment
* Sanding and polishing machines
* Buffing machine
* Masking machines
* Computer
* Electronic meal gauge

**Materials and supplies (consumables)**

* Personal Protective Equipment (PPE)
* Earmuffs/ear plugs
* Insulated gloves
* Paint
* Sand paper
* Dust respirator
* Rubber sanding block
* Spot putty
* Body filler
* Clear coat
* Blaster
* Bond seals
* Grinding disc
* Masking covers/papers
* Masking tapes
* Plastic sheet masking
* Primers

**Trainee**

* Pair of safety boot
* Apron/overall
* Writing materials
* Drawing tools and equipment

**Relevant Reference Materials**

* Manufacturers service manuals for vehicles body that are being spray painted
* Digital instructional material including DVDs and CDs
* Appropriate automotive engineering vehicle body repair text books

## TRIMMING VEHICLE BODY

**UNIT CODE:** ENG/CU/ABT/CR/07/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Trim Vehicle Body.

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required by an Autobody technician to trim vehicle body. It involves observing occupational health and safety, collecting trim materials, upholstering vehicle interior, padding vehicle cushion seat, installing vehicle restraints, install airbag, replacing mouldings, emblems and pin-striping, documenting and updating protocol book

**Summary of learning outcomes**

1. Observing occupational health and safety
2. Collect trim materials
3. Upholster vehicle interior
4. Pad vehicle cushion seat
5. Install vehicle restraints
6. Replace mouldings, emblems and pin-striping
7. Document and update protocol book

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment methods** |
| --- | --- | --- |
| 1. Observe occupational health and safety | * Observation of personal protective equipment (PPE) is used according to OSHA 2007 * Store and maintain tools and equipment correctly according to manufacturer’s specifications * Use tools and equipment correctly according to designated purpose. * Maintain workspace housekeeping according to standard operating procedures | * Observation * Written assessment * Oral questioning |
| 1. Collect trim materials | * Inspection of the vehicle as per workshop standard operating procedures * Clean and degreasing of the surface per workshop * Collection of trim materials as per the specification sheet | * Practical exercise * Oral questioning * Observation |
| 1. Upholster vehicle interior | * Types of upholstery materials * Cut and sew of upholstery materials as per the vehicle design and the working drawing * Application of adhesive on surface to be trimmed as per the workshop | * Observation * Practical assignment * Product checklist * Written assessment |
| 1. Pad vehicle cushion seat | * Inspection of seats frames as per the working drawing * Cut of upholstery materials as per the design drawing * Upholstery materials are glued as per workshop * Seat covers are fixed as per the workshop | * Case study * Oral questioning using * Projects assignment * Trainer/facilitator report |
| 1. Install vehicle restraints | * Identification and collection of vehicle restraints as per specification sheet * Air bags, seat belts * Mount vehicle restraints on the seat frame as per KS 372 standard * Secure vehicle restraints as per the workshop | * Observation * Practical test * Oral questioning * Written assessment |
| 1. Replace mouldings, emblems and pin-striping | * Identification and collection of mouldings, emblems and pin-striping as per specification sheet. * Clean vehicle surface as per the workshop * Replace mouldings, emblems and pin-striping workshop | * Observation * Written assessment |
| 1. Document and update protocol book | * Specification sheet is reviewed to define the work to be performed. * Service work done is recorded on the protocol book as per the manufacturer’s specification. * Record work done on the workshop job card as per the workshop | * Observation * Written tests * Oral questioning |

**Suggested Methods of Instruction**

* Trainer-led facilitation
* Practice by trainee
* Demonstration of task by trainer
* Industrial visits
* Viewing videos related to trimmed vehicle body
* Presentations and practical demonstrations by trainer
* Guided learner activities and research to develop underpinning knowledge
* Supervised activities and projects in a workshop
* The delivery may also be supplemented and enhanced by the following, if the opportunity allows
* Guided learner activities and research to develop underpinning knowledge
* Supervised activities and projects in a workshop

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

* Visiting lecturer/trainer from the motor vehicle service and repair sector
* Industrial visits

**Recommended resources**

**Institutional Resources**

**Tools**

* Whiteboards
* Projectors
* Drilling machine
* Rivet gun

**Equipment**

* Model vehicle frame
* Model vehicle seats
* Power tools
* Hand tools
* Trim removal tool kit
* Hand scissors
* Straight, curved needles and skewers
* Mould removal wedges
* Adhesive remover
* Pin-striping brushes
* Beagle pin-striper
* Upholstery material (leather, cushions, seat cover materials)
* Trim fabrics
* Faux leather
* Headlining material
* Cushion foam, felt and fiber board
* Adhesive contact glue
* Entertainment systems
* Radio

**Vehicle Safety Equipment**

* Fire extinguisher
* Lifesaver
* First aid kit

**Trainee Requirements**

* PPEs;
  + Goggles
  + Earmuffs
  + Safety mask
  + Helmets
  + Safety boots
  + Leather gloves
  + Overall

**Relevant Reference Materials**

* The vehicle body repairs manual
* Digital instructional material including DVDs and CDs
* Appropriate automotive engineering vehicle body repair engineering text books

## MOTOR VEHICLE ASSEMBLING

**UNIT CODE:** ENG/CU/ABT/CR/08/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Assemble Vehicle Body Parts.

**Duration of Unit:** 120 hours

**Unit Description**

This unit describes the competencies required by Autobody technician in order to assemble vehicle body parts. It involves observing occupational safety and health, installing vehicle seats, performing vehicle glazing, installing vehicle auxiliary and fluid power systems, installing vehicle electrical components, installing vehicle mechanical components, installing vehicle locks, latches and window regulator, installing safety kits, performing water leak test, performing vehicle road obtaining final approval, documenting and updating protocol book.

**Summary of Learning Outcomes**

1. Observe occupational health and safety
2. Install vehicle seats
3. Perform vehicle glazing
4. Install vehicle auxiliaries and fluid power systems.
5. Install vehicle electrical components
6. Install vehicle mechanical components
7. Install vehicle locks, latches and window regulator
8. Install safety kits
9. Perform water leak test
10. Perform vehicle road test
11. Obtain final approval
12. Document and update protocol book

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe occupational health and safety | * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) * Tools and equipment   + - Types     - Storage     - Maintenance * Work place housekeeping * Maintenance * Planning * Disposal methods of hazardous wastes | * Oral questioning * Written tests * Observation |
| 1. Install vehicle seats | * Interpretation of specification sheets * Marking out procedures * Drilling procedures * Construction and mounting of vehicle seats * Types and fitting procedures for vehicle carpets | * Written tests * Observation * Projects * Projects exercise * Supervisor’s reports |
| 1. Perform vehicle glazing | * Types of vehicle glass * Cleaning procedures for glass and body panels * Types of adhesives * Application of adhesives * Joining of glass to body panels using adhesives | * Observation * Observation * Projects * Supervisor’s report |
| 1. Install vehicle auxiliaries and fluid power systems | * Types of vehicle auxiliary units * Construction and operation of the various auxiliary units * Fault diagnosis of auxiliary units * Procedures for installing auxiliary units * Fundamental concepts to fluid power systems   + Pneumatic (gas)   + Hydraulic (liquid) * Understanding working principles basic components in fluid power systems   + Reservoir/ receiver   + Pump/ compressor   + Valves   + Cylinder * Fluid power systems devices in Specialised truck and bus equipment * Buses   + - Pneumatic door     - Hydraulic wheelchair lift ramp * Trucks   + - Cranes     - Winches     - Tail gates     - Truck tipper bodies * Basic components and functions of fluid power devices * Differentiate between the characteristics of pneumatic and hydraulic systems * Calculate values in a fluid power system utilizing Pascal's law * Calculate flow rate, flow velocity and mechanical advantage in a hydraulic system | * Written tests * Observation * Projects * Workplace reports * Lab experiments |
| 1. Install vehicle electrical components | * Vehicle electrical components * Construction and operation of vehicle electrical components * Testing of electrical components * Procedures for installing vehicle electrical components | * Oral questioning * Observation * Projects |
| 1. Install vehicle mechanical components | * Vehicle mechanical components * Construction and operation of vehicle mechanical components * Fault diagnosis and repair of vehicle mechanical components * Vehicle mechanical components assembly procedures | * Written test * Observation * Projects * Practical exercise |
| 1. Install vehicle locks, latches and window regulator | * Construction and function of vehicle doors, locks, latches and window regulators * Testing of vehicle locks, latches and window regulator * Procedure for installing locks, latches and window regulators | * Oral questioning * Written tests * Observation * Projects |
| 1. Install safety kits | * Types of vehicle safety equipment * Types, use and application of fire extinguishers * Testing functionality of safety kits * Safety kits installation procedures | * Oral questioning * Observation * Practical exercise |
| 1. Perform water leak test | * Utilization of Personal Protective Equipment (PPE), including but not limited to * Helmet * Earmuffs * Ear plugs * Rubber soles * Safety boots * Insulated gloves * Inspection of full outer body panels and fittings including; * Armrests * Door panels * Sound deadening * Cigarette lighter * Window planes * windscreen * Handrails * handholds * Ventilator vents * Passenger seats * Seatbelt anchorage * Interior lightings * Doors lock actuators switches * Identification and rectification of dents, defects and loose sections * Application of high-pressure water jet on vehicle body * Checking of water leaks and sealant failure * Sealing of leaking areas | * Practical demonstration * Observe * Projects reports |
| 1. Perform vehicle road test | * Check of vehicle specification sheet items * Modification and rectifications of components * Checking of vehicle documentation * Preparation and installation of vehicle number plate * Vehicle road testing * Fault identification and rectification | * Oral questioning * Practical demonstration * Observation |
| 1. Obtain final approval | * Documentation compilation including but not limited to; * Approved design documents * Approved bodybuilder documents * Approved materials standards * In stage approval documents * Assembly park list marking plate affixed on the body * Internal inspection documents * Invitation of final inspectors including but not limited to: * Government vehicle inspectorate unit * Mechanical engineers * KEBS * Ministry of transport | * Written test * Projects reports |
| 1. Document and update protocol book | * Recording of work done * Protocol book * Job cards | * Oral questioning * Written tests * Oral questioning |

**Suggested Methods of Instruction**

* Trainer-led facilitation of theory
* Demonstration of task by trainer
* Practice by trainee
* Industrial visits
* Viewing videos related to assembling vehicle body parts
* Presentations and practical demonstrations by trainer
* Guided learner activities and research to develop underpinning knowledge
* Supervised activities and projects in a workshop
* Visiting lecturer/trainer from the motor vehicle service and repair sector
* Industrial visits
* Supervised projects in work places in the industry

**Recommended Resources**

**Institutional Resources**

**Tools**

* Whiteboards
* Projectors
* Drilling machine
* Rivet gun
* Welding machine

**Equipment**

* + Hydraulic and pneumatic model
  + Model vehicle seats, front and rear windshields, door windows
  + Model vehicle auxiliary units, door locks, latches and window regulators
  + Model vehicle electrical harness
  + Vehicle electrical components
* Side mirrors
* Rear view mirror
* Exhaust system radio
* Charging sockets
* Entertainment systems
* Radio
  + Vehicle safety equipment
* Fire extinguisher
* Lifesaver
* First aid kit
* Air-con system
* Fuel tank
* High pressure water jets

Bus fluid power components

* + Pneumatic door
  + Hydraulic wheelchair lift ramp
* Truck fluid power components
* Cranes
* Winches
* Tail gates
* Truck tipper bodies

**Materials and Supplies (Consumables)**

* Petrol
* diesel
* Whiteboard markers
* Waste cloth
* Adhesives
* Detergents
* Terminal clips
* Chevrons
* Reflector strip
* Round reflectors
* Parcel rack
* Water sealant
* Fuel filter

**Trainee Requirements**

**PPEs;**

* + Goggles
  + Earmuffs
  + Safety mask
  + Helmets
  + Safety boots
  + A pair of leather gloves
  + Overall

**Tools**

* + Soft hammer
  + Screw driver set
  + Box spanners set
  + Ring spanner set

**Relevant Reference Materials**

* Manufacturers service manuals for assembling of vehicle body parts
* Manufacturers service manuals for assembling of bus body assembly
* Manufacturers service manuals for assembling of truck assembly
* Appropriate motor vehicle bodywork text books
* Health and safety manuals

## VEHICLE PREVENTIVE MAINTAINANCE

**UNIT CODE:** ENG/CU/ABT/CR/09/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Preventive Maintenance.

**Duration of Unit:** 240 hours

**Unit Description**

This unit of competence describes the competencies required by an Autobody Technician to perform preventive maintenance on a vehicle. It involves observing occupational health and safety, assessing vehicle operational condition, replenishing vehicle fluids, replacing service parts, adjusting specified systems, lubricating wear and tear parts, aligning electronic headlamp, resetting service reminders, performing quality test, cleaning the vehicle systems and documenting service records.

**Summary of Learning Outcomes**

1. Observe occupational health and safety
2. Assess vehicle operational condition
3. Replenish vehicle fluids
4. Replace service parts
5. Adjust specified parts
6. Lubricate wear and tear parts
7. Align electronic headlamp
8. Reset service reminders
9. Perform quality tests
10. Clean the vehicle systems
11. Document service records

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Observe occupational health and safety | * Types and uses of PPE in line with environmental regulations * Occupational Safety and Health Standards (OSHS) * Tools and equipment * Types * Storage * Maintenance * Work place housekeeping * Maintenance * Planning * Principles of preventive maintenance * Draining and disposal of used oils * Workshop and road safety standards and possible hazards. * Disposal methods of hazardous wastes | * Oral questioning * Written tests * Observation |
| 1. Assess vehicle operational condition | * Identifying and repairing tyre punctures * Performing wheel balancing * Performing tyre fitting on the rim * Straightening bent wheel rims * Replacing tyre pressure nozzles * Maintaining tyre pressure * Inspect exterior lights functionality including; * Head lamp * Parking light * Fog light * Brake lights * Reverse lights * Indicator light * Number plate * Checking wipers for wear and wiper jets for clogging and target * Types of instrument cluster for warning lights including; * Service reminders lights * ABS (Anti-lock braking system) light * Overheating light * Check engine light * Diagnosing vehicle operation system including; * Engine test * Gearbox performance * Working of the ABS system * Seat belt * Check brake pads and linings for wear * Check drive belts for wear, abrasion, cracks and tension including; * V-belt * Fan belt * Alternator belt * Air Con belt * Timing chain belt * Water pump belt * Performing engine starting for abnormal sound * Observing vehicle test-driven and its clutch, brakes, steering and suspension * Lifting and observing vehicle for under leakages and anomalies * Preparing vehicle operational assessment report | * Practical exercises * Written tests * Learner portfolio of evidence |
| 1. Replenish vehicle fluids | * Lubricants and fluids replenished to the levels and quantities as specified by the manufactures * The use of manufacturer’s specifications to identify the correct types and grades of lubricants and fluids for systems * Protective measures to avoid spillage that may damage the vehicle and cause a safety and health hazards * Perform top up of fluids not due for replacement checked for anomalies including; * Minor service * Major service * Drain used oil into the disposing drain tank * Perform lubrication by fixing drain plug and topping up oils/fluids | * Oral questioning * Written tests * Observation * Practical assessment |
| 1. Replace service parts | * Identification of service parts that should be replaced as part of routine maintenance including; * Oil filters * Air filters * Fuel filters * Cabin filters * Spark plugs * Glow plugs * Drive belts * The use of manufacturer’s part numbers to verify that the parts are correct for the type of vehicle * Use of appropriate tools for removal and replacement to ensure correct replacement without damage * Replace faulty parts * Tests to ensure that the replacement parts perform to manufacturers specifications * Disposal of waste oil, fluids, and scrap parts in accordance with current environmental regulations | * Oral questioning * Observation * Practical assessment |
| 1. Adjust specified parts | * Use of manufacturers technical information to identify operating specifications and tolerances * Tools and equipment for checking and carrying out adjustments * Identification of components and systems that are to be checked and adjusted including; * Hand brake lever travel * Clutch, brake * Accelerator pedal play and travel * Wiper nozzles * Principles of power torque and speed * The use of approved checklists and documentation to record checks and adjustments carried out | * Oral questioning * Written tests * Supervisor report * Learner portfolio of evidence |
| 1. Lubricate wear and tear parts | * Application of antirust (WD40) to rusted friction parts * Types, characteristics and applications of antirust, grease and general lubricants * Apply lubricants to door hinges and locks, window winder and window path * Apply grease to suspension parts and joints including * Shock absorber/ strut * Control arms * Ball joints | * Practical assessment * Oral questioning * written tests * Supervisor report |
| 1. Align electronic headlamp | * Parking vehicle on a flat level ground with headlamps aiming a plain opaque target * Connection of vehicle OBD-II port with the VCI and computer * Vehicle lighting legal requirements * Access headlamps using controller and the computer including; * Xenon lamps * Halogen lamps * Perform headlamps alignment | * Oral questioning * Written assessment * Portfolio of evidence |
| 1. Reset service reminders | * Connection of vehicle OBD-II port with the VCI and computer * Uses of computer to access cluster/meter controller * Service reminders update including; * Fluid levels * Brakes * Plugs * Air cleaner element * Any leaks * Perform counters update | * Observation * Oral questioning |
| 1. Perform quality tests | * Recheck performed work * Confirmation of fluid levels and status * lights functionality * Vehicle lighting legal requirements. * functionality and effectiveness of screen wipers and washer jets * Driver operated system’s play and travel including; * Accelerator * Brake pedal * Clutch pedal (manual cars) * Light lever * Wiper lever * Carry out test on wheels, pedals, and knobs for free play and travel including; * Bonnet stopper * Door stopper * Boot door stopper * Engine/Gearbox mountings * Perform vehicle road test on noise, vibration and harshness detection and analysis. * Effects of pressure on vehicle components and materials * Pressure testing | * Portfolio of evidence * Written assessment |
| 1. Clean the vehicle systems | * Blow and wipe dust from sensitive under hood vehicle parts * Cleaning and spraying vehicle interiors including; * Dashboard * Seats * Mats * The vehicle interior and exterior clean and presentable in compliance with company policy * wiping vehicle body * Effects of water on electronics, friction surfaces and materials | * Written assessment * Oral questioning * Learner portfolio of evidence. |
| 1. Document service records | * Recording service work done on owner’s manuals * Recording work done on the workshop job card * A report for the customer that includes all the work that was carried out during the routine maintenance * A report to advise the customer of any further defect(s) that were identified during the routine maintenance, with recommendations for further action * Maintenance records completed accurately in an approved format | * Portfolio of evidence assessment portfolio * Trainer/facilitator report * Observation |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Practical work by trainee(s)
* Guided learner activities and research to develop underpinning knowledge
* Supervised activities and projects in a workshop
* Power point presentation
* Visiting expert worker from the motor vehicle service and repair sector
* Industrial visits
* Industrial attachment

**Recommended Resources**

**Institutional Resources**

**Tools**

* Scanners
* Simulation software
* Spanners
* Electric wiring diagram
* Repair manual
* Multimeter
* Test lamp
* Cutter plier
* Screw driver
* Diagnostic tools and equipment

**Equipment**

* A fully equipped motor vehicle maintenance workshop
* Fully functional light vehicle(s)
* Vehicle lift/inspection pit
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle electrical systems that are being maintained including multi-meters, scanners and code readers
* Internet access to manufacturers’ technical information
* Torque setting tools
* Personal protective equipment (PPE)
* Vehicle protective coverings
* Facilities for the disposal of used parts

**Materials and Supplies (Consumables)**

* Whiteboard markers
* Filters and purifiers (oil, air, etc.)
* Engine and transmission lubricants
* Fluids for cooling systems, brakes, clutch, windscreen washer, hydraulic power assisted steering and diesel engine exhaust emission control
* Petrol and diesel

**Replacement Parts Include**

* Air, oil, exhaust, and air conditioning filters
* Oil seals and gaskets
* Brake pads and linings
* Spark plugs
* Screen wiper blades
* Drive belts
* Vehicle cleaning materials
* Hand cleaner

**Others**

* Component manuals
* Health and safety manuals
* First aid kits and firefighting equipment
* Appropriate hydraulic and pneumatics books and other reference materials (journals, past papers etc.)
* Drawing room with tables
* Safety manuals
* Service manuals

**Trainee Requirements**

* Computing machines: Desktop computers, laptops, tablets, etc.
* Drawing tools and equipment: Rulers, draftsman set
* Protective clothing: Dust coat, safety gloves, safety boots, and safety goggles etc.

**Relevant Reference Materials**

* Manufacturers service manuals for vehicles that are being serviced
* Appropriate automotive engineering text books available on numerous websites

## MOTOR VEHICLE DRIVING

**UNIT CODE:** ENG/CU/ABT/CR/10/6/A

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Drive Motor Vehicle.

**Duration of Unit:** 120 hours

**Unit Description**

This unit covers the competencies required to drive motor vehicle. It involves demonstrating road safety knowledge, demonstrating legal driving requirements knowledge, demonstrating knowledge of the model town board, demonstrating road signs knowledge, demonstrating basic knowledge of light vehicles, starting/stopping manual transmission vehicle, starting/stopping automatic transmission vehicle, demonstrating vehicle control capability, demonstrating situational driving capability and obtaining valid driving license

**Summary of Learning Outcomes**

1. Demonstrate road safety knowledge
2. Demonstrate legal driving requirements knowledge
3. Demonstrate knowledge of the model town board
4. Demonstrate road signs knowledge.
5. Demonstrate basic knowledge of light vehicles
6. Start manual transmission vehicle
7. Stop manual transmission vehicle
8. Start automatic transmission vehicle
9. Stop automatic transmission vehicle
10. Demonstrate vehicle control capability
11. Demonstrate situational driving capability (on road driving)
12. Obtain valid driving license

**Learning Outcomes, Content and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Demonstrate road safety knowledge | * Interpretation of highway codes * Road safety * Basic vehicle mechanics * Traffic rules * First aid during an accident | * Observation * Oral questioning * Written assessment * Case studies * Simulation exercise |
| 1. Demonstrate legal driving requirements knowledge | * Priority vehicles * Traffic Act | * Observation * Oral questioning * Written assessment * Case studies |
| 1. Demonstrate knowledge of the model town board | * Traffic rules * Traffic rules include; * Rules of the round about * Change of lanes * Types of traffic include; * One-way * Two-way * Road signs | * Observation * Oral questioning * Written assessment * Case studies |
| 1. Demonstrate road signs knowledge | * Classification of roads * Road categories include; * Class A * Class B * Class C * Hand signals * Road sign boards | * Observation * Oral questioning * Written assessment * Case studies * Simulation exercise |
| 1. Demonstrate basic knowledge of light vehicles | * Explanation of vehicle systems * Vehicle systems include; * Engine, ignition, accelerator and exhaust * Controls and instrumentation * Transmission and steering * Braking and suspension * Electrical system * Identification and access of safety equipment locations * Safety equipment include; * First aid kits * Toolbox * Lifesaver * Fire extinguisher * Basic operation procedures of motor vehicle * Basic operation procedure includes; * Water level * Oil level * Braking system * Tyre wear * Indicator condition * Check headlight * Horn * Taillight * Wiper | * Observation * Oral questioning * Written assessment * Case studies * Simulation exercise |
| 1. Start manual transmission vehicle | * Basic motor vehicle checks * Adjustment of mirror, safety belts and seats * How to use an ignition key * Gear positions in a manual transmission vehicle * Starting a motor vehicle engine * Gearbox operation in a manual transmission vehicle * Operation pedals in a manual transmission vehicle | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Stop manual transmission vehicle | * Speed reduction in a manual transmission vehicle * Application of low and high gear in a driving operation | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Start automatic transmission vehicle | * Basic motor vehicle checks * Adjustment of mirror, safety belts and seats * Gear positions in an automatic transmission vehicle * Starting a motor vehicle engine * Gearbox operation in an automatic transmission vehicle * Operation of handbrake in a vehicle * Pedals in an automatic transmission vehicle | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Stop automatic transmission vehicle | * Speed reduction in an automatic transmission vehicle * Stopping an automatic transmission vehicle | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Demonstrate vehicle control capability | * Operation of control pedals in manual transmission vehicle * Vehicle parking * Types of parking space include; * Kerb parking * Perpendicular parking * Angled parking * Parallel parking * Double parking * Assessment of vehicle length and width during parking and turning * Turns may include; * U-turn * Forward turn * Reverse turn | * Observation * Oral questioning * Case Studies * On-the-job assessment |
| 1. Demonstrate situational driving capability (on road driving) | * Speed control in driving situations * Merging and exiting service lanes * Performance of lane changing and overtaking * Observation of correct driving behaviour while at junctions, zebra crossing, with signals, without signals, with restricted view and without restricted view * Correct driving behaviour include; * Stopping to check for on\coming traffic at junctions * Giving the right of way to other road users e.g. pedestrians * Maintaining safe driving distance from the vehicle ahead * Correct use of car lights and car horn as communication   + Tool to other road users | * Observation * Oral questioning * Written assessment * Case studies * On-the-job assessment |
| 1. Obtain valid driving license | * Requirements for registration with a driving institution * Driving in different scenarios * Contents of a driving test | * Observation * Oral questioning * Case studies |

**Suggested Methods of Instruction**

* Direct instruction method
* Demonstration method
* Practical exercises
* Workplace experiential learning
* Projects method
* Case study
* Simulation
* Discussion

**Recommended Resources**

**Institutional Resources**

**Tools**

* Tool box
* Projectors
* Markers
* Whiteboards

**Equipment**

* Model town board
* Manual transmission training vehicle
* Automatic transmission training vehicle
* Manual transmission gearbox
* Automatic transmission gearbox
* Road signs
* First aid box
* Lifesaver
* Fire extinguisher

**Materials and Supplies**

* Kerb parking
* Manoeuvre yard
* Gasoline

**Trainee Requirements**

* Writing materials

**Relevant Reference Materials**

* Up-to-date highway codes book
* Traffic Act
* Manufacturer’s manuals
* Appropriate automatic and manual transmission textbooks
* Appropriate textbooks for driving a motor vehicle