

**REPUBLIC OF KENYA**

**COMPETENCY BASED CURRICULUM FOR**

# AUTOMOTIVE ENGINEERING LEVEL 6



TVET CDACC

P.O BOX 15745-00100

NAIROBI

First published 2018

© 2018, TVET CDACC

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

**Council Secretary/CEO**

**TVET Curriculum Development, Assessment and Certification**

**Council**

**P.O. Box 15745–00100**

**Nairobi, Kenya**

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

**FOREWORD**

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

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution of Kenya 2010 and this resulted in the formulation of the Policy Framework for Reforming Education and Training. 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 for Automotive Engineering level 6 has been developed.

It is my conviction that this curriculum will play a great role towards development of competent human resource for engineering sector 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, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET in order to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with engineering Sector Skills Advisory Committee (SSAC) have developed Occupational Standards for Automotive 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, Engineering SSAC, expert workers and all those who participated in the development of these Occupational Standards.

**CHAIRPERSON, TVET CDACC**

**ACKNOWLEDGMENT**

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 Engineering 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 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**

Table of Contents

[AUTOMOTIVE TECHNICIAN LEVEL 6 i](#_Toc23442596)

[FOREWORD iv](#_Toc23442597)

[PREFACE iv](#_Toc23442598)

[ACKNOWLEDGMENT v](#_Toc23442599)

[ACRONYMS vi](#_Toc23442600)

[OVERVIEW vi](#_Toc23442601)

[COMMUNICATION SKILLS 1](#_Toc23442602)

[DIGITAL LITERACY 4](#_Toc23442603)

[ENTREPRENEURIAL SKILLS 6](#_Toc23442604)

[EMPLOYABILITY SKILLS 12](#_Toc23442605)

[ENVIRONMENTAL LITERACY 17](#_Toc23442606)

[OCCUPATIONAL SAFETY AND HEALTH PRACTICES 22](#_Toc23442607)

[TECHNICAL DRAWING 24](#_Toc23442608)

[WORKKSHOP TECHNOLOGY PRINCIPLES 39](#_Toc23442609)

[PERFORMING VEHICLE BASIC MAINTENANCE 45](#_Toc23442610)

[SERVICING AND REPAIRING VEHICLE ENGINE COMPONENTS 56](#_Toc23442611)

[SERVICING VEHICLE FUEL SYSTEM 60](#_Toc23442612)

[SERVICING VEHICLE TRANSMISSION SYSTEMS 64](#_Toc23442613)

[SERVICING VEHICLE STEERING SYSTEMS 70](#_Toc23442614)

[SERVICING VEHICLE SUSPENSION SYSTEMS 76](#_Toc23442615)

[SERVICING VEHICLE BRAKING SYSTEMS 83](#_Toc23442616)

[SERVICING VEHICLE ELECTRICAL SYSTEMS 89](#_Toc23442617)

# ABBREVIATIONS AND ACRONYMS

A Control version

AC Air conditioning

AIDS Acquired Immunodeficiency Syndrome

BC Basic Unit

CBET Competency Based Education and Training

CC Common unit

CDACC Curriculum Development Assessment Certification Council

CEO Council Secretary

CI Compression ignition

CR Core Unit

CU Curriculum

CV Constant velocity joint

DTI Dial test indicator

FOT Fixed orifice tube

GPS Global positioning system

HIVHuman Immuno-Deficiency Virus

KCSE Kenya Certificate of Secondary Education

KNQA Kenya National Qualifications Authority

KPI King Pin Inclination

LCD Liquid Crystal Display

OBD On-board diagnostics

OSH Occupational Safety and Health

PESTEL Political Environmental Social Technological Economic Legal

PPE Personal Protective Equipment

PPE Personal protective equipment

Q&A Questions and Answer

SI Spark ignition

SSAC Sector Skills Advisory Committee

SWOT Strength Weakness Opportunity Threat

TVET Technical and Vocational Education and Training

TXV Thermal expansion valve

UJ Universal joint

# COURSE OVERVIEW

Automotive Engineering Level 6 qualification consists of competencies that a person must achieve to enable him/her to service and repair vehicle engines components, service vehicle fuel systems, vehicle transmission system, vehicle steering systems, vehicle suspension systems, vehicle braking systems and vehicle electrical systems

The course consists of the following basic, common and core units of learning as indicated below

**Basic Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factor** |
| ENG/CU/AUT/BC/1/6 | Communication Skills | 40 | 4 .0 |
| ENG/CU/AUT/BC/2/6 | Digital Literacy | 60 | 6 .0 |
| ENG/CU/AUT/BC/3/6 | Entrepreneurial Skills | 100 | 10.0 |
| ENG/CU/AUT/BC/4/6 | Employability Skills | 80 | 8.0 |
| ENG/CU/AUT/BC/5/6 | Environmental Literacy | 40 | 4 .0 |
| ENG/CU/AUT/BC/6/6 | 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/AUT/CC/1/6 | Engineering Mathematics | 150 | 15 .0 |
| ENG/CU/AUT/CC/2/6 | Technical Drawing | 150 | 15.0 |
| ENG/CU/AUT/CC/3/6 | Automotive Engineering Science Principles | 100 | 10.0 |
| ENG/CU/AUT/CC/4/6 | Workshop Technology  Principles | 100 | 10 .0 |
| **Subtotal 2** | | **500** | **50 .0** |

**Core Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Unit Title** | **Duration in Hours** | **Credit Factor** |
| ENG/CU/AUT/CR/1/6 | Service and Maintain Motor Vehicles. | 120 | 12.0 |
| ENG/CU/AUT/CR/2/6 | Service and Repair  Motor Vehicle Engines. | 170 | 17 .0 |
| ENG/CU/AUT/CR/3/6 | Service Light Motor Vehicle Engine Auxiliary Systems. | 100 | 10.0 |
| ENG/CU/AUT/CR/4/6 | Service Motor Vehicle Transmission Systems. | 150 | 15.0 |
| ENG/CU/AUT/CR/5/6 | Service Motor Vehicle Braking Systems. | 100 | 10.0 |
| ENG/CU/AUT/CR/6/6 | Service Motor Vehicle Suspension | 120 | 12.0 |
| ENG/CU/AUT/CR/7/6 | Servicing vehicle steering systems | 170 | 17 .0 |
| ENG/CU/AUT/CR/8/6 | Servicing vehicle electrical systems | 150 | 15.0 |
| ENG/CU/AUT/CR/9/6 | Industrial attachment | 480 | 48 .0 |
| **Subtotal 3** | | **1560** | **156.0** |
| **Grand total** | | **2420** | **242.0** |

The total duration for this course is 2420 hours.

**Entry Requirements**

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

a) Kenya Certificate of Secondary Education (K.C.S.E.) with a minimum mean grade of C- (C minus)

**Or**

b) Automotive Engineering Technician Level 5 certificate with **one** year of continuous work experience

**Or**

c) Equivalent qualifications as determined by Kenya National

Qualifications Authority (KNQA)

**Industrial attachment**

It is envisaged that the trainee will have undergone an industrial training and assessment with a recognised motor vehicle service garage as a prerequisite for completion of this training 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 internal accredited verifier while external assessment is the responsibility of TVET CDACC.

As part of the continuous internal assessment process, trainees will maintain a portfolio of evidence of their achievements.

**Certification**

On successful completion of a Unit of Learning, a trainee will be issued with a Certificate that acknowledges the achievement of that competence. On successful completion of **all** units of learning, a trainee will be awarded an Automotive Technician Diploma qualification. These certificates will be issued by TVET CDACC in conjunction with training provider.

**BASIC UNITS OF LEARNING**

# COMMUNICATION SKILLS

**UNIT CODE:** ENG/CU/AUT/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/AUT/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/AUT/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/AUT/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/AUT/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/AUT/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**

## TECHNICAL DRAWING

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

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Prepare and Interpret Technical Drawings

**Duration of Unit:** 150hours

**UNIT DESCRIPTION**

This unit covers the competencies required to prepare and interpret technical drawings. It involves selecting, using and maintaining drawing equipment and materials, producing plain geometry drawings, solid geometry drawings, pictorial and orthographic drawings and applying Computer Aided Design (CAD) packages.

**Summary of Learning Outcomes**

1. Use and maintain drawing equipment and materials
2. Produce plane geometry drawings
3. Produce solid geometry drawings
4. Produce orthographic drawings
5. Produce pictorial drawings
6. Produce electrical drawings
7. Apply CAD packages

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Use and maintain drawing equipment and materials | * Identification and care of drawing equipment * Identification and care of drawing materials * Reference to manufacturer’s instructions and work place procedures on use and maintenance of drawing equipment and materials * Reference to relevant environmental legislations * Use of Personal Protective Equipment (PPEs) | * Observation * Oral questioning * Written tests |
| 1. Produce plane geometry drawings | * Types of lines in drawings * Construction of geometric forms e.g. squares, circles * Construction of different angles * Measurement of different angles * Bisection of different angles and lines * Standard drawing conventions | * Oral questioning * Practical tests * Observation |
| 1. Produce solid geometry drawings | * Interpretation of sketches and drawings of patterns e.g. cylinders, prisms and pyramids * Sectioning of solids e.g. prisms, cones * Development and interpenetrations of solids e.g. cylinder to cylinder and cylinder to triangular, prism | * Observation * Practical tests * Oral questioning |
| 1. Produce orthographic drawings and pictorial drawings | * Meaning of pictorial and orthographic drawings * Meaning of sectioning * Meaning of symbols and abbreviations * Drawing and interpretation of orthographic elevations * Dimensioning of orthographic elevations * Sectioning of views * Assembly drawing * Meaning of pictorial drawings * Drawing objects in isometric view * Drawing objects in oblique view | * Observation * Practical tests * Oral questioning |
| 1. Produce electrical drawings | * Electrical symbols and abbreviations * Meaning of electrical drawings * Drawing of electrical diagrams e.g. block, schematic, circuit, line and wiring | * Observation * Oral questioning * Practical tests |
| 1. Apply CAD packages | * Identification of CAD packages e.g. AutoCAD, circuit maker * Use of CAD packages in drawing of: * Plane geometry * Solid * Orthographic * Pictorial * Electrical e.g. block, schematic, circuit, line and wiring | * Observation * Oral questioning * Practical tests |

**Suggested Methods of Instruction**

* Projects
* Demonstration by trainer
* Practice by the trainee
* Discussions

**Recommended Resources**

* Drawing room
* Drawing instruments e.g. T-squares, set squares, drawing sets
* Drawing tables
* Pencils, papers, erasers
* Masking tapes
* Computers installed with relevant CAD packages

# ENGINEERING MATHEMATICS

**UNIT CODE: ENG/CU/AUT/CC/1/6**

**Relationship to Occupational Standards**

*This unit addresses the unit of competency and meets the requirements specified by the Occupational Standards*: **Apply engineering mathematics**

**Duration of Unit:** 150 hours

**Unit Description**

This unit describes the competencies required by a technician in order to apply algebra apply trigonometry and hyperbolic functions, apply complex numbers, apply coordinate geometry, carry out binomial expansion, apply calculus, solve ordinary differential equations, carry out mensuration, apply power series, apply statistics, apply numerical methods, apply vector theory and apply matrix.

**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. Carry out Mensuration
9. Apply Power Series
10. Apply Statistics
11. Apply Numerical methods
12. Apply Vector theory
13. Apply Matrix

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

|  |  |  |
| --- | --- | --- |
| **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 |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 2. Apply Trigonometry and hyperbolic functions | * Half -angle formula * Factor formula * Trigonometric functions * Parametric equations * Relative and absolute measures * Measures calculation * Definition 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    |
| 3. Apply |  Definition of complex |  Assignments |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| complex numbers | 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 | * Oral questioning * Supervised exercises * Written tests |
| 4. 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    |
| 5. Carry out  Binomial  Expansion |  Binomial theorem Power series using binomial theorem Roots of numbers using | * Written tests * Oral questioning * Assignments |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
|  | binomial theorem.   Estimation of errors of small changes using binomial theorem. |  Supervised exercises   |
| 6. Apply Calculus | * Definition of derivatives of a function * Differentiation from fist principle * Tables of some common derivatives * Rules of differentiation * Rate of change and small change * Stationery points of functions of two variables * Definition of integration * Indefinite and definite integral * Methods of integration application of integration. * Integrals of hyperbolic and inverse functions | * Written tests * Oral questioning * Assignments * Supervised exercises    |
| 7. Solve Ordinary differential equations | * Types of first order differential equations * Formation of first order differential equation | * Written tests * Oral questioning * Assignments * Supervised |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
|  | * 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 | exercises |
| 8. Carry out  Mensuration | * Units of measurements * Perimeter and areas of regular figures * Volume of regular solids * Surface area of regular solids * Area of irregular figures * Areas and volumes using Pappus theorem | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 9. Apply Power Series | * Definition of the term power series * Taylor’s theorem * Deduction of   McLaurin’s theorem to obtain power series | * Written tests * Oral questioning * Assignments * Supervised exercises |

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
|  |  Application of Taylor’s theorem and McLaurin’s theorems in numerical work |  |
| 10. Apply Statistics | * Measures of central tendency mean, mode and median * Measures of dispersion * Variance and standard deviation * Definition of probability * Laws of probability * Expectation variance and S.D. * Types of distributions * Mean, variance and SD of probability   distributions   * Application of probability distributions | * Assignments * Oral questioning * Supervised exercises * Written tests * Simulation * Data modelling    |
| 11. Apply Numerical methods | * Definition of interpolation and extrapolation * Application of interpolation * Application of interactive methods to solve equations | * Assignments * Oral questioning * Supervised exercises * Written tests |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
|  |  Application of interactive methods to areas and volumes |  |
| 12. Apply Vector theory | * Vectors and scalar in two and three dimensions * Operations on vectors:   Addition and  Subtraction   * Position vectors * Resolution of vectors | * Assignments * Oral questioning * Supervised exercises * Written tests |
| 13. Apply Matrix methods | * Matrix operation * Determinant of 3x3 matrix * Inverse of 3x3 matrix * Solution of linear simultaneous equations in 3 unknown * Application of matrices | * Assignments * Oral questioning * Supervised exercises * Written tests |

**Suggested Delivery Methods**

* 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

**AUTOMOTIVE ENGINEERING SCIENCE PRINCIPLES**

**UNITCODE: ENG/CU/AUT/CC/3/06**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply Automotive Engineering Science 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 automotive science principles in their work. It involves resolving forces, determining effects of loads in automotive systems, analysing properties of materials determining the nature of friction in automotive systems, solving problems related to motion, applying simple machines concepts, determining the effect of heat and applying the gas laws and using the concept of density and pressure.

**Summary of Learning Outcomes**

1. Resolve forces
2. Determine effects of loads in automotive systems
3. Analyse properties of materials
4. Determine the nature of friction in automotive systems.
5. Solve problems related to motion
6. Apply simple machines concepts
7. Determine the effect of heat and apply the gas laws
8. Use the concept of density and pressure.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment**  **Methods** |
| 1. Resolve forces. | * Define force * State and explain the parallelogram, triangle and polygon of forces theorems * Determine the resultant of coplanar forces * Application of force theorems | * Written tests * Oral questioning * Assignments * Supervised exercises |
| 1. Determine effects of loads in automotive systems | * Define moment of a force about an axis * Analysis of point loads and reaction Calculations. * State the principle of moments * Determination of center of gravity * Application of moments to automotive systems | * Written tests * Oral questioning * Assignments * Supervised exercises. * Practical tests |
| 1. Analyse properties of materials | * Definition of mechanical properties of materials * Draw the stress strain graph * Carry out material testing * Determine factors affecting choice of materials. * Calculate direct, shear and torsion stress in materials | * Assignments * Oral questioning * Supervised exercises * Written tests. * Practical tests |
| 1. Determine the nature of friction in automotive systems | * Definition of friction * State the laws of friction * State the effects of friction * Calculate the force to overcome friction on horizontal and inclined planes, bearings, brakes, belts, and clutch | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Solve problems related to motion | * Definition of terms related to motion * State newton’s laws of motion, law of conservation   of momentum   * Calculate: velocity, acceleration, momentum, impulse, inertia force and simple harmonic motion. * Draw velocity time graphs. * Determine relationship between linear and angular motion. * Analyze motion of a vehicle on a curved and banked track | * Assignments * Supervised exercises * Written tests * Practical test |
| 1. Apply simple machines concepts in automotive engineering | * Definition of: work, power energy, mechanical advantage, velocity ratio and efficiency. * Describe simple machines: gears, levers, pulleys, screw jack, and wheel and axle. * Apply the law of machine. * Determination of work, energy, power, mechanical advantage, velocity ratio and efficiency | * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |
| 1. Determine the effect of heat and apply the gas laws | * Definition of heat, temperature and heat capacity * Explain the effect of heat on matter. * Describe modes of heat * transfer * State the gas laws. * Measure quantity of heat and temperature. * Solve problems on heat and gases. | * Assignments * Supervised exercises * Written tests * Practical test * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises   Written tests |
| 1. Use the concept of density and pressure. | * Define density, relative density and pressure. * Measure density, relative density and pressure using appropriate instruments. * State Archimedes principle and the law of floatation. * Calculate problems on * density, relative density and pressure. * Application of pressure in brakes, pumps, jacks and other engineering systems. | * Written test * Assignments * Oral questioning * Practical tests * Observation * Supervised exercises * Written tests |

**Suggested Methods of Instruction**

* Group discussions
* Demonstration by trainer
* Online videos
* Power point presentation
* Exercises by trainee

**Recommended Resources**

* Scientific Calculators
* Relevant reference materials
* Stationeries
* Automotive workshop
* Relevant practical materials
* Laboratories
* Internet

# WORKKSHOP TECHNOLOGY PRINCIPLES

**UNIT CODE:** ENG/CU/AUT/CC/04/6

**Relationship to Occupational Standards:**

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

**Duration of Unit**: 240 Hours

**Unit description**

This unit describes the competencies required to workshop technology skills. It involves using technical drawing to plan work operations, choosing of appropriate tools and materials, measuring and marking out dimensions on work pieces ,using hand tools to cut and file parts , using drills to make holes, threading using taps and dies, producing components using a lathe machine, assembling metal parts and sub-assemblies, polishing finished work, performing housekeeping, inspecting finished work for accuracy and quality and maintaining tools and equipment.

**Summary of Learning Outcome**

1. Use technical drawing to plan work operations
2. Choosing of 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. Assemble metal parts and sub-assemblies
9. Polish finished work
10. Perform housekeeping
11. Inspect finished work for accuracy and quality
12. Maintenance of tools and equipment

**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 (dimensions, tolerances, BS/ANSI Drawing Standards, geometric ISO symbols & abbreviations) * Development of working procedure/ operational plan | * Administration of written and oral tests * Assessment of worksheet/ operation plans |
| 2. Choosing of appropriate tools and materials | * Types of hand tools * Using hand tools. * Using 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 | * Observation of correct selection of tools for specific operation * Observation of inspection and/or recalibration of tools * Observation of appropriate handling of tools * Administration of oral and written questions |
| 3. Measure and mark out dimensions on work pieces | * Use of marking out tools * Laying out work piece(s) * Transfer of dimensions onto the work piece(s) | * Observation of laying out of work piece(s) * Assessment of transferred   dimensions   * Administration of oral and written questions |
| 4. Use hand  tools to cut and file parts | * Types of hand tools * Uses of hand tools * Selection of tools as per the specific operation * Inspection and/or recalibration of tools * Demonstration of correct handling of tools | * Observation of correct selection of tools for specific operation * Observation of inspection and/or recalibration of tools * Observation of appropriate handling of tools * Administration of oral and written questions |
| 5. Use drills to make holes | * Marking and centre punching the hole * Selecting and mounting   drill bits   * Mounting and clamping work pieces * Drilling hole to specification * Inspecting the hole | * Observation of degree of surface finish * Assessment of finished surface(s) using   inspection tools   * Assessment of finished surface(s) |
| 6. Thread using taps and dies | * Selecting taps and dies based on operation plan * Setting up the taps and dies * Cutting threads to specifications | * Observation of the joined or fitted parts * Assessment of the   joined or fitted parts   * Assessment of * functionality |
| 7. Produce components  using a lathe machine | * Cleaning of work environment (waste sorting and disposal) * Cleaning and storing of tools and equipment * Servicing and maintenance of machine (lubrication, inspection, alignment and adjustment) | * Observation of servicing and maintenance of the machine * Observation of clean working environment * Observation clean and stored tools and equipment |
| 8. Assemble  metal parts and subassemblies | * fitting parts * Quality control * (Dimensions, Tolerances, surface finishing, Alignment) | * Observation of the joined or fitted parts * Assessment of the visually   joined or fitted parts   * Assessment of functionality |
| 9. Polish finished work | * Polishing * Cleaning | * Assessing polishing and cleaning of parts |
| 10. Perform housekeeping | * Cleaning of work environment (waste sorting and disposal) * Cleaning and storing of tools and equipment * Servicing and maintenance of machine (lubrication, inspection, alignment and | * Observation of cleaned working environment * Observation of cleaned and stored sheet metal tools and equipment |
| 11. Inspect finished work for accuracy and quality | * Measuring * Surface finishing * Functionality | * Assessing measurements, finishing and functionality of machined parts |
| 12. Maintenance of tools and equipment | * Cleaning tools and equipment after operations * Servicing and maintenance of tools and equipment (lubrication, inspection, alignment and adjustment, coolant, safety guard) | * Observation of cleaning of lathe machine tool * Observation of servicing and maintenance of tools and   Equipment  Administration of oral and written tests |

**Suggested Methods of Instruction**

* Demonstration by trainer
* Discussions
* Practical work by trainee(s)
* Exercises
* Industrials visits
* Internet.
* Simulation

**List of Recommended Resources**

**Tools and equipment suggested but not limited to:**

* Welding
* Drilling machines
* Vices
* Burnishing machine
* Cutting tools
* Combination square
* Centre punch
* Centre lathe
* scribers
* 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 and NOT GO gauges
* Jigs and fixture
* Pliers
* Rotary disc abrasive grinder
* Reamers
* Saw
* Screwdrivers
* Spiral lowering
* Tap wrench
* Vacuum cleaners
* V-block
* Workbenches
* Vacuum cleaners
* Mops/ Brooms and buckets
* Firefighting equipment
* First Aid kit

**Materials and supplies suggested but not limited to:**

* Personal safety gear:
* Goggles
* Safety shoes
* Overall
* Cap
* Ear Muffs
* Gloves
* 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 detergents

# CORE UNITS OF LEARNING

# PERFORMING VEHICLE BASIC MAINTENANCE

**UNIT CODE:** ENG/CU/AUT/CR/1/6

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Perform Vehicle Basic Maintenance.

**Duration of Unit:** 120hours

**Unit description**

This unit specifies the competencies required to perform vehicle basic maintenance. It involves assessing vehicle mechanical and operational condition, carrying out diagnosis tests, servicing vehicle lubrication system, replenishing fluids and lubrications, replacing vehicle service parts, conducting road tests carrying out adjustments o vehicle components and systems, servicing vehicle wheels and tyres and finalising service and repair procedure.

**Summary of Learning Outcomes**

1. Assess vehicle mechanical and operational condition
2. Carry out diagnostic tests
3. Service vehicle lubrication system
4. Replenish fluids and lubricants
5. Replace/service vehicle service parts
6. Conduct road tests
7. Carry out adjustments to vehicle components and systems
8. Service Vehicle Wheels and Tyres
9. Finalize service and repair procedures.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Assess vehicle mechanical and operational condition. | * Preparing periodic maintenance schedule * Preparing work area * Assessment methods * OSHA 2007 * Conducive working environment e.g. appropriate ventilations, free from fumes and poisonous gases * use of personal protective equipment and clothing   (PPE)   * selection and use of appropriate tools and   equipment   * use of protective covering to prevent damage to vehicles * Draining and disposal of used oils * Disposing of scrap components * Preparing mechanical and operational assessment report | * Observation * Written * Oral |
| 1. Carry out diagnostic tests | * Identifying sources of technical information and regulations * Identifying vehicle system codes * Assessing condition and performance of the vehicle system * Identifying defects using diagnostic equipment Adhering to manufacturers’ specifications and guidelines * Proper use of diagnostic machine in the vehicle Adhering to agreed timescales and completion * times * Keeping customers informed of progress Preparing diagnostic assessment report Maintenance * documentation and records | * Observation * Written * Oral |
| 1. Service vehicle lubrication system | * Diagnosing vehicle lubrication system Replacing Engine * transmission and hydraulic filters * Greasing vehicle components * Testing lubrication system pressure | * Practical * Oral * Observation * Written |
| 1. Replenish fluids and lubricants. | * Identification and selection of appropriate tools, equipment, vehicle and personal protective equipment; * Assessment methods used to check for vehicle conformity; * Identification of the different systems to be inspected including: * Engine * Chassis * Brakes * Wheels and tyres * Steering and suspension * Transmission and driveline * Electrical and electronics * Exterior vehicle body * Vehicle interior Use of approved inspection checklists and recording documentation. | * Practical exercises with observation checklists conducted by trainer. * Oral questioning with checklist conducted by trainer to assess underpinning knowledge. * Short tests to assess underpinning knowledge. * Learner portfolio of evidence |
| 1. Replace/service vehicle service parts. | * Identification of appropriate diagnostic equipment and instrumentation; The importance of equipment calibration before use; * Identification of systems to be tested including: * Battery and charging; * Fuel; * Ignition; * Engine management; * Exhaust emission; * Lighting; * Electrical and electronics; Steering and suspension * geometry * Air-conditioning. Procedures for carrying out diagnostic tests and identification of faults Carrying out adjustments in accordance with manufacturers specifications * Rectification of identified faults to restore performance to original specifications * The use of checklists and recording documentation. | * Practical exercises with observation checklists conducted by trainer. * Oral questioning with checklist conducted by trainer to assess. * Underpinning knowledge. Short answer written tests to assess underpinning knowledge. Learner portfolio of evidence |
| 1. Conduct road tests. | * The use of manufacturers’ specifications to identify the correct types and grades of lubricants and fluids for systems including: * Brakes and clutch operation; * Power assisted steering; * Cooling system; * Windscreen washers; * Diesel engine emission control. * Lubricants and fluids replenished to the levels and quantities as specified by the manufactures * Protective measures to avoid spillage that may damage the vehicle and cause a safety and health hazard * Identification of service parts that should be replaced as part of routine maintenance including: * Oil, fuel, air and diesel exhaust filters; * Wiper blades; * Spark plugs; * Brake pads/linings; * Drive belts; * Seals and gaskets. * The use of manufacturers’ 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; * 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. | * Practical exercises with observation checklists conducted by trainer. * Oral questioning with checklist conducted by trainer to assess underpinning knowledge. * Short answer written tests to assess underpinning knowledge. * Learner portfolio of evidence |
| 1. Carry out adjustments to vehicle components and systems. | * Use of manufacturers technical information to identify operating specifications and tolerances; Special tools and equipment for checking and carrying out adjustments; Identification of components and systems that are to be checked and adjusted including: Valve clearances; * Spark plug gaps; * Exhaust emission settings; Wheel, steering and suspension alignment; Headlight alignment; * Drive belt tension; * Engine idling speed; Lubricants and fluid * levels; fuel pressure; * Brake clearances; * Tyre rotation; * Wheel balancing. * The use of approved checklists and documentation to record checks and adjustments carried out. | * Practical exercises with observation checklists conducted by trainer. * Oral questioning with checklist conducted by trainer to assess underpinning knowledge. * Short answer written tests to assess underpinning knowledge. * Learner portfolio of evidence. |
| 1. Service Vehicle   Wheels and  Tyres | * 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 | * Practical * Observations |
| 1. Finalize service and repair procedures. | * All maintenance activities completed within an agreed timescale; The vehicle interior and exterior clean and presentable in compliance with company policy; A report for the customer that includes all the work that was carried out during the routine maintenance, * including results of assessments, rectifications and replaced parts; 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. | * Practical exercises with observation checklists conducted by trainer. * Oral questioning with checklist conducted by trainer to assess underpinning knowledge. * Short tests to assess underpinning knowledge. * Learner portfolio of evidence. |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

Comprehensive set of hand tools for motor vehicle maintenance and repair.

**Equipment**

* A fully equipped motor vehicle maintenance workshop;
* Fully functional light vehicle(s);
* Vehicle lift;
* Specialist tools and diagnostic equipment appropriate for the different makes of vehicles that are being maintained;
* Exhaust emission tester;
* Headlamp alignment equipment;
* Internet access to manufacturers’ technical information;
* Torque setting tools;
* Personal protective equipment (PPE) and suitable coverings to protect vehicles;
* Facilities for the disposal of waste oil and used parts;
* Customer database and systems for recording maintenance records.

**Materials and supplies**

Consumables for maintaining light vehicles including:

* Engine and transmission lubricants;
* Fluids for cooling systems, brakes, clutch, windscreen washer, hydraulic power assisted steering and diesel engine exhaust emission control;

Replacement parts including:

* 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.

**Reference materials**

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

# SERVICING AND REPAIRING VEHICLE ENGINE COMPONENTS

**UNIT CODE: ENG/AUT/CR/2/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Service and Repair Vehicle Engine components

**Duration of Unit:** 170 hours

**Unit Description:**

This unit describes the competencies required in service and repair vehicle engine components. It involves troubleshooting and servicing vehicle engine components, performing vehicle engine overhaul, servicing vehicle engine cooling system, servicing vehicle engine exhaust system and lubricating vehicle engine system

**Summary of Learning Outcomes:**

1. Troubleshoot and service vehicle engine components
2. Perform vehicle engine overhaul
3. Service vehicle engine cooling system
4. Service vehicle engine exhaust system
5. Lubricate vehicle engine system

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Troubleshoot vehicle engine components conditions | * Use of Personal protective equipment (PPE) * Health and safety regulations * Engine removal * Dismantling of engine * Engine parts * Servicing engine parts * Reassembling of engine parts * Engine fitting * Re-installation checks | * Practical * Oral * questioning * • Written test |
| 1. Perform vehicle engine Overhaul | * Replacement of Engine oil seals Replacement of Engine oil rings/ piston gudgeon pin Replacement of Timing * belts/chains * Replacement of Engine bearings * Replacement of Engine pulleys * Replacement of Engine V-belts * Replacement of Engine gaskets * Servicing Engine blocks * Replacement of Water/oil pump * Adjustment of Tappet clearance * Replacement of Engine camshaft * Grinding Valve seats * Replacement of Valve guides * Replacement of Oil sump/strainer/PCV * Replacement of Engine mountings * Performing Engine tune up | * Practical * Observation * Written tests * • Writing reports |
| 1. Service vehicle engine cooling System | * Checking and testing Radiator cap * Checking and testing cooling radiator * Checking and testing cooling system hoses * Checking and testing thermostat operations * Checking and testing thermistor switches/ sensors * Checking and testing water pump * Checking and testing cooling fan operation * Checking and testing cooling system * bleeding cooling system reading vehicle engine coolant * replenishing coolant | * Practical * Oral * Short tests * Learner * portfolio of evidence. |
| 1. Service vehicle engine exhaust system | * Checking leakage * Checking blockage * Checking and testing catalytic converter/ particulate filters * Repairing exhaust system leaks Installing and mounting exhaust system * Checking and testing oxygen sensor | * Practical * Oral * Short tests * Learner * portfolio of evidence |
| 1. Lubricate vehicle engine system | * Draining and replacing engine oil * Replacing engine transmission * and hydraulic filters Greasing light vehicle * components * Greasing heavy commercial vehicle components * Greasing Heavy machinery * Reading Lubricants | * Practical * Oral * Short tests * Learner * portfolio of evidence. |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

* Comprehensive set of hand tools for the service and repair of motor vehicle Engines.

**Equipment**

* Engine instructional models;
* A fully equipped motor vehicle maintenance workshop;
* Fully functional vehicle(s);
* Functional engines;
* Engine components;
* Vehicle lift/inspection pit;
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle engines that are being maintained;
* Internet access to manufacturers’ technical information/data
* Torque setting tools;
* Personal protective equipment (PPE) and suitable coverings to protect vehicles;
* Vehicle protective coverings;
* Facilities for the disposal of waste oil and used parts;
* Customer database and systems for recording maintenance records.

**Materials and supplies**

* Digital instructional material including DVDs and CDs;
* Consumables for service and repair of vehicle engines including:
* Engine lubricants;
* Sealants, oil seals and gaskets;
* Cleaning materials;
* Hand cleaner;
* Cotton waste for cleaning

**Reference materials**

* Manufacturers service manuals for the vehicles that are being serviced;
* Appropriate automotive engineering text books available on numerous websites e.g.

# SERVICING VEHICLE FUEL SYSTEM

**UNIT CODE: ENG/CU/AUT/CR/3/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competencyService Vehicle Fuel System

**Duration of Unit:** 150hours

**Unit Description:**

This unit describes the competencies required to service vehicle fuel system. It involves servicing fuel components, replacing petrol fuel pump and diesel injector pump, performing injector timing, testing injectors for pressure and voltage.

**Summary of Learning Outcomes:**

By the end of the unit, the trainee should be able to:

1. Service fuel components e.g. injectors, tank
2. Replace petrol fuel pump
3. Replace diesel injector pump, rail, pipes and nozzles.
4. Perform injector pump timing
5. Test fuel injectors for injection pressure and voltage

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| Service fuel components e.g. injectors, tank. | * The observance of Kenyan regulations concerned with health, safety and the environment; Disposal of faulty components * The use of personal protective equipment and clothing (PPE) used throughout work activities; Components of vehicle fuel system * Tools and equipment for servicing fuel system Troubleshooting of fuel system * Dismantling of the fuel system of the vehicle Use of technical data in servicing and repairing components. | * Practical exercise * Oral questioning * Learner portfolio of evidence |
| Replace petrol fuel pump | * Functions of the petrol fuel pump. * Principle of operation of the pump * Structure of the pump * Servicing and fitting of the pump in the vehicle fuel system * Precautions when handling petrol fuel pump. | Observation  Practical  Projects |
| Replace diesel injector pump, rail, pipes and nozzles. | * Functions of the * Diesel injector pump * Rail * Fuel pipes * Nozzles * Principle of operation of the: * Diesel injector pump * Rail * Fuel pipes * Nozzles * Structure of the pump * Injector pump * Rail * Fuel pipes * Nozzles * Servicing and fitting of the diesel pump components in the vehicle fuel system * Precautions when handling petrol fuel pump | * Practical exercises * Oral questioning Written tests * Learner portfolio of evidence. |
| Perform injector pump timing | * Definition of the injector pump timing * Importance of the injector * pump timing * Injector timing units Tools and equipment for injector pump timing | * Practical exercises * Oral questioning |
| Test fuel injectors for injection pressure and voltage | * Tools and equipment for testing * Manufacturer’s specification in setting pressure and voltage Procedure for testing voltage and pressure for * fuel injectors Default voltage and pressure for fuel injectors. | * Practical exercises * Oral questioning * Learner portfolio of evidence. * Observation |

**Suggested Methods of Instruction**

* + 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:
  + Visiting lecturer/trainer from the motor vehicle service and repair sector;
  + Industrial visits.

**Recommended Resources**

**Tools**

* + Comprehensive set of hand tools for the service and repair of motor vehicle auxiliary systems

**Equipment**

* + A fully equipped motor vehicle maintenance workshop;
  + Fully functional vehicle(s)
  + Functional fuel system;
  + Fuel system components and units;
  + Vehicle lift/inspection pit;
  + Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle that are being maintained;
  + Internet access to manufacturers’ technical information;
  + Torque setting tools;
  + Personal protective equipment (PPE) and suitable coverings to protect vehicles;
  + Facilities for the disposal of waste oil and used parts;
  + Customer database and systems for recording maintenance records.

**Materials and supplies**

* + Digital instructional material including DVDs and CDs;  Consumables for service and repair of vehicle auxiliary systems including;
  + Oil seals and gaskets;
  + Coolants;
  + Cleaning materials;  Hand cleaner;
  + Dusters.

**Reference materials**

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

# SERVICING VEHICLE TRANSMISSION SYSTEMS

**UNIT CODE: ENG/CU/AUT/CR/4/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Service Vehicle Transmission Systems.

**Duration of Unit:** 150hours

**Unit Description**

This unit specifies competencies required to service vehicle transmission system.

It involves preparing to service vehicle transmission systems, removing, assessing, repairing/replacing and testing the vehicle transmission system.

**Summary of Learning Outcomes**

1. Organize to service vehicle
2. Troubleshoot vehicle transmission system
3. Overhaul gearbox (manual)
4. Overhaul gearbox (semi/ automatic)
5. Carry out hydraulic/ Tiptronic
6. system tests and measurements.

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Methods** |
| 1. Organize to service vehicle | * The observance of Kenyan regulations concerned with health, safety and the environment; * The adoption of safe working practices to avoid injury and the prevention of damage to vehicles and property; * The use of personal protective equipment and clothing (PPE) used throughout work activities; * The selection and use of appropriate tools and equipment relevant to all * activities; * Steps taken to avoid spillage of fluids that may cause personal injury and damage vehicles; * The use of protective covering to prevent damage to vehicles; * The disposal of scrap * components, waste oils and fluids in accordance with current legal requirements and company policy. | * Practical * Oral questioning Written tests * Learner portfolio of evidence. |
| 1. Troubleshoot vehicle transmission system | * How transmission systems and their related units and components are constructed and operate; * The importance of using appropriate technical information for the removal of units; * Cleaning of components to facilitate inspection and * assessment * Correct methods and procedures of inspecting and assessing transmission components including: * Damage; Wear; * Fracture. Troubleshooting techniques * Evaluation of components for: * Serviceability; * Unserviceability; * Need for replacement; * Need for adjustment | * Written tests * Observation * Report writing * Practical |
| 1. Overhaul gearbox unit 2. (manual) | * How transmission units and components are removed and replaced for the type of vehicle worked upon. Units include: * Manual friction clutch; * Torque converter; * Manual gearbox; * Propeller shaft and centre; * support bearing; * Drive shafts; * Final drive; * Differential; * Transaxle * Vehicle transmission * components Bearings; * Wheel hubs; * Gears; * Synchronizer; * Gearbox shafts and thrust plates; * Gear selectors, sensors and linkages; * Constant velocity (CV) and universal joints (UJ); * Clutch assemblies release bearings; * Transmission unit mountings. * Correct methods and procedures for dismantling transmission units; * Importance of the use of manufactures’ part numbers for replacement parts * Assembling of components in accordance with manufacturers’ procedures including: * Torque setting; * Clearances; * Adjustments; * End-float; * Tolerances. * Selection and use of gaskets, sealants, seals, fittings and fasteners | * Practical * Oral questioning * Short tests to assess underpinning knowledge. * Learner portfolio of evidence. |
| 1. Overhaul gearbox unit (semi/ automatic) | * How transmission systems and their related units and components are constructed and operated Importance of the use of manufactures’ part numbers for replacement parts; * Reassembling components in accordance with manufacturers’ procedures including: * Torque setting; * Clearances; * Adjustments; End-float; Tolerances. * Selection and use of gaskets, sealants, seals, * fittings and fasteners; Transmission components Units include: * Torque converter; * Semi/ automatic gearbox; * Front clutch * Rear clutch * Front brake band * Rear brake band * Sun wheel gear * Planetary gear * Carrier gear * Pressure pump * Shift valve | * Practical exercises * Oral questioning * Learner portfolio of evidence. |
| 1. Carry out hydraulic/ tiptronic system tests and measurements | * Types of post vehicle transmission system tests * Importance of testing after reassembly. * The importance of completing all service and repair activities within an agreed timescale. | * Practical exercises * Oral questioning Short tests to assess under knowledge. * Learner portfolio of evidence. |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

* Comprehensive set of hand tools for the service and repair of motor vehicle transmission systems.

**Equipment**

* Transmission Instructiona
* A fully equipped motor vehicle maintenance workshop;
* Fully functional light vehicle(s);
* Transmission units;
* Vehicle lift/inspection pit;
* Gearbox jack;
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle transmission systems that are being maintained;
* Automatic transmission test equipment;
* Internet access to manufacturers’ technical information;
* Torque setting tools;
* Personal protective equipment (PPE) and suitable coverings to protect vehicles;
* Facilities for the disposal of waste oil and used parts;
* Customer database and systems for recording maintenance records

**Materials and supplies**

* Digital instructional material including DVDs and CDs
* Consumables for service and repair of vehicle transmission systems including:
* Transmission lubricants
* Oil seals and gaskets
* Cleaning materials
* Hand cleaner
* Dusters

**Reference materials**

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

# SERVICING VEHICLE STEERING SYSTEMS

**UNIT CODE: ENG/CU/AUT/CR/5/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competencyService Vehicle Steering System.

**Duration of Unit:** 120 hours

**Unit Description:**

This unit specifies competencies required to service vehicle steering system. It involves assessment, removal, servicing and replacement of vehicle steering components. It also involves fitting and testing vehicle steering components and documenting vehicle steering service.

**Summary of Learning Outcomes:**

1. Assess vehicle steering system
2. Remove steering components
3. Assess serviceability of vehicle.
4. Replace/service vehicle steering.
5. Fit and test vehicle steering components.
6. Document vehicle steering system service

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Method** |
| Assess vehicle steering system | * The observance of Kenyan regulations concerned with health, safety and the environment; * The use of personal protective equipment and clothing (PPE) used throughout work activities; * The disposal of scrap components, waste oils and fluids in accordance with current legal requirements and company policy. * Functions of steering system in the vehicle * Types of steering systems * Conventional * Twin-axle | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Remove  steering components | * Functions of steering system * Components of steering system * Layout of various steering * systems * Tools and equipment for servicing steering system * Dismantling of the steering * system * Safety precautions in servicing steering system Disposal of faulty components | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Assess serviceability of vehicle. | * Diagnosis and servicing of * steering gearbox Worm and wheel * Worm and sector * Worm and nut * Worm and roller * Recirculating * Rack and pinion Diagnosis, service and replacement of steering * systems Conventional * Power assisted * Leakages * Over steering * Under steering * Power * Components of four wheel steering system | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Replace/service vehicle steering | * The importance of using appropriate technical information as a guide for assessment; * Correct methods and procedures for dismantling steering units; * Cleaning of components to facilitate inspection and assessment of components; Using visual and measurement methods and procedures for inspecting and assessing components for: * Damage; * Wear; * Corrosion; Fracture; * Distortion. * Evaluate components for: * Serviceability; * Unserviceability * Tolerances; * Need for replacement; * Need for adjustment. * Importance of the use of manufactures’ part numbers for replacement parts; * Selection and use of gaskets, seals, shims, fittings and fasteners; * Steering wheel centralisation; * Test and evaluate the performance of the steering units and components after reassembly. | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Fit and test vehicle steering components | * The selection and use of appropriate tools and equipment for the replacement of suspension and steering units; * Replacement of steering units and components. * Securing and adjusting external linkages, * connections and operating mechanisms; * Replenish lubricants and fluids as prescribed; * Testing and components for satisfactory operation; * Setting steering geometry | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence |
| Document vehicle steering system service | * Importance of testing vehicle steering system. * Types of tests done on steering system. * Data analyzation and report writing. * The importance of completing all service and repair activities within an agreed timescale and keeping others informed of progress | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

Comprehensive set of hand tools for the service and repair of motor vehicle suspension and steering systems.

**Equipment**

* Steering systems instructional models
* A fully equipped motor vehicle maintenance workshop
* Fully functional light vehicle(s)
* Steering units
* Vehicle lift/inspection pit,
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle that are being worked on;
* Steering geometry measurement equipment;
* Internet access to manufacturers’ technical information
* Torque setting tools
* Personal protective equipment (PPE) and suitable coverings to protect vehicles.
* Facilities for the disposal of waste oil and used parts;
* Customer database and systems for recording maintenance records

**Materials and supplies**

Digital instructional material including DVDs and CDs

Consumables for service and repair of suspension and steering systems including:

* Steering and suspension lubricants including grease
* Power assisted steering fluid
* Oil seals and gaskets
* Cleaning materials
* Hand cleaner
* Dusters

**Reference materials**

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

# SERVICING VEHICLE SUSPENSION SYSTEMS

**UNIT CODE: ENG/CU/AUT/CR/6/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competency:Service Vehicle Suspension.

**Duration of Unit:** 120 hours

**Unit description:**

This unit specifies competencies required to service vehicle suspension system. It involves assessment, removal, servicing and replacement of vehicle suspension components. It also involves fitting and testing vehicle suspension components and documenting vehicle suspension service.

**Summary of Learning Outcomes:**

1. Assess vehicle suspension system.
2. Remove vehicle suspension components.
3. Assess vehicle suspension components serviceability.
4. Replace/service vehicle suspension components.
5. Fit and test vehicle suspension components.
6. Vehicle suspension system service documentation

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment Method** |
| Assess vehicle suspension system | * The observance of Kenyan regulations concerned with health, safety and the environment; * The use of personal protective equipment and clothing (PPE) used throughout work activities; * The disposal of scrap components, waste oils and fluids in accordance with current legal requirements and company policy. * Functions of suspension system in the vehicle * Types of suspension systems * MacPherson strut * Wishbone * Construction * Operation * Suspension units in a vehicle Springs * Arms * Dampers * Air suspension * Hydra gas * Hydro pneumatic * Hydraulic suspension * Rubber suspension * Hydrolastic | * Practical exercises * Oral questioning * Written test * Learner * portfolio of evidence. |
| Remove vehicle suspension components. | * The importance of using appropriate technical information throughout servicing and repair * activities; * Identification and selection of appropriate tools, equipment, and personal protective when removing suspension units and components; * Correct methods and procedures for the removal of suspension units. * The layout and operation of suspension systems; * The construction and   operation of suspension systems units including:   * Suspension coil and leaf springs; * Torsion bar spring; * Suspension dampers; * Suspension struts; * Control arms; * Tie rods; * Anti-roll bar; * Hydro-Pneumatic and control unit; | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Assess vehicle suspension components serviceability. | * Troubleshooting vehicle suspension components * Tools and equipment for troubleshooting vehicle suspension system * Using visual and measurement methods and procedures for inspecting and assessing components for: * Damage; * Wear; * Corrosion; * Fracture; * Distortion. * Servicing vehicle suspension system * Materials used in servicing vehicle suspension system * Disposal of faulty vehicle suspension system | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Replace/service vehicle suspension components. | * Cleaning of components to facilitate inspection and assessment of components * Evaluate components for: * Serviceability; * Unserviceability; * Tolerances; * Need for replacement; * Need for adjustment. * Components reassembled in accordance with manufacturers’ procedures, * torque settings and adjustments; * Importance of the use of manufactures’ part numbers for replacement parts; * Selection and use of gaskets, seals, shims, fittings and fasteners; * Test and evaluate the performance of the suspension and steering units and components after reassembly. | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence. |
| Fit and test vehicle suspension components. | * The selection and use of appropriate tools and equipment for the replacement of suspension and steering units; Procedure of replacing suspension * Securing and adjusting external linkages, connections and operating mechanisms; * Replenishing of lubricants and fluids. * Setting of suspension geometry. | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence |
| Vehicle suspension system service documentation | * Importance of testing vehicle suspension system. * Types of tests done on suspension system * Data analyzation and report writing. * The importance of completing all service and repair activities within an agreed timescale and keeping others informed of progress | * Practical exercises * Oral questioning * Written test * Learner portfolio of evidence |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

Comprehensive set of hand tools for the service and repair of motor vehicle suspension and steering systems.

**Tools**

Comprehensive set of hand tools for the service and repair of motor vehicle suspension and steering systems.

**Equipment**

* Suspension systems instructi
* A fully equipped motor vehicle maintenance workshop
* Fully functional light vehicle(s)
* Suspension units
* Vehicle lift/inspection pit,
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle that are being worked on;
* Internet access to manufacturers’ technical information
* Torque setting tools
* Personal protective equipment (PPE) and suitable coverings to protect vehicles.
* Facilities for the disposal of waste oil and used parts;
* Customer database and systems for recording maintenance records

**Materials and supplies**

Digital instructional material including DVDs and CDs

Consumables for service and repair of suspension and steering systems including:

* Steering and suspension lubricants including grease
* Power assisted steering fluid
* Oil seals and gaskets
* Cleaning materials
* Hand cleaner
* Dusters

**Tools**

Comprehensive set of hand tools for the service and repair of motor vehicle suspension and steering systems.

**Reference materials**

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

# SERVICING VEHICLE BRAKING SYSTEMS

**UNIT CODE: ENG/CU/AUT/CR/7/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Service Vehicle Braking Systems.

**Duration of Unit:** 240hours

**Unit Description**

This unit specifies competencies required to service motor vehicle braking system. It involves, assessing, servicing, replacing or repairing and maintaining vehicle braking units and components. It includes final testing to ensure satisfactory operation to the customer’s specification.

**Summary of Learning Outcomes**

1. Assess vehicle braking system
2. Dismantle wheel brake assembly parts
3. Assess braking components
4. Replace brake units and components
5. Replace brake cylinders
6. Service brake system

**Learning Outcomes, Content and**

**Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment**  **Method** |
| 1. Assess vehicle braking system | * Selection and use of appropriate tools and equipment * Kenyan health and safety regulations * Safe working practices * Conducive working environment e.g. Ventilation, dust and fumes free * Personal protective equipment(PPE) and clothing * Work area cleaning • Motor vehicle cleaning. * Brake fluid draining and disposed * • Steps taken to avoid spillage of fluids and damage to vehicles | * Observation * Written * • Oral |
| 1. Dismantle wheel brake assembly parts | * The construction and operation of the following types of braking systems:   + Mechanical brakes;   + Hydraulic brakes;   + Pneumatic brakes • Antilock brakes; • Traction control.   + Using appropriate technical information   + Methods and procedures for the removal of brake   + units;   + The operation of the following components:   + Master cylinders;   + Wheel cylinders;   + Brake lines;   + Brake servo units;   + Brake discs;   + Callipers;   + Brake pads;   + Brake pedal;   + Drum;   + Shoes and lining;   + Brake adjusters;   + Brake sensors and   + actuators;   + ABS unit;   + Parking brake cable;   + Hydraulic brake fluid. | • Observation  • Written  Oral |
| 1. Assess braking components | * Methods and procedures for disassembling braking system * Cleaning braking components for inspection and assessment * Methods and procedures of inspecting and assessing braking components * Evaluating brake components for: * Serviceability, * Unserviceability, * Need for replacement, * Need for adjustment * Replacing worn out and damage components * Assembling of braking components * Selection and use of seals, fittings and fasteners; * Test and evaluate the performance of brake units and components after reassembly. | * Observation * Written * • Oral |
| 1. Replace brake units and components. | * Manufacturers’ technical specification replacing braking units and components * Replacing braking units and components * Replacing brake pads and * linings * Replacing Brake callipers and drum * Replacing Brake flexible pipes * Replacing Brake adjusters/actuators (HCV) * Servicing Parking brake * Replenishing brake fluids • Use of manufactures’ part numbers for replacement parts * Testing braking units and components | * Observation * Written * Oral |
| 1. Replace brake cylinders | * Replacing Brake master cylinder * Servicing Brake booster | * Observation * Written * Oral |
| 1. Service brake system | * Assembling Drum/disc brakes * Replenishing and bleeding * Brake fluid * Servicing Brake booster and ABS system * Adjusting Braking * (Dynamometer test) * Servicing Auxiliary brakes * Conducting Vehicle Road * test * Adhering to Service and repair time frame * Documentation of Service and repair | * Observation * Written * Oral |

**Suggested Methods of Instruction**

* Presentations and practical demonstrations by trainer
* Guided learner activities
* Research project assignments
* Supervised activities and projects in a workshop
* The delivery may also be supplemented and enhanced by the following, if the opportunity allows:
* Visiting expert worker from the motor vehicle service and repair sector
* Industrial visits.

**Recommended Resources**

**Tools**

* Comprehensive set of hand and power tools for the service and repair of motor vehicle brake system **Equipment**
* Brake system A fully equipped motor vehicle maintenance workshop
* Fully functional vehicle(s)
* Brake units
* Vehicle lift/inspection pit
* Jack and stands
* Brake testers/platform /roller
* Specialist tools and diagnostic equipment appropriate for the different makes and types of vehicle braking systems that are being maintained
* Internet access to manufacturers’ technical information
* Torque setting tools
* Personal protective equipment (PPE) and suitable coverings to

protect vehicles

* Facilities for the disposal of waste brake fluid and used parts
* Customer database and systems for recording maintenance records

**Materials and supplies**

* Digital instructional material including DVDs and CDs;
* Brake fluids;
* Lubricants;
* Seals, fasteners and fittings;
* Cleaning materials;
* Hand cleaner;
* Dusters;
* Vehicle protective covering

**Reference materials**

* Manufacturers service manuals for the vehicles

# SERVICING VEHICLE ELECTRICAL SYSTEMS

**UNIT CODE: ENG/CU/AUT/CR/8/6**

**Relationship to Occupational Standards**

This unit addresses the unit of competency:Service Vehicle Electrical Systems

**Duration of Unit: 120** hours

**Unit Description:**

This unit specifies competencies required to service vehicle electrical systems. It involves diagnosing electrical systems and servicing ignition, electrical accessories, air conditioning, auxiliary, lighting and vehicle electrical motors systems.

**Summary of Learning Outcomes:**

1. Diagnose electrical systems
2. Service vehicle ignition system
3. Service vehicle electrical accessories
4. Service vehicle air conditioning system
5. Service vehicle charging systems
6. Service vehicle auxiliary system
7. Service vehicle lighting system
8. Service vehicle electrical motors
9. Install Vehicle safety systems

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested**  **Assessment**  **Methods** |
| 1. Diagnose electrical systems | * The importance of verifying electrical defect(s) with the client; * The importance of referring to appropriate technical information throughout diagnostic and rectification activities; * The use of relevant electrical diagnostic equipment * including on   • multi meters • scanners  • code readers  • board diagnostics  • The use of correct and systematic methods and procedures for the removal of components.  Measures taken to prevent electrical hazards. | * Practical exercises with observation checklist * Oral * questioning * Written test * Learner * portfolio of evidence. |
| 1. Service vehicle ignition system | * Types of ignition systems * Coil ignition * Magneto ignition * Transistor assisted ignition * Electronic ignition * Capacitor discharge ignition * Operating principles of ignition system * Coil ignition * Primary and secondary * Contact breaker points * Condenser * Spark plugs * Distributor * Battery * High tension leads * Switch * Operation * Construction components of ignition systems * Diagnosing and repair of ignition system * Diagnosing tools and equipment * Testing of ignition system | * Practical * Project * Observation |
| 1. Service vehicle electrical accessories | * The importance of confirming replacement accessory compatibility with the vehicle; * Confirmed of the accessories with legislations in terms of legality and prohibition; * Fitting of the accessories to the vehicle * Accessory installed in accordance with prescribed guidelines; * Accessory tested after fitting to confirm correct operation. | * Practical exercises * Oral questioning * Written test |
| 1. Service vehicle air conditioning systems | * Definition of vehicle air conditioning * Construction and operation of air condition system * Evaporator * Heater blower motor * Condenser * Pump * Drier * Piping * Electric control of vehicle air conditioning system * Diagnosing of air conditioning system | * Practical exercises * Oral * questioning * Learner * portfolio of evidence. |
| 1. Service vehicle charging systems | * Vehicle charging circuit components * Charging circuit principles * Dynamo * Alternator * Parts of charging system * Generator/dynamo/alternator * Rectifier * Regulator * Stator * Rotor * Battery * Switch * Dismantle vehicle charging system * Diagnose and repair faults in a charging system | * Practical exercises * Oral * questioning * Written test * Learner * portfolio of evidence. |
| 1. Service vehicle auxiliary systems. | * Auxiliary components of vehicles * Windscreen * Radio and television * Camera * GPRs * Wipers * Mirrors * Central locking * Windows and doors * Gauges * Horns * Security alarms * Air bags * Principles of operations of auxiliary components * Diagnosing and servicing of the components * Installation of auxiliary components | * Practical exercises * Oral * questioning • Written test * Learner * portfolio of evidence. |
| 1. Service vehicle lighting systems | * Definition of vehicle lighting system * Lighting system layouts * Construction and operation of different types of vehicles * lamps * Diagnosis and repair of vehicle lighting system * Vehicle lighting circuits * Types of lamps * Beam setting * Manual * Optical * Switches | * Practical * Oral * Written test |
| 1. Service vehicle electrical motors | * Definition of electrical motors * Principles of operation of electrical motors * Types of electrical motors * Handling of vehicle electrical motors * Servicing of motors * Components of motors * Uses of motors * Fitting of electrical motors in vehicles * Disposal of faulty electrical motors * Electrical motor calculations | * Practical * Oral * Written test * Project |
| 1. Install Vehicle safety systems | * Installing Airbags * Connecting Safety belts * Mounting electrical components related to vehicle * Fitting anti-roll components * Fitting vehicle tracker | * Practical * Observation * Oral * questions |

**Suggested Methods of Instruction**

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

**Recommended Resources**

**Tools**

Comprehensive set of hand and power tools for the diagnosis service and repair of motor vehicle electrical systems

**Equipment**

* Electrical system instructional models;
* 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;

**Reference materials**

* Manufacturers service manuals for the vehicles that are being serviced;
* Appropriate automotive engineering text books available on numerous websites e.g.
* Vehicle Construction and Use Regulations;
* After-market manufacturer’s manuals.

**Tools**

Comprehensive set of hand and power tools for the diagnosis service and repair of motor vehicle electrical systems

* Customer database and systems for recording maintenance records.

**Materials and supplies**

Digital instructional material including DVDs and CDs

Consumables for service and repair of vehicle electrical systems including:

* Vehicle Electrical cables and connectors
* Seals, fasteners and fittings
* Cleaning materials
* Dusters
* Aftermarket accessories including GPS systems, dash cameras;radios and speakers, auxiliary lights.