ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

HIGHER EDUCATION EXAMINATIONS COUNCIL

2023

REGULATIONS AND MODULES FOR THE

NATIONAL CERTIFICATE

IN

DIESEL PLANT FITTING

Course Code: 319/22/CR/0

Implementation date: January 2023

HERITAGE-BASED EDUCATION 5.0

PREAMBLE

The course is designed to develop a Diesel Plant Fitting Artisan with knowledge, skills and attitudes required to competently practice in the Automotive Industry. The entry requirement are 5 'O' Level subjects passed with grade C or better including English, Mathematics and a relevant Science subject plus any other three subjects or National Foundation Certificate (NFC) subjects or equivalent. The duration of the course is two semesters with one year (1280 hours) of theory and another year of On-the-Job Education and Training (OJET). The course is offered on a full time, part time, Block release or Open Distance e-Learning (ODEL) or Part Qualification on a Single Modular basis (The single modular basis is exempted from 5 O' levels requirement). Assessment is through field based assignments, continuous assessment, written examination and On- the- Job Education and Training (OJET). The course will consider gender mainstreaming, sustainable development, physical challenges, health dispositions, and the intersections between race, class and culture. It shall embrace innovative heritage-based education and training philosophy to solve national problems and to produce goods and services for industrialization and modernization.

CONSULTATION		YEAR
1.	Motor Trade Association of Zimbabwe (MTAZ)	2022
2.	Motor Industry Employer's Association of Zimbabwe	2022
3.	BARZEM	2022
4.	Masimba Pvt Ltd	2022
5.	National Railways of Zimbabwe (NRZ)	2022
6	Wankie Colliery Company	2022
7.	Bitumen World	2022
8	Lovol Earthmoving Equipment	2022
9	Sanny Earthmoving Equipment	2022
10	Kuzolunga (Pvt) Ltd	2022
11	Fossil Pvt Ltd	2022

PART I: COURSE REGULATIONS

1.0 TITLE AND LEVEL OF AWARD

National Certificate in Diesel Plant Fitting

2. 0 AIM

The aim of the course is to develop a Diesel Plant Fitting Artisan with the knowledge, skills and attitudes to be able to service, repair and modify heavy-duty vehicle, plant and equipment operating systems.

3.0 LEARNING OUTCOMES

At the end of the course the student should be able to:

3.1 practice and adhere to Safety, Health and Environment in workshop processes,

3.2 demonstrate patriotism on national issues

3.3 carry out maintenance of components/equipment as per schedule and to specified standards

3.4 apply acquired communication and computer skills to enhance business operations in real world of work.

3.5 maintain power train systems to solve problems for Diesel Plant Fitting

3.6 apply drawing knowledge and skills to assist in trouble-shooting and maintenance in workshop processes.

3.7 carry-out maintenance of Diesel Plant Fitting engines and plants.

3.8 apply scientific and mathematic principles in trouble-shooting.

3.9 maintain undercarriage and ground engaging tools and equipment

3.10 maintain Hydraulics and braking systems

3.11 carry out basic service of electrical and electronics systems

3.12 engage in entrepreneurial activities

3.13 demonstrate knowledge and technical skills in diesel plant fitting industry real world of work.

3.15 apply knowledge and skills

4. 0 COURSE STRUCTURE

	MODULE TITLE	MODULE CODE	NOTIONAL HOURS
	SEMESTER 1		
1	Maintain Safe, Health, Environment and Fitting & Machining Processes (common)	346/22/M01	100
2	National Studies (common)	401/22/M01	80
3	DPF Workshop Practice and Processes (Skills Proficiency)*	319/22/M01	
4	Automotive Communication and Computer Applications	346/22/M02	150
5	Hydraulics & Braking Systems Maintenance	319/22/M02	200
6	Automotive Engineering Drawing (common)	346/22/M03	80
7	Engine and Plant Maintenance	319/22/M03	200
	SEMESTER 2		
	Power Train Maintenance	319/22/M04	200
	Automotive Engineering Mathematics and Science	346/22/M08	200
9	Undercarriage, & Ground Engaging Equipment Maintenance	319/22/M05	200
11	Automotive Electrics and Electronics Systems Maintenance	346/22/M11	100
12	DPF Workshop Practice and Processes (Skills Proficiency)*	319/22/M01	
13	Entrepreneurial Skills Development	402/22/M01	80
	SEMESTER 3 & 4		
14	On The Job Education and Training	319/22/M06	1 year
	TOTAL		**1 590 Hours**

* Workshop Practice and Processes (Skills Proficiency)* submitted in the last semester

5.0 DURATION

The duration of the course is two semesters with one year (1 590 hours) of theory and another year of On-the-Job Education and Training (OJET).

6.0 ENTRY REQUIREMENTS

6.1 The entry requirement are 5 'O' Level subjects passed with grade C or better including English, Mathematics and a relevant Science subject plus any other three subjects or National Foundation Certificate (NFC) subjects or equivalent.

6.2 The single module part Qualification pathway is exempted from 5 O' levels requirement

6.3 The single module part qualification should be taken one (1) module at a time by those without 5 Ordinary levels

7.0 MODE OF STUDY

Full Time : 1590 hours plus one year OJET
Part Time : 1590 hours plus one year OJET
Block Release: 1590 hours plus one year OJET
ODeL : 1590 hours plus one year OJET

8.0 ASSESSMENT

8.1 ASSESSMENT SCHEME

MODULE TITLE AND CODE		MODE OF ASSESSMENT		WEIGHTING
		WRITTEN EXAMINATION 40%	CONTINUOUS ASSESSMENT 60%	
1	Maintain Safe, Health, Environment and Fitting & Machining Processes (346/22/M01)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical project Submit project component (20%) • 2 Tests 20%	100%
2	DPF Workshop Practice and Processes (Skill Proficiency) 319/22/M01	Submit Marks		100%
3	Engine and Plant Maintenance 319/22/M03	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
4	Power Train Maintenance 319/22/M04	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%

5	Hydraulic & Breaking Systems Maintenance 319/22/M02	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
6	Undercarriage & Ground Engaging Tools Maintenance 319/22/M05	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
7	Automotive Electrics and Electronics Maintenance 346/22/M11	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
8	Automotive Engineering Mathematics and Science 346/22/M08	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
9	Automobile Engineering Drawing 346/22/M03	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
10	Automotive Communication and Computer Applications 346/22/M02	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
11	National Studies 401/22/M01	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
12	Entrepreneurship Skills Development 402/22/M01	3 hour paper	A Minimum of: • 2 Assignments 20% • 2 Practical Assignments 20% • 2 Tests 20%	100%
13	On The Job Education and Training 319/22/M06	As per log book		100%

9.0 GRADING

0% t0 49%	-	Fail
50% to 59%	-	Pass
60% to 79%	-	Credit
80% to 100%	-	Distinction

10.0 CONDITIONS OF AWARD

10.1 A candidate should attend at least 100% of learning sessions to qualify for examinations. (An approved absent is shall be considered as a present)

10.2 Approved absenteeism shall not exceed 15% learning sessions

10.3 The final mark should be obtained through aggregation provided the candidate scores at least 50 % in each of continuous assessment, Skills Proficiency and examinations.

10.4 The pass mark shall be 50 %.

10.5 Candidates should pass all modules to be awarded a National Certificate.

10. 6 Single module candidates will be awarded part certificates in single module

11.0 RE-WRITE

11.1 Re-write(s) should conform to current course structure.

11.2 Candidates should pass at least two thirds of the course to qualify for a referral.

11.3 Any candidate who fails to pass at least two thirds of the course should repeat the whole course, including the subjects they would have passed.

11.4 There is no time limit for which to re-write a failed examination.

11.5 There is no aggregation for re-writes.

11.6 All re-writes should pass on performance in the examination.

11.7 If a candidate fails continuous assessment he/she repeats the module

12.0 EXEMPTIONS AND TRANSFER OF CREDITS

12.1 Exemptions are only granted in subjects already attained from a completed accredited qualification provided an exemption certificate specifying subjects of exemption is produced.

12.2 Transfer of credits are ONLY granted in modules passed from accredited course programmes

12.3 Exemption or Transfer of credits Certificate should be applied for at enrolment and produced before registration of examinations.

13.0 IRREGULAR PRACTICES

13.1 Cheating in examinations will result in disqualification from the whole course and all other HEXCO courses. The candidate will be suspended for one year.

13.2 Plagiarisms in any of the assessments will result in automatic disqualification in the course and any other HEXCO courses and the penalty as in 13.1 will apply.

14.0 RESOURCES

14.1 **Lecturers' Qualifications:**

National Diploma in Diesel Plant Fitting or equivalent, a teaching qualification and at least five years post qualifying experience.

14.2 **Infrastructure and Equipment**

14.2.1 Theory classroom to accommodate at least 12 students per given time (fitted with writing surface-e.g. Whiteboard).
14.2.2 Engineering Drawing Room fitted with appropriate drawing office furniture to accommodate at least 12 students per given time (fitted with writing surface).
14.2.3 Diesel Laboratory (fully equipped).

14.2.4 Automotive workshop equipped as follows.
- Sufficient DPF tool kits.
- Protected inspection pit, vehicle ramp or hoist.
- Workbenches providing at least 10 work stations for students.
- 12 x fitted bench vices.
- Fire-fighting appliances and Emergency Exit.
- Fire Aid Equipment.
- Hand-wash basins.
- Lifting equipment Mechanical, Electrical or Pneumatic.
- Pedestal drill.
- Bench grinder (fitter).
- Compressed Air Supply and Appliances.
- Hydraulics Laboratory.
- Pneumatics Laboratory.

14.3 Computer Laboratory equipped with

14.3.1 12 x Personal Computers
14.3.2 Computer Software (adequately licensed software to include:
- Spreadsheet.
- Word Processing.
- Database.
- DOS.
- MS Windows 95 or later.

14.3.3 Writing surface for the instructor (e.g. securely mounted Whiteboard).
14.4.4 Computer desks and chairs for at least 12 students (1 student per computer recommended)

14.4 SUGGESTED REFERENCES

1.	Asmus A.	(1981)	*Diesel engines and fuel system*	Butterworths	London
2.	Bland S.	(1980)	*Diesel Engines*	Longman	London
3.	Cookery A.J.	(1982)	*Graded Exercise in Technical Drawing*	Longman	London
4.	Crouse	(1981)	*Automotive Electrical Systems*	Newness	Basingstoke
5.	Crouse & Anglin	(1981)	*Automotive Electronic and Electrical Equipment*	McGraw-Hill	New York
6.	Culphin C.	(1981)	*Automotive Technician's Handbook*	McGraw-Hill	New York
7.	Flood C.R.	(1985)	*Farm Machinery*	Granada	London
8.	Gocring C.E.	(1981)	*Fabrications, Welding & Metal Joining Processes*	Butterworths	London
9.	Greer A. Et al	(1990)	*Engine and Tractor Power*	Breton	Basingstoke
10.	Hillier and Pittuck	(1997)	*Tables, Data and Formulae for Engineers*	Thornes	London
11.	Kett P.W.	(1981)	*Fundamentals of Heavy Vehicle Technology*	Hutchinson	
12.	Maleckv V.I.	(1982)	*Motor Vehicle Calculations and Science Book Two*	Chapman & Hall	New York
13.	Mudd S.C.	(1982)	*Diesel Engine Operation and Maintenance*	McGraw-Hill	London
14.	Mummy F.J	(1990)	*Mechanical Science for Motor Mechanics (Book 2)*	Arnold	London

15.	Nummey E.J.	(1982)	*Vehicle Technology 2*	Butterworths	London
16.	Pituck and Hillier	(1981)	*Vehicle Technology 2*	Butterworths	London
17.	Schultz E.J.		*Fundamentals of Motor Vehicle Technology*	Hutchinson	New York
18.	Schultz E.J.	(1983)	*Diesel Mechanics*	McGraw-Hill	New York
19.	Schultz E.J.	(1982)	*Diesel Equipment I: Lubrication, Hydraulics and Brakes*	McGraw-Hill	New York
20.	Shorbolt C.R.	(1982)	*Diesel Equipment II: Electro-Controls, Frames, Steering and Suspension, Transmission*	McGraw-Hill	London
21.	Whipp J.	(1982)	*Technical Workshop Processes & Materials I.*	Cassell	London
22.	Zammit S.J	(1982)	*Motor Vehicle Craft Studies Part II*	MacMillan	London
23.	Mudd S.C.	(1980)	*Motor Vehicle Engineering*	Longman	New York
24.	Crouse & Anglin	(1990)	*Technology for motor Mechanics Books 1 – 4.*	McGraw-Hill	New York
25.	Tucker H.F	(1992)	*Automotive Manual Transmissions & Power Trains*	Delmar/Breton	London
26	Little & Edmondson	(1984)	*Automatic Transmissions*	Breton	London
27..	Stone R.	(1985)	*Diesel Mechanics*	MacMillan	London
28	Watson & Janota	(1985)	*Introduction to Internal Combustion Engines*	MacMillan	London
29.	Goodger E.M.	(1985)	*Turbo-Charging the Internal Combustion*	MacMillan	London

30.	Smith P.H	(1970)	*Combustion Calculations: theory, Worked Examples and Problems*	Foulis & Co.	London
31.	Martin A.L.	(1970)	*Scientific Design of Exhaust & Intake Systems*	English University	London
32	Billet. W.	(1980)	*Science & Calculations for Motor Vehicle Technicians: Part I*	American Technical Publications	New York
33.	Dolan S.	(1985)	*Automotive Engines: Maintenance & Practical Work: Parts I & II*	Heinemann	
34.	Pippernger & Hicks	(1983)	*Industrial Hydraulics*	McGraw-Hill	New York
35.	Leeming, Hartley	(1982)	*Heavy Vehicle Technology*	Hutchinson	London
36.	Stroud K.A.	(1995)	*Engineering Mathematics*	Bath Press	London

Module Code	**346/22/M01**
Module Title	**MAINTAIN SAFE, HEALTH & ENVIRONMENT AND FITTING & MACHINING PROCESSES**
ZNQF Level	4
Credits	**10**
Duration	**100** hours
Relationship with Qualification Standards	Based on Unit Standard **346/22/M01** Maintain Safe, Health & Environment And Fitting & Machining Processes
Pre-requisite modules	N/A
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain safe working environment and carry-out fitting and machining. This includes, practice and adhere to safety, health and environment, use of appropriate PPE and PPC, carry out risk assessment, participate in safety awareness meetings and carry-out fitting and machining processes. The advantages of maintaining safe working environment include; reduced breakdowns, improved occupational health and safety standards and minimize accidents related costs due to wrong use of equipment. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintaining Safe Working Environment.
List of Learning Outcomes	LO1: Practice and adhere to Safety, Health and Environment LO2: Use of Appropriate PPE and PPC LO3: Carry out Risk Assessment LO4: Participate in Safety Awareness Meetings LO5: Use of measuring, marking, hand and machine tools LO6: Carry-out metal and non-materials joining techniques LO7: Produce a fitting and machining project/component
Learning Outcome O1	**LO1: Practice and adhere to Safety, Health and Environment**
Assessment Criteria	1.1 Introduce Safety, Health and Environment policies and acts to employees 1.2 Establish safety colour codes 1.3 Label gangways

	1.4 Identify storage areas 1.5 Demonstrate firefighting procedures 1.6 Demonstrate use of tools and lifting equipment 1.7 Produce manual for handling of hazardous substances
Content	**LO1: Practice and Adhere to Safety, Health and Environment** 1.1 Introduce Safety, Health and Environment policies to employees • Acts and Policies ✓ Employee wellness policy ✓ Health and safety act ✓ Factories act ✓ Workman's compensation act ✓ NSSA 1.2 Establish Safety Colour Codes • Safety Colour Codes 1.3 Label Gangways • Workshop Set-up • Fire 1.4 Identify Storage Area • Flammable and Inflammable liquids and gases ✓ Fire-fighting techniques ✓ Gas Safety • Non-Flammable Liquids and Gases 1.5 Demonstrate fire-fighting procedures • Firefighting techniques • Back burning • Fire guards ✓ Alarms ✓ Assembly point ✓ Evacuation roots ✓ Fire brigade and police 1.6 Demonstrate use of tools and lifting equipment • Hand Tools ✓ Artisan's toolbox ✓ Noise level meter ✓ Gas analyser ✓ Thermometer ✓ Camera ✓ Breathalyser ✓ Thermometer ✓ Lux meter • Cutting Tools ✓ Chisels ✓ hacksaws • Measuring Tools

	✓ Vernier callipers ✓ Micro-meter • Lifting Equipment ✓ Block and tackle ✓ Trolley jacks 1.7 Produce manual for handling of hazardous substances • Display of hazardous substance codes ✓ Green ✓ Red ✓ Purple ✓ Orange/ Amber ✓ PPE ✓ Disposal
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to maintain Safe, Health, Environment and Fitting & Machining Processes as outlined in the assessment criteria Practice and adhere to Safety, Health and Environment based on the Introduce Safety, Health and Environment policies and acts to Employees, Establish safety colour codes, Label gangways, Identify storage areas, Demonstrate firefighting procedures, Demonstrate use of tools and lifting equipment Produce manual for handling of hazardous substances 2. Practical assessment on maintaining Safe, Health & Environment and Fitting & Machining Processes based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments and tools • Marking tools • Work bench

	• Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Injector tester • Parts catalogue • Fire extinguisher • Hand tools and machine tools
Learning Outcome 02	**LO2: Use of Appropriate PPE and PPC**
Assessment Criteria	2.1 Introduce Safety, Health and Environment policies to employees 2.2 Establish safety colour codes 2.3 Label gangways 2.4 Identify storage areas 2.5 Demonstrate fire-fighting procedures 2.6 Demonstrate use of tools and lifting equipment 2.7 Produce manual for handling of hazardous substances
Content	**LO2: Use of Appropriate PPE and PPC** 2.1 Use Personnel protective equipment • Welding shield, apron, leather pads, ear buds, helmet, goggles, and respirator. 2.2 Wear personnel Protective Clothing • Safety shoes • Work suits • gloves 2.3 Monitor use of PPE and PPC ✓ PPC 2.4 Enforce Organisational Standards and Regulations • Hearing ✓ Fine ✓ Suspension ✓ Discharge 2.5 Demonstrate fire-fighting procedures • Classes of fire • Fire-fighting equipment • Fire-fighting techniques
	2.6 Demonstrate use of tools and lifting equipment • Automotive lifting equipment. 2.7 Produce manual for handling of hazardous substances • Automotive hazardous substances

Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to use of appropriate PPE and PPC as outlined in the assessment criteria introduce Safety, Health and Environment policies to employees, Establish safety colour codes, Label gangways, Identify storage areas, Demonstrate fire-fighting procedures, Demonstrate use of tools and lifting equipment and Produce manual for handling of hazardous substances 2. Practical assessment on maintaining Safe, Health & Environment and Fitting & Machining Processes based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • PPE clothing • Hydraulic press • Measuring instruments and tools • Marking tools • Work bench • Diagnostic machine • Overhead crane and lifts • Fire extinguisher • Hand tools and machine tools
Learning Outcome 03	**LO3: Carry out Risk Assessment**
Assessment Criteria	3.1 Address housekeeping issues 3.2 Follow correct work procedure 3.3 Enforce equipment register 3.4 Follow /observe equipment storage 3.5 Store lockout mechanism 3.6 Barricade hazardous areas 3.7 Issue permit on hot jobs and work on heights 3.8 Generate incidents reports
Content	**LO3: Carry out Risk Assessment** 3.1 Address housekeeping issues • working environment • gangways/escape route

	• tools and equipment 3.2 Follow correct work procedure • Procedures 3.2 Enforce equipment register • Serializing equipment • Inventory record 3.4 Follow /observe equipment storage • Audits • storage place 3.5 Store lockout mechanism • Lock • In and out voucher • Stores attendant and duties 3.6 Barricade hazardous areas • Methods of barricading ✓ Ribbons ✓ Fence ✓ Screens 3.7 Issue permit on hot jobs and work on heights • Risks of hot jobs and work on heights • work permit 3.8 Generate incidents reports • The content to include in the incident report ✓ Date ✓ Time ✓ Place ✓ Pre- incident ✓ Actual incident ✓ Post incident analysis ✓ Personnel involved
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to carry out risk assessment as outlined in the assessment criteria Address housekeeping issues, Follow correct work procedure, Enforce equipment register, Follow /observe equipment storage, Store lockout mechanism, Barricade hazardous areas, Issue permit on hot jobs and work on heights and Generate incidents reports 2. Practical assessment on maintaining Safe, Health & Environment and Fitting & Machining Processes based on the performance criteria of the Qualification Standard Diesel Plant Fitter

Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • PPE clothing • workshop machines • Measuring instruments and tools • Marking tools • Work bench • Stationary • Overhead crane and lifts • Fire extinguisher • Hand tools and machine tools
Learning Outcome 04	**LO4: Participate in Safety Awareness Meetings**
Assessment Criteria	4.1 Attend safety meetings 4.2 Implement meeting pointer 4.3 Identify safety signs and symbols 4.4 Carry out firefighting drills 4.5 Designate smoking zones
Content	**LO4: Participate in Safety Awareness Meetings** 4.1 Attend safety meetings • Safety meetings ✓ Safety procedures 4.2 Implement meeting pointer • key safety issues 4.3 Carry out fire-fighting drills ✓ Firefighting techniques ✓ Back burning 4.4 Designate smoking zones ✓ Smoking Hazards 4.5 Designate smoking zones ✓ Fire related smoke ✓ Air Pollution
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to participate in safety awareness meetings as outlined in the assessment criteria Attend safety meetings, Implement

	meeting pointer, Identify safety signs and symbols, Carry out firefighting drills- and Designate smoking zones. . 2. Practical assessment on participating in safety awareness meetings based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Dynamometer • Jack and axle stands • Work bench • Fire equipment
Learning Outcome 05	**L05: Use of measuring, marking, hand and machine tools**
Assessment Criteria	5.1: Use of measuring tools 5.2: Use of marking tools 5.3: Use of hand and machine tools
Content	**L05: Use of measuring, marking, hand and machine tools** 5.1 Measuring Tools • Safety and Care • Types of measuring tools • Measuring techniques 5.2 Marking Tools • Safety and Care • Types of marking tools • Marking techniques 5.3 Use of hand and machine tools • Safety and Care • Types of hand and machine tools • Hand and machine tools techniques
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to use of measuring, marking, hand and machine tools as outlined in the assessment criteria, Use of measuring tools, Use of marking tools and Use of hand and machine tools

	2. Practical assessment use of measuring, marking, hand and machine tools as outlined in the assessment criteria, Use of measuring tools, Use of marking tools and Use of hand and machine tools based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Marking tools • Measuring tools • Hand tools • Machine tools • Work bench • Fire equipment
Learning Outcome 06	**LO6: Carry-out metal and non-metal materials joining techniques**
Assessment Criteria	6.1 Demonstrate knowledge on metals and non-metal materials 6.2 Demonstrate skills on metal/non-material joining techniques 6.3 Use Stocks and dies and basic workshop machines
Content	**LO6: Carry-out metal and non-metal materials joining techniques** 6.1 Demonstrate knowledge on metals and non-metal materials • Ferrous and Non-ferrous Metal Properties • Non Metal Materials • Common Metals ✓ Thermal Properties ✓ Electrical Properties ✓ Magnetic Properties • Heat Treatment

	✓ Hardening ✓ Annealing ✓ Normalising ✓ Quench-Temper • Strength of Materials ✓ Stress ✓ Strain ✓ Fatigue 6.2 Demonstrate skills on metal/non-material joining techniques • Brazing • Soldering • Nailing • Welding • Screwing • Bonding • Bolting • Fastening 6.3 Use Stocks and dies and basic workshop machines • Stock and dies • Drilling machines • Welding machines • Hydraulic operated machines • Grinders
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to carry-out metal and non-metal materials joining techniques as outlined in the assessment criteria based on demonstrate knowledge on metals and non-metal materials, demonstrate skills on metal/non-material joining techniques and Use Stocks and Dies.

	2. Practical assessment to carry-out metal and non-metal materials joining techniques based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Nails • Rivet gun • Welding equipment • Gas bottles • Brazing equipment • Hammer • Drilling equipment • Prime-bond • Wood • Metals • Plastic steel • Prime bond • Glue • Matches • Work bench • Diagnostic machine • Screws • Bolt and Nuts • Belts and clips
Learning Outcome 07	**LO7: Produce a fitting and machining project/component**
Assessment Criteria	7.1 Demonstrate Filing skills 7.2 Demonstrate machining skills 7.3 Produce components

Content	**LO7: Produce a fitting and machining project/component** 7.1 Demonstrate Filing skills • Filing procedures 7.2 Demonstrate machining • Machines 7.3 Produce Components • Measurements and polishing
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to produce a fitting and machining project/component as outlined in the assessment criteria based on ddemonstrating Filing skills, demonstrating machining skills and producing components 2. Practical assessment to produce a fitting and machining project/component base on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Welding equipment • Gas bottles • Brazing equipment • Hammer • Drilling equipment • Metals • Work bench • Diagnostic machine • Screws • Bolt and Nuts • Belts and clips

MODE OF ASSESSMENT

EXAMINABLE MODULE	**MODE OF ASSESSMENT**		**TOTAL**
	EXAMINATIONS 40%	**COURSEWORK ASSESSMENT 60%**	

Maintain Safe, Health, Environment and Fitting & Machining Processes (346/22/M03)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical project Submit project component (20%) • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME		WEIGHTING%
1	Practice and adhere to Safety, Health and Environment	24
2	Use of Appropriate PPE and PPC	2
3	Carry out Risk Assessment	2
4	Participate in Safety Awareness Meetings	2
5	Use of measuring, marking, hand and machine tools	45
6	Carry-out metal and non-materials joining techniques	25
7	Produce a fitting and machining project/component	-
	TOTAL	**100%**

Approach to Teaching and Learning:

1. Observation of adult learning principles.
2. Both institution-based and work-based learning to facilitate the integration of theory and practice.
3. Face-to-face education and learning.
4. Problem-based learning.
5. Online/distance education and learning.
6. Blended/hybrid education and learning.
7. Use of social media.

Approach to Assessment:

1. Weighting of practical and theory assessment: 70% theory and 30% practical.
2. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
3. Oral assessment to be conducted by a panel of two or more assessors.
4. RPL assessment.
5. Portfolio of evidence.
6. Assessment of work conducted by both individual learners and teams of learners.

Resources:

1. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

2. Facilities, Tools, Equipment and Materials
    - Electrical tool box
    - Ladder
    - PPE
    - Drilling machine
    - Welding machine
    - Megger
    - Insulation tape
    - Mutton cloth
    - Detergents
    - PPC
    - Cables
    - Cable enclosures
    - Electrical accessories

3. Learning Resources

    Relevant training manual (learners' guide) and facilitators' guide

4. Reference Materials (recommended textbooks, recommended readings)

1. Asmus A. (1981) Diesel engines and fuel system Butterworths London
2. Bland S. (1980) Diesel engines Longman London
3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London
4. Crouse (1981) Automotive Electrical Systems Newness Basingstoke
5. Flood C.R (1985) Farm Machinery Granada London
6. Schultz (1983) Diesel Mechanics McGraw-Hill London

Module code:	**346/22/M02**
Module title:	**AUTOMOTIVE COMMUNICATION AND COMPUTER APPLICATIONS**
ZNQF level:	**4**
Credits:	**15**
Duration:	**150** hours
Relationship with qualification standards:	Based on Unit Standard **Workshop Communication and Design in Automotive Engineering** of Unit Standards for different workplaces
Pre-requisite modules:	No prerequisites
Purpose of module:	This module describes the skills, knowledge and attitudes required by an **Automotive Artisan** to be able to effectively communicate, operate and design in Automotive Engineering and related trades. This includes writing business documents, use of appropriate communication skills in automotive trade, applying effective communication techniques, applying legislation affecting employees, use of basic stores management, preparing different types of business meetings, demonstrate knowledge of computer operations, demonstrate knowledge of Data Communications and basic Networking, Internet services, Computer Security and Emerging computer Technologies, apply Paint and AutoCAD skills to produce Automotive related diagrams and circuits, and solve automotive related challenges and vehicle problems through use of computerized automotive equipment. This module is important as it ensures proper and effective communication skills for automotive and related business. The module targets individuals who are in engineering trade and related business irrespective of gender, age or ethnicity.
List of learning outcomes:	**L01: Practice and apply language and writing skills in automotive trade** **L02: Write business documents** **L03: Prepare different types of meetings for business organisations** **L04: Differentiate organization structures** **L05: Apply legislation and related laws to Automotive trade** **L06: Carry-out Basic Stores Management and Safety Health and Environment in relating to automotive trade** **L07: Demonstrate knowledge of computer operations** **L08: Demonstrate knowledge of Data Communications and basic Networking, Internet services, Computer Security and Emerging computer Technologies.**

	L09: Apply Paint and AutoCAD skills to produce Automotive related diagrams and circuits. **LO10: Solve automotive related challenges and vehicle problems through use of computerized automotive equipment.**
Learning outcome 01	**Practice and apply language and writing skills in automotive trade**
Assessment criteria:	**1.1 Use the correct language style** **1.2 Use business jargon in appropriate situations.** **1.3 Organize written material logically** **1.4 Select and use the most effective method of communication in business context.** **1.5 Use telephone effectively**
Content:	**1.1. Use the correct language style** • Apply the concept of the 'seven (7) c's of written communication • Describe use of languages **1.2. Use business jargon in appropriate situations** • Identify and avoid barriers to communication • Discuss selection of words **1.3.Select and use the most effective method of communication in a business context**. • Various methods of communication • Select and use the most effective method • Identify major communication channels **1.4.Use the telephone effectively** • Telephone etiquette • Making calls • Answering calls **1.5 Use communication skills to satisfy Automotive needs** • Oral Communication • Written Communication • Grammar • Meaning of Words • Rhyming Words • Punctuation
Assessment tasks:	1. Written and/or oral assessment on the skills and knowledge required in basic communication relating to language and writing skills. 2. Practical assessment on the requirements and principles of basic communication relating to language and writing skills.
Conditions/context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution.

	3. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Telephone - Fax Machine - Secretary chair and desk - Stationary - Text Books
Learning outcome 02	**LO2 Write business documents**
Assessment criteria	**2.1 Produce business letters** **2.2 Generate reports** **2.3 Write a memorandum** **2.4 Write a notice for the company notice board**
Content	**2.1 Produce business letters** • Letters ✓ Business letter ✓ Application ✓ Non-Business **2.2 Generate reports** • Progress and routine • Technical • Recommendatory • Inquiry • Accident **2.3 Write a memorandum** • Identify the major components of a memo • Uses of memo. • Differentiate between a notice and memo. **2.4 Write a notice for the company notice board** • Identify major components of a notice • The uses of notice • Differentiate between a notice and memo.
Assessment tasks	1. Written and/or oral assessment on the skills and knowledge required in producing business documents. 2. Practical assessment on the requirements and principles of producing business documents.
Conditions/context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools,

	equipment and materials listed below: - - Secretary chair and desk - Stationary - Text Books - Stamp and pad - Notice Boards
Learning outcome 03	**LO3 Prepare different types of meetings for business**
Assessment criteria	**3.1 Differentiate types of meetings** **3.2 Identify meeting requirements** **3.3 Taking minutes** **3.4 Prepare meeting documents**
Assessment tasks	**3.1 Differentiate types of meetings** • Procedures of meetings • Formal (private/public) meetings. • Committee meetings • Command meetings **3.2 Identify requirements for meetings.** • Quorum • Notice • Agenda • Minutes • Constitution (Organisation, Company) **3.3 Take notes from meetings and meeting roles.** • Narrative minutes • Resolution minutes • Verbatim minutes • Resolutions • Meeting Terms • Convener • Secretary • Chairman • Treasurer **3.4 Prepare meeting documents** • Notice • Agenda • Minutes of meetings.
Conditions/context of assessment	1. Written and/or oral assessment on the skills and knowledge required in preparing for meetings. 2. Practical assessment on the requirements and principles of preparing for meetings.

Content	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Board room - Stationary
Learning outcome 04	**LO4 Differentiate organization structures**
Assessment Criteria	**4.1 Draw-up organization structures** **4.2 differentiate communication channels in organisations.** **4.3 Explain different types of company set-ups**
Content	**4.1. Draw-up organization structures** • Organization structure • Function of organization structure **4.2. Differentiate communication channels in organizations.** • Vertical • Horizontal • Mixed **4.3. Explain different types of company set-ups** • Public entity • Private entity • Sole proprietor
Conditions/context of assessment	1. Written and/or oral assessment on the skills and knowledge required in basic communication relating to organizational structures. 2. Practical assessment on the requirements and principles of organizational structures.
Content	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Stationary - Charts
Learning outcome 05	**LO5 Apply legislation and related laws to Automotive trade**

Assessment criteria	**5.1 Demonstrate knowledge on Acts related to Automotive trade** **5.2 Demonstrate knowledge on Trade Unions, NSSA and organisations related to Automotive trade.**
Content	**5.1 Demonstrate knowledge on Acts related to Automotive trade** • Health and Safety Act • Factories Act • Workman's Compensation **5.2 Demonstrate knowledge on Trade Unions, NSSA and organisations related to Automotive trade.** • Automobile Association of Zimbabwe (AA) • Vehicle Inspectorate Department • Motor Trade Unions Notice
Assessment tasks	1. Written and/or oral assessment on the skills and knowledge required on legislation and related laws Automotive trade related. 2. Practical assessment on the requirements and on legislation and related laws automotive trade related.
Conditions/context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Acts - Pamphlets - Brochures - Stationary
Learning outcome 06	**LO6 Carry-out Basic Stores Management and Safety Health and Environment in relating to automotive trade**
Assessment criteria	**6.1 Differentiate between equipment, tools, consumables** **6.2 Demonstrate knowledge of storekeeping** **6.3 Show awareness of workshop safety** **6.4 Explain basic Accounting terms** **6.5 Prepare job cards and log book records**
Content	**6.1 Differentiate between equipment, tools, consumables** • Workshop tools and equipment ✓ Safety ✓ Equipment/Machine service schedules/books • Consumables **6.2 Demonstrate knowledge of storekeeping**

	• Stock control techniques ✓ Delivery Note (D-note) ✓ Goods Received Voucher (GRV). ✓ Asset registers ✓ Loan - book ✓ Stock-taking ✓ Security measures (locking, passwords, alarms) **6.3 Show awareness of workshop safety** • Goods Safety • Human Safety • Equipment Safety • Fire and fire-fighting techniques **6.4 Explain basic Accounting terms** • Basic financial terms ✓ Audit ✓ Capital ✓ Working Capital ✓ Assets ✓ Liability ✓ Credit and debt ✓ Revenue ✓ Profit and Loss **6.5 Prepare job cards and log book records** • Job Cards • Logbooks
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to Carry-out Basic Stores Management and Safety Health and Environment in relating to automotive trade. 2 Practical assessment on the requirements and to carry-out Basic Stores Management and Safety Health and Environment in relating to automotive trade.
Conditions/context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Acts - Pamphlets - Brochures - Stationary
Learning Outcomes 07	**LO7: Demonstrate knowledge of computer operations**

Assessment Criteria	**LO7 Demonstrate knowledge of computer operations** 7.1 List computer hardware components, software operations, input, output computer devices and telecommunication devices 7.2 Compare and Contrast storage devices. 7.3 Identify the role of operating system and application software systems. 7.4 Operate the computer 7.5 Use Storage devices 7.5 Demonstrate file management 7.6 Carry-out word processing, spreadsheets and presentation applications.
Assessment tasks	**LO7 Demonstrate knowledge of computer operations** 7.1 List computer hardware components, software operations, input, output computer devices and telecommunication • Computer Hardware configuration and accessories ✓ Define Basic Computer Terms • Computer software basic operations • Data and Information • Input devices • Output devices • Telecommunication devices • Computer software Operations ✓ System software ✓ Application software • Types of Computer • Storage devices • Computer Viruses • Word Processing • Power Point • Spreadsheets (Excel)
Assessment tasks:	1. Written and/or oral assessment on the skills and knowledge required in word processing techniques, presentation and spreadsheets to enhance automotive operations. 2. Practical assessment on the requirements and principles of word processing, presentation and spreadsheets to enhance automotive operations.
Conditions/context of assessment	3. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 4. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 5. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Storage device - Computer lab - Desktop

	- Laptops - Cellphones - Software - Printers - Storage devices - Printers Stationary - Charts Modems - Printers
Learning Outcome 08	**L08: Demonstrate knowledge of Data Communications and basic Networking, Internet services, Computer Security and Emerging computer Technologies.**
Assessment criteria	8.1 Demonstrate knowledge of Data Communications 8.2 Demonstrate knowledge of Computer Networking and Internet Services 8.3 Demonstrate Computer and data security requirements. 8.4 Use emerging computer Technologies.
Assessment tasks	**8.1 Demonstrate knowledge of Data Communications** • Data Communications • Data Transmission Modes • Data Security **8.2 Demonstrate knowledge of Computer Networking and Internet Services** • Computer Networks ✓ Topology ✓ Advantages and Disadvantages • Internet Terminology and usages • Online Communications • Social Media and Communications • Internet and Automotive Trade (Marketing Advertising). **8.3 Demonstrate Computer and data security requirements.** • Computer lab environment • Health, Safety and Environment • Computer crime • Malicious Software • Copyright and the law • Information privacy • Ethical issues **8.4 Use emerging computer Technologies.** • Geographical Information Systems (GIS) • Global Position Satelite (GPS) • Mobile Databases. • Database Management Systems (DBM) ✓ Terminology ✓ Basic DMB

Assessment tasks	1. Written and/or oral assessment on the skills and knowledge required to Demonstrate knowledge of Data Communications and Basic Networking, Internet services and emerging computer Technologies. 2. Practical assessment on the requirements and principles of data networking, Internet services and emerging computer Technologies
Conditions/context of assessment	3. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 4. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 5. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Modems - Storage device - Computer lab - Desktop - Laptops - Cellphones - Printers - Storage devices - Printers
Learning Outcome L09	**LO9: Apply Paint and AutoCAD skills to produce Automotive related diagrams and circuits.**
Assessment criteria	**9.1 Demonstrate knowledge of PAINT Application** **9.2 Demonstrate knowledge of AUTOCAD Application.**
Content	**9.1 Use PAINT Application to produce circuits and diagrams** • PAINT Terminology • Circuits • Drawings • Presentations **9.2 Demonstrate knowledge of AUTOCAD Application** • AUTOCAD Terminology • Simple Circuits • Simple Drawings • Presentations • Advantages and Disadvantages
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required on PAINT and AUTOCAD applications. 2. Practical assessment on the requirements and on PAINT and AUTOCAD applications.
Conditions/context of assessment	3. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 4. The practical assessment will be conducted in the workplace or

	simulated work environment in the training institution. 5. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Laptops - Computer lab - AUTOCAD Software - Storage devices - Printer - Bond paper
Learning outcome 10	**LO10 Solve automotive related challenges and vehicle problems through use of computerized automotive equipment.**
Assessment criteria	**10.1 Outline Workshop Safety and security** **10.2 Carry-out Computer based operations** **10.3 Trouble-shoot Computer related Diagnostics** **10.4 Apply On-Board Diagnostic Equipment**
Assessment Tasks	**10.1 Outline Workshop Safety and security** • Computer Workshop Safety and Security ✓ Lab rules ✓ Fire ✓ Safety Rules ✓ Security **10.2 Carry-out Computer based operations** • Vehicle related Computer Operation - Sensor - Actuators - ECM - ECU - Trip Computer • Demonstrate Simple knowledge on Programming - Key - ECU **10.3 Trouble-shoot Computer related Diagnostics** • Computerised Equipment - Input devices - Output devices - Storages devices - Upkeep • Trouble-shooting and rectification **10.4 Apply On-Board Diagnostic Equipment** • On-Board Diagnostics Terminology • Codes • Operation • Upkeep • Trouble-shooting and rectification
Conditions/context of	1. Written and/or oral assessment on the skills and knowledge required

assessment	to solve automotive related challenges and vehicle problems through use of computerized automotive equipment. 2. Practical assessment on the requirements and principles to Solve automotive related challenges and vehicle problems through use of computerized automotive equipment.
Conditions/context of assessment	3. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 4. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 5. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Laptops - Computer lab - AUTOCAD Software - Storage devices - Printer - Bond paper

MODE OF ASSESSMENT

EXAMINABLE MODULE	MODE OF ASSESSMENT		TOTAL
	EXAMINATIONS 40%	COURSEWORK ASSESSMENT 60%	
Workshop Communication and Design in Automotive Engineering (319/22/M03)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical Assignment 20% • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME		WEIGHTING%
1	Practice and apply language and writing skills in automotive trade	10
2	Write business documents	8
3	Prepare different types of meetings for business organisations	6
4	Differentiate organization structures	3
5	Apply legislation and related laws to Automotive trade	8
6	Carry-out Basic Stores Management and Safety Health and Environment in relating to automotive trade	15
7	Demonstrate knowledge of computer operations	15
8	Demonstrate knowledge of Data Communications and basic Networking, Internet services, Computer Security and Emerging computer Technologies.	10
9	Apply Paint and AutoCAD skills to produce Automotive related diagrams and circuits.	20
10	Solve automotive related challenges and vehicle problems through use of computerized automotive equipment	5
	TOTAL	**100**

Approach to teaching and learning:

1. Observation of adult learning principles.
2. Both institution-based and work-based learning to facilitate the integration of theory and practice.
3 Face-to-face education and learning.
4 Problem-based learning.
5 Online/distance education and learning.
6 Blended/hybrid education and learning.
7 Use of social media.

Approach to assessment:

1. Weighting of 60% continuous assessment and 40% examination.
2. Oral assessment to be conducted by a panel of two or more assessors.
3. RPL assessment.
4. Portfolio of evidence.
5. Assessment of work conducted by both individual learners and teams of learners.

Resources:

1. Qualifications and experience of trainers, assessors and moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

2. Facilities, tools, equipment and materials

- Computer
- Desk
- Swivel chair

- Visitors chairs
- Filing cabinets
- Puncher
- Stapler
- Pens
- Dust bin
- Fax machine
- Printer
- Paper tray
- Document scanner
- Photocopier
- Heater
- Fan/air conditioner
- Document holders
- Refrigerator
- Water dispenser
- Water glasses
- Tea set
- Electric jugs
- Trays
- Cash box
- Microwave
- Office ornaments
- Paper scissors
- First aid kit
- Storekeeping books
- Accounting books
- Equipment and tools
- Fire fighting equipment

3. Learning resources

Relevant training manual (learners' guide) and facilitators' guide

4. Reference materials (recommended textbooks, recommended readings)

Module Code	**346/22/M03** **ICATE IN MOTOR VEHICLE MECHANICS – 346/21/CR/0**
Module Title	**AUTOMOTIVE ENGINEERING DRWAING**
ZNQF level:	**4**
Credits:	**15**
Duration:	**150** hours
Relationship with qualification standards:	Based on Unit Standard **Automotive Engineering Drawing** of Unit Standards for Automotive Engineering Trade
Pre-requisite modules:	No prerequisites
Purpose of module:	This module describes the skills, knowledge and attitudes required by an **Automotive Artisan** to be able to effectively communicate using graphic language. It requires the use of computers and related drawing equipment and machinery to produce Automotive engineering drawings and other related trades. This includes writing business documents and use of computer skills to carry out AUTO CAD. It also lays a foundation for further studies in the Automotive trade and other related areas. This module is important as it ensures proper and effective use of computer skills and drawing equipment for automotive and related trades. The module targets individuals who are in engineering trade and related business irrespective of gender, age or ethnicity.
List of learning outcomes:	**LO1 interpret engineering drawings by definition and relevance to automotive.** **LO2 make drawings of components for use in Automotive industry.** **LO3 draw basic engineering drawings.** **LO4 apply principles of engineering drawing standards.** **LO5 demonstrate knowledge of orthographic projection** **LO6 explain basic assembly drawing** **LO7 make pictorial presentation** **LO8 demonstrate knowledge of circuit diagrams** **LO9 demonstrate knowledge of conventional representation** **LO10 practice cad**
Learning outcome 01	**INTRODUCTION TO ENGINEERING DRAWING**

Assessment criteria:	1.1 Define Engineering Drawing. 1.2 List the ways Engineering Drawing is used in automotive trades. 1.3 Explain the importance of presenting drawings in the required standards. 1.4 List the advantages of using drawings as a means of communicating technical information. 1.5 List the types of Projection used in automotive engineering drawing. 1.6 Describe the selection process for standard paper and pencil grades. 1.7 Explain the use of scales in engineering drawing. 1.8 Copy to a given scale. 1.9 Explain the use of universal standards in Engineering Drawing.
Content:	**INTRODUCTION TO ENGINEERING DRAWING** 1.1 Define Engineering Drawing. 1.2 List the ways Engineering Drawing is used in automotive trades. 1.3 Explain the importance of presenting drawings in the required standards 1.4 List the advantages of using drawings as a means of communicating tech 1.5 List the types of Projection used in automotive engineering drawing. 1.6 Describe the selection process for standard paper and pencil grades. 1.7 Explain the use of scales in engineering drawing. 1.8 Copy to a given scale. 1.9 Explain the use of universal standards in Engineering Drawing.
Assessment tasks:	3. Written and/or drawn assessment on the skills and knowledge required in basic communication relating to drawing language and writing skills. 4. Practical assessment on the requirements and principles of basic communication relating to drawing language and writing skills.
Conditions/context of assessment	5. Written and/or drawn assessment can be conducted in a classroom environment. drawing assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees in the drawing room. 6. The practical assessment will be conducted in the workplace or simulated work environment or in the computer labs in the training institution.
Learning outcome 02	**DRAWING EQUIPMENT**
Assessment criteria	.2.1 List drawing equipment used in Engineering Drawing. 2.2 Describe the attributes that govern the selection of instruments and equipment to be used for given drawings. 2.3 Demonstrate the proper use, care and maintenance of drawing instruments and equipment, to include: - Drawing boards. - Tee-Square. - Draughting Machine. - Pens and Pencils.

	- Scale rules. - Stencils. 2.4 Explain the need for cleanliness in the drawing office. 2.5 Discuss the longevity of drawing depending on: - Drawing Media (e.g. ink type). - Drawing Fabric (paper, plastic film etc.). - Exposure to various types of rays, heat ranges or chemicals.
Content	2.1 List drawing equipment used in Engineering Drawing. 2.2 Describe the attributes that govern the selection of instruments and equipment to be used for given drawings. 2.3 Demonstrate the proper use, care and maintenance of drawing instruments and equipment, to include: - Drawing boards. - Tee-Square. - Draughting Machine. - Pens and Pencils. - Scale rules. - Stencils. 2.4 Explain the need for cleanliness in the drawing office. 2.5 Discuss the longevity of drawing depending on: - Drawing Media (e.g. ink type). - Drawing Fabric (paper, plastic film etc.). - Exposure to various types of rays, heat ranges or chemicals.
Assessment tasks	3. Written and/or oral assessment on the skills and knowledge required in demonstrating knowledge of computer management and file management. 4. Practical assessment on computer management and file management.
Conditions/context of assessment	4. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 5. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 6. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Telephone - Modems - Storage device

	- Computer lab - Desktop - Laptops - Cellphones - Software - Printers - Storage devices - Printers
Learning outcome 03	**LO3 LINES AND LETTERING**
Assessment criteria	3.1 Identify types of lines used in engineering drawing. 3.2 State the uses of the different types of lines. 3.3 Draw examples of each line type. 3.4 Apply each type of line where appropriate. 3.5 List the requirements for different letter and number, sizes, and their types in technical drawing. 3.6 Produce clear, uniform, freehand letters and numerical, applying the appropriate lines and using the correct pencil type. 3.7 Produce bold lettering and numbering suitable for engineering drawing. 3.8 Illustrate the use of lettering and numbering in the production of the title blocks used in engineering.
Assessment tasks	3.1 Identify types of lines used in engineering drawing. 3.2 State the uses of the different types of lines. 3.3 Draw examples of each line type. 3.4 Apply each type of line where appropriate. 3.5 List the requirements for different letter and number, sizes, and their types in technical drawing. 3.6 Produce clear, uniform, freehand letters and numerical, applying the appropriate lines and using the correct pencil type. 3.7 Produce bold lettering and numbering suitable for engineering drawing. 3.8 Illustrate the use of lettering and numbering in the production of the title blocks used in engineering. ✓
Conditions/context of assessment	3. Written and/or oral assessment on the skills and knowledge required to demonstrate knowledge of Data Communications and Basic Networking, Internet services and emerging computer Technologies. 4. Practical assessment on the requirements and principles of data networking, Internet services and emerging computer Technologies
Content	6. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 7. The practical assessment will be conducted in the workplace or simulated work environment in the training institution.

	8. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Modems - Storage device - Computer lab - Desktop - Laptops - Cellphones - Printers - Storage devices - Printers
Learning outcome 04	**LO4 GEOMETRICAL CONSTRUCTION AND DIMENSIONING**
Assessment criteria	4.1 LINES Perform the listed geometrical activities: - Bisect a line. - Construct a perpendicular from a given point to a line. - Divide a line into proportional parts. - Construct a perpendicular from any point to a line - Construct parallel lines. 4.2 ANGLES - Define and identify types of angles. - Bisect an angle. - Construct various types of angles without a protractor. - Copy an angle. 4.3 ARCS AND CIRCLES - Define a circle and identify various parts of a circle. - Find the center of given arc or a circle. - Construct geometrical shapes as required. - Join straight lines to curves by an arc. - Construct ellipse and scales. 4.4 DIMENSIONING a) Apply rules of dimensioning to include: - Functional and non-functional dimensions. - Auxiliary Dimensions. - Chain Dimensioning. - Datum Dimensioning. b) Allocate dimensions to working drawings following the BS 308 standard (and local equivalent). c) Use pencils for dimensioning.

Assessment tasks	•
Conditions/context of assessment	3. Written and/or oral assessment on the skills and knowledge required in word processing techniques, presentation and spreadsheets to enhance automotive operations. 4. Practical assessment on the requirements and principles of word processing, presentation and spreadsheets to enhance automotive operations.
Content	Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the perfor 4.1 LINES Perform the listed geometrical activities: - Bisect a line. - Construct a perpendicular from a given point of a line. - Divide a line into proportional parts. - Construct a perpendicular from any point to a line - Construct parallel lines. 4.2 **ANGLES** - Define and identify types of angles. - Bisect an angle. - Construct various types of angles without a protractor. - Copy an angle. 4.3 **ARCS AND CIRCLES** - Define a circle and identify various parts of a circle. - Find the center of given arc or a circle. - Construct geometrical shapes as required. - Join straight lines to curves by an arc. - Construct ellipse and scales. 4.4 **DIMENSIONING** a) Apply rules of dimensioning to include: - Functional and non-functional dimensions. - Auxiliary Dimensions. - Chain Dimensioning. - Datum Dimensioning. b) Allocate dimensions to working drawings following the BS 308 standard (and local equivalent). c) Use pencils for dimensioning. 6. mance of the practical assessment by the trainees. 7. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 8. The context of assessment should include the facilities, tools,

	equipment and materials listed below: - - Storage device - Computer lab - Desktop - Laptops - Cellphones - Software - Printers - Storage devices - Printers Stationary - Charts
Learning outcome 05	**LO5 ORTHOGRAPHIC PROJECTION**
Assessment criteria	5.1 Describe and identify the difference between Isometric and Oblique Projection. 5.2 Describe and demonstrate automotive applications of isometric and oblique projections. 5.3 FIRST ANGLE PROJECTION a) Identify diagrams in Fist Angle Projection. b) Construction simple Orthographic drawings in First Angle Projection, using typical Motor Vehicle (Light and Heavy) application. c) Select and use appropriate types of lines for drawing diagrams in orthographic First Angle Projection to include: - Hidden detail. - Centre lines. - Arcs and Curves. d) THIRD ANGLE ORTHOGRAPHIC PROJECTION - Produce orthographic projection drawings from pictorial drawings. - Identify diagrams in THIRD Angle Projection. - Describe and identify the difference(s) between FIRST & THIRD Angle Projection. e) FREEHAND SKETCHING - Produce diagrams following the principles of freehand sketching. - Sketch diagrams in First Angle Projection using freehand sketches. f) ISOMETRIC PROJECTION - Draw diagrams using Isometric Projection to include any angles involved. - Construct an ellipse and Isometric circles using given methods. - Construct simple diagrams using the Isometric scale. g) SECTIONING - Describe rules of sectioning.

	- Draw diagrams in First Angle Projection, applying the rules of sectioning. - Extend the principle of orthographic projection. - Describe and identify components which must NOT be sectioned generally or those which may not be sectioned under certain circumstances. h) CONVERSIONS a) Convert diagrammatic representation into simple drawings of mechanical components to include: - Bars, Tubes and shafts. - Compression and Tension springs. - Splined and serrated shafts (both internally and externally) b) Sketch and work from Datum. **5.4 BASIC ASSEMBLY DRAWING** 5.5 Explain the following: - Shape - Size - Specifications - Location and relationship of all parts 4.5.4.2 Describe the elements of engineering procedure 4.5.4.3 Distinguish between types of drawings **4.6 PICTORIAL REPRESENTATION** 4.6.1 Distinguish orthographic projection drawings from pictorial drawings. 4.6.2 Interpret orthographic projection drawings. 4.6.3 Convert orthographic projection drawings of mechanical components to pictorial drawings. 4.6.4 Interpret conventional abbreviations and symbols on Automotive Engineering drawings. 4.6.5 Interpret exploded diagrams of Motor Vehicle Mechanical components.
Assessment tasks	4.5.1 Describe and identify the difference between Isometric and Oblique Projection. 4.5.2 Describe and demonstrate automotive applications of isometric and oblique projections. 4.5.3 FIRST ANGLE PROJECTION a) Identify diagrams in Fist Angle Projection. b) Construction simple Orthographic drawings in First Angle Projection, using typical Motor Vehicle (Light and Heavy) application. c) Select and use appropriate types of lin**4.5.4 BASIC ASSEMBLY DRAWING** 4.5.4.1 Explain the following: - Shape - Size

	- Specifications - Location and relationship of all parts 4.5.4.2 Describe the elements of engineering procedure 4.5.4.3 Distinguish between types of drawings **4.6 PICTORIAL REPRESENTATION** 4.6.1 Distinguish orthographic projection drawings from pictorial drawings. 4.6.2 Interpret orthographic projection drawings. 4.6.3 Convert orthographic projection drawings of mechanical components to pictorial drawings. 4.6.4 Interpret conventional abbreviations and symbols on Automotive Engineering drawings. 4.6.5 Interpret exploded diagrams of Motor Vehicle Mechanical components. es for drawing diagrams in orthographic First Angle Projection to include: - Hidden detail. - Centre lines. - Arcs and Curves. d) THIRD ANGLE ORTHOGRAPHIC PROJECTION - Produce orthographic projection drawings from pictorial drawings. - Identify diagrams in THIRD Angle Projection. - Describe and identify the difference(s) between FIRST & THIRD Angle Projection. e) FREEHAND SKETCHING - Produce diagrams following the principles of freehand sketching. - Sketch diagrams in First Angle Projection using freehand sketches. f) ISOMETRIC PROJECTION - Draw diagrams using Isometric Projection to include any angles involved. - Construct an ellipse and Isometric circles using given methods. - Construct simple diagrams using the Isometric scale. g) SECTIONING - Describe rules of sectioning. - Draw diagrams in First Angle Projection, applying the rules of sectioning. - Extend the principle of orthographic projection. - Describe and identify components which must NOT be sectioned generally or those which may not be sectioned under certain circumstances. h) CONVERSIONS

	a) Convert diagrammatic representation into simple drawings of mechanical components to include: - Bars, Tubes and shafts. - Compression and Tension springs. - Splined and serrated shafts (both internally and externally) **4.5.4 BASIC ASSEMBLY DRAWING** 4.5.4.1 Explain the following: - Shape - Size - Specifications - Location and relationship of all parts 4.5.4.2 Describe the elements of engineering procedure 4.5.4.3 Distinguish between types of drawings **4.6 PICTORIAL REPRESENTATION** 4.6.1 Distinguish orthographic projection drawings from pictorial drawings. 4.6.2 Interpret orthographic projection drawings. 4.6.3 Convert orthographic projection drawings of mechanical components to pictorial drawings. 4.6.4 Interpret conventional abbreviations and symbols on Automotive Engineering drawings. 4.6.5 Interpret exploded diagrams of Motor Vehicle Mechanical components.
Conditions/context of assessment	6. Written and/or oral assessment on the skills and knowledge required on PAINT and AUTOCAD applications. 7. Practical assessment on the requirements and on PAINT and AUTOCAD applications.
Content	6. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. The practical assessment will be condu**4.5.4 BASIC ASSEMBLY DRAWING** 4.5.4.1 Explain the following: - Shape - Size - Specifications - Location and relationship of all parts 4.5.4.2 Describe the elements of engineering procedure 4.5.4.3 Distinguish between types of drawings **4.6 PICTORIAL REPRESENTATION** 4.6.1 Distinguish orthographic projection drawings from pictorial drawings.

	4.6.2 Interpret orthographic projection drawings. 4.6.3 Convert orthographic projection drawings of mechanical components to pictorial drawings. 4.6.4 Interpret conventional abbreviations and symbols on Automotive Engineering drawings. 4.6.5 Interpret exploded diagrams of Motor Vehicle Mechanical components. 7. cted in the workplace or simulated work environment in the training institution. 8. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Laptops - Computer lab - AUTOCAD Software - Storage devices - Printer - Bond paper -
Learning outcome 06	**CONVENTIONAL REPRESENTATION** 4.8.1 Demonstrate the following: Threads. Interrupted views. Repeated parts. Splined and serrated shafts. Knurling. A square or a flat on a shaft. Holes on linear or circular pitch. Spur gears.
Assessment criteria	**CONVENTIONAL REPRESENTATION** 4.8.1 Demonstrate the following: Threads. Interrupted views. Repeated parts. Splined and serrated shafts. Knurling. A square or a flat on a shaft. Holes on linear or circular pitch. Spur gears.
Assessment tasks	**CONVENTIONAL REPRESENTATION** 4.8.1 Demonstrate the following: Threads. Interrupted views. Repeated parts. Splined and serrated shafts. Knurling.

	A square or a flat on a shaft. Holes on linear or circular pitch. Spur gears.
Conditions/context of assessment	1. Written and/or oral assessment on the skills and knowledge required to Solve automotive related challenges and vehicle problems through use of computerized automotive equipment. 1 Practical assessment on the requirements and principles to Solve automotive related challenges and vehicle problems through use of computerized automotive equipment.
Content	Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Laptops - Computer lab - OBD machine - Storage devices - Printer - Bond paper - Internet - Toolbox

Learning outcome 07	
Assessment criteria	**9 CIRCUIT DIAGRAMS** 4.9.1 **Hydraulic circuits** **Hydraulic circuits** 4.9.1.1 Interpret a tractor hydraulic circuit. 4.9.1.2 Identify by name all control units (i.e. valves, pumps, etc.). 4.9.1.3 Use hydraulic circuit symbols to graphically produce hydraulic circuits used on light and heavy vehicles (i.e. Power steering, Power Brakes, tipping, mechanisms etc.) 4.9.2 **Pneumatic circuits** 4.9.2.1 Read and interpret a basic heavy vehicle air brake circuit. 4.9.2.2 Identify all circuit units (e.g. Unloaders, compressor, filters, accumulators, various valves, etc.). 4.9.2.3 Reproduce given pneumatic circuits on paper – using pneumatic – appropriate circuit symbols. 4.9.3 **Basic Electrical Circuits** 4.9.3.1 Interpret basic auto-electrical circuits. 4.9.3.2 Identify basic units from given circuit diagrams. 4.9.3.3 Reproduce given basic auto-electrical circuits on paper using

	convention symbols to represent system components
Assessment tasks	**9 CIRCUIT DIAGRAMS** 4.9.1 **Hydraulic circuits** **Hydraulic circuits** 4.9.1.1 Interpret a tractor hydraulic circuit. 4.9.1.2 Identify by name all control units (i.e. valves, pumps, etc.). 4.9.1.3 Use hydraulic circuit symbols to graphically produce hydraulic circuits used on light and heavy vehicles (i.e. Power steering, Power Brakes, tipping, mechanisms etc.) 4.9.2 **Pneumatic circuits** 4.9.2.1 Read and interpret a basic heavy vehicle air brake circuit. 4.9.2.2 Identify all circuit units (e.g. Unloaders, compressor, filters, accumulators, various valves, etc.). 4.9.2.3 Reproduce given pneumatic circuits on paper – using pneumatic – appropriate circuit symbols. 4.9.3 **Basic Electrical Circuits** 4.9.3.1 Interpret basic auto-electrical circuits. 4.9.3.2 Identify basic units from given circuit diagrams. 4.9.3.3 Reproduce given basic auto-electrical circuits on paper using convention symbols to represent system components
Conditions/context of assessment	8.
Content	**9 CIRCUIT DIAGRAMS** 4.9.1 **Hydraulic circuits** **Hydraulic circuits** 4.9.1.1 Interpret a tractor hydraulic circuit. 4.9.1.2 Identify by name all control units (i.e. valves, pumps, etc.). 4.9.1.3 Use hydraulic circuit symbols to graphically produce hydraulic circuits used on light and heavy vehicles (i.e. Power steering, Power Brakes, tipping, mechanisms etc.) 4.9.2 **Pneumatic circuits** 4.9.2.1 Read and interpret a basic heavy vehicle air brake circuit. 4.9.2.2 Identify all circuit units (e.g. Unloaders, compressor, filters, accumulators, various valves, etc.). 4.9.2.3 Reproduce given pneumatic circuits on paper – using pneumatic – appropriate circuit symbols. 4.9.3 **Basic Electrical Circuits** 4.9.3.1 Interpret basic auto-electrical circuits. 4.9.3.2 Identify basic units from given circuit diagrams. 4.9.3.3 Reproduce given basic auto-electrical circuits on paper using - convention symbols to represent system components
	AUTO CAD

Learning outcome 08	**4.10 AUTO CAD** 4.10.1 Describe and explain methods of preparing Engineering Drawings using CAD - User interface - Customizing user interface - Auto Cad Commands - Draw lines and shapes - Use erase, undo and redo tools - Draw entities using absolute and relative coordinate points - Draw entities using the tracking method - Use drawing aids - Use editing tools - Multi-view drawings - Dimensions and annotation - Sectional views - Block, attributes and Xrefs - Layout and annotative objects - Templates and plotting 4.10.2 Use CAD to: - Produce basic automotive related diagrams
Assessment criteria	**AUTO CAD**4.10.1 Describe and explain methods of preparing Engineering Drawings using CAD - User interface - Customizing user interface - Auto Cad Commands - Draw lines and shapes - Use erase, undo and redo tools - Draw entities using absolute and relative coordinate points - Draw entities using the tracking method - Use drawing aids - Use editing tools - Multi-view drawings - Dimensions and annotation - Sectional views - Block, attributes and Xrefs - Layout and annotative objects - Templates and plotting 4.10.2 Use CAD to: - Produce basic automotive related diagrams

Assessment tasks	**AUTO CAD** 4.10.1 Describe and explain methods of preparing Engineering Drawings using CAD - User interface - Customizing user interface - Auto Cad Commands - Draw lines and shapes - Use erase, undo and redo tools - Draw entities using absolute and relative coordinate points - Draw entities using the tracking method - Use drawing aids - Use editing tools - Multi-view drawings - Dimensions and annotation - Sectional views - Block, attributes and Xrefs - Layout and annotative objects - Templates and plotting 4.10.2 Use CAD to: - Produce basic automotive related diagrams
Conditions/context of assessment	1. Written and/or oral assessment on the skills and knowledge required to Solve automotive related challenges and vehicle problems through use of computerized automotive equipment. 2 Practical assessment on the requirements and principles to Solve automotive related challenges and vehicle problems through use of computerized automotive equipment.
Content	Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. The context of assessment should include the facilities, tools, equipment and materials listed below: - - Laptops - Computer lab - OBD machine - Storage devices - Printer - Bond paper - Internet - Toolbox

Approach to teaching and learning:

8. Observation of adult learning principles.
9. Both institution-based and work-based learning to facilitate the integration of theory and practice.
10. Face-to-face education and learning.
11. Problem-based learning.
12. Online/distance education and learning.
13. Blended/hybrid education and learning.
14. Use of social media.

Approach to assessment:

7. Weighting of 60% continuous assessment and 40% examination.
8. drawing assessment to be conducted by a panel of two or more assessors.
9. RPL assessment.
10. Drawing folio of evidence.
11. Assessment of work conducted by both individual learners and teams of learners.

Resources:

5. Qualifications and experience of trainers, assessors and moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

6. Facilities, tools, equipment and materials

- Computer
- Desk
- Swivel chair
- Visitors chairs
- Filing cabinets
- Puncher
- Stapler
- Drawing pencils
- Dust bin
- Plotter machine
- 3D Printer
- Paper tray
- Document scanner
- Photocopier
- Heater
- Fan/air conditioner
- Document holders
- Refrigerator
- Water dispenser
- Water glasses
- Tea set
- Electric jugs
- Trays

- Microwave
- Office ornaments
- Paper scissors
- First aid kit
- Storekeeping books
- Drawing Equipment and tools
- Fire fighting equipment

7. Learning resources

Relevant training manual (learners' guide) and facilitators' guide

8. Reference materials (recommended textbooks, recommended readings)

Module Code	**319/22/M03**
Module Title	**ENGINE AND PLANT MAINTENANCE**
ZNQF Level	**4**
Credits	**20**
Duration	**200** hours
Relationship with Qualification Standards	Based on Unit Standard **319/22/M01 Engine and Plant Maintenance** of Qualification Standard for Diesel Plant Fitting Artisan
Pre-requisite modules	**346/22/M03 MAINTAIN SAFE, HEALTH & ENVIRONMENT AND FITTING & MACHINING PROCESSES**
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain engine and plant. This includes prepare maintenance schedule, conduct visual inspection, service/repair plant and test run plant. The advantages of maintaining plant include reduced down time, long life, reduced running costs, reduce breakdowns. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintaining Plant.
List of Learning Outcomes	**LO1: Prepare Maintenance Schedule** **LO2: Conduct visual inspection** **LO3: Service/repair engine/plant** **LO4: Test run the engine/plant/machine**
Learning Outcome 01	**LO1 Prepare Maintenance Schedule**
Assessment Criteria	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Identify and prepare installation site 1.6 Test-run and commission engine and plant 1.7 Analyse service record book/checklist/manual compliance
Content	**LO1: Prepare Maintenance Schedule** 1.1 Prepare a service program based on the machine time/mileage and with service intervals • Service programs ✓ Minor service after 250hrs/5000km

	✓ Major service after 2000hrs/10 000km/15 000km **1.2 Define specific tasks for each service interval and time frame** • Minor service after 250hrs/500km ✓ Changing filters, oils, checking condition of belts, leakage ✓ Changing filters, oils, checking condition of belts ,leakages • Major service after 2000hrs/10 000km/15 000km ✓ checking valve clearances, bearings, re-torque cylinder head, changing filters and oils ✓ Servicing injector pump and injectors ➢ Phasing injector pump ➢ Calibrating ➢ Spray pattern ➢ Dribbling ➢ Back leakage test ➢ Cracking point **1.3 Identify service kits and tools for each service interval** • Service kits and tools ✓ Filters ✓ Oils ✓ Belts ✓ Service manual ✓ Standard tool box • Minor service ✓ Filters ✓ Oils ✓ Belts ✓ Service manual ✓ Standard tool box • Major service ✓ Filters ✓ Oils ✓ Belts ✓ Service manual **1.4 Identify relevant equipment and human resources** • Equipment and tools ✓ Standard tools box ✓ Service manual ✓ Standard tool box

	✓ Engine diagnostic machine ✓ Gas analyser ✓ Compression test kit **1.5 Identify and prepare installation site** • Installation site ✓ Purpose of anti-pollution devices ✓ Types of anti-pollution devices ✓ operation of anti-pollution devices **1.6 Test-run and commission engine/plant** • Test-run and commissioning ✓ Visual check ✓ Sound check **1.7 Analyse service record book/checklist** • Service record and checklist ✓ Checklist and record book ✓ Machine/Plant history ✓ Job card
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare maintenance schedule as outlined in the assessment criteria prepare a service program based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and tools for each service interval, identify relevant equipment and human resources, identify and prepare installation site, test-run and commission plant and analyse service record book/checklist. 2. Practical assessment on conducting plant maintenance including the following perform daily checks, perform service range from 250hr/5000km to 5000hrs/ 10 000km/15 000km the consideration of environmental factors which affect plant maintenance and the production of a plant maintenance report based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox

	• Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Injector tester • Parts catalogue • Fire extinguisher
Learning Outcome 02	**LO2: Carry-out trouble shooting**
Assessment Criteria	2.1 Inspect whole plant/machine/engine 2.2 Identify notable defects 2.3 Clean plant/ machine 2.4 Recommend replacement of defective components 2.5 Determine nature of problem
Content	**LO2:Conduct visual inspection** **2.1 Inspect whole engine/plant/machine.** • Major components ✓ Leakages ✓ Wear and tear effects ✓ Exhaust gases **2.2 Identify notable defects** • Materials ✓ Ferrous and Non-Ferrous materials ✓ Heat treatment ✓ Common defects **2.3 Clean plant/machine** • Cleaning Methods ✓ Sand blasting ✓ Pressurised system ✓ Effects of grime or dirty on components. **2.4 Recommend replacement of defective components** ✓ Major plant/machine visible components ✓ Common defects ✓ Common effects **2.5 Determine nature of problem** ✓ Faults ✓ Scan tools

Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to carry-out trouble shooting as outlined in the assessment criteria; inspect whole plant/machine, identify notable effects, clean plant/recommend replacement of defective components. 2. Practical assessment on carry-out troubleshooting visual inspection based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Artisan tool books • Measuring instruments and tools • Torque range
Learning Outcome 03	**Service/Repair Engine/Plant**
Assessment Criteria	3.1 Observe SHEQ 3.2 Consult visual inspection report 3.3 Source operation manual and appropriate tools and equipment 3.4 Repair serviceable components according the manufacturer's specifications. 3.5 Replace defective components
Content	**LO3: Service/Repair Plant** **3.1 Observe SHEQ.** • Safety Precautions ✓ Safety rules and precautions pertaining to plant. **3.2 Consult visual inspection report** • Job Cards • Types of Maintenance/services ✓ Planned

	✓ Scheduled ✓ Incident/accident **3.3 Source operation manual and appropriate tools and equipment** • Manufacturer's Manual ✓ Symbols ✓ Specifications • Tools and Equipment ✓ Hydraulic tools/equipment ✓ Pneumatic Tools/equipment ✓ Mechanical Tools/Equipment **3.4 Repair serviceable components according the manufacturer's specifications** • Minor Components ✓ Function ✓ Operation ✓ Faulty diagnosis ✓ Disassembling and assembling of components • Major Components ✓ Function ✓ Operation ✓ Faulty diagnosis ✓ Disassembling and assembling of components **3.5 Replace defective components** • Minor Components ✓ Function ✓ Operation ✓ Faulty diagnosis ✓ Removal and replacement defective components • Major Components ✓ Function ✓ Operation ✓ Faulty diagnosis ✓ Removal and replacement defective components **3.6 Follow appropriate engine servicing /repairing procedure** • Types of services ✓ Minor service procedure ✓ Major service procedure **3.7 Carry out necessary engine checks** • Checks done on an engine ✓ Oil checks/tribology ✓ Check belts/chains

	✓ Bearings ✓ Cracks ✓ Leaks **3.8 Conduct prestart procedure(priming, bearings)** ✓ Bleeding air lock ✓ Bearing pre-loading **3.9 Connect necessary running instruments** • Procedure for connecting running instruments ✓ Dynamometer ✓ Rev counter ✓ Speedometer ✓Compression test kit
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to service/repair of plant as outlined in the assessment criteria; source operation manual and appropriate tools and equipment, repair serviceable components according the manufacturer's specifications, replace defective components. 2. Practical assessment on service/ repair based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Valve adjustment set • Injector tester • Parts catalogue • Torque wrench • Hydraulic press • Measuring instruments

	• Measuring tools
Learning Outcome 04	**Test run Engine/Plant/Machine**
Assessment Criteria	4.1 Conduct and Analyse relevant checks. 4.2 Connect appropriate instruments 4.3 Start Plant/Machine in compliance to operating specifications 4.4 Carry out adjustments 4.5 Produce plant/machine service/repair report.
Content	**LO4: Test run Engine/Plant/Machine** **4.1 Conduct and Analyse relevant checks** • Function ✓ Cooling ✓ Lubrication ✓ Battery electrolyte ✓ Electrical ✓ Mechanical ✓ Hydraulic ✓ Pneumatic **4.2 Connect appropriate instruments** • Measuring Instruments eg gauges **4.3 Start Plant/Machine in compliance to operating specifications** ✓ Basic Engine Operation ✓ Fuel, oil and water consumption ✓ Knocks ✓ Vibrations **4.4 Carry out adjustments** ✓ Pressures ✓ Idling ✓ Mechanism adjustments **4.5 Produce plant/machine service/repair report.** ✓ Log write ups
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to test run plant/machine as outlined in the assessment criteria conduct and Analyse relevant checks, connect appropriate instruments, start Plant/Machine in compliance to operating specifications, carry out adjustments, produce plant/machine service/repair report.

	2. Practical assessment on test run plant/machine based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. 1 Artisan's toolbox 1. Plant service manual 2. Torque wrench 3. Dynamometer 4. Jack and axle stands 5. Hydraulic and or pneumatic press 6. Measuring instruments 7. Work bench 8. Diagnostic machine 9. Overhead crane and lifts 10. Stocks and dies, hacksaws 11. Valve adjustment set 12. Injector tester 13. Parts catalogue 14. Fire extinguisher 15. Marking instruments

Approach to Teaching and Learning:

1 Observation of adult learning principles.
2 Both institution-based and work-based learning to facilitate the integration of theory and practice.
3 Face-to-face education and learning.
4 Problem-based learning.
5 Online/distance education and learning.
6 Blended/hybrid education and learning.
7 Use of social media.

Approach to Assessment:

1 Weighting of practical and theory assessment: 40% theory and 60% practical.
2 Weighting of institution-based and work-based assessment:

50% institution-based assessment and 50%.

3 Oral assessment to be conducted by a panel of two or more assessors.
4 RPL assessment.
5 Portfolio of evidence.
6 Assessment of work conducted by both individual learners and teams of learners.

Resources:

9. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

10. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

MODE OF ASSESSMENT

EXAMINABLE MODULE	MODE OF ASSESSMENT		TOTAL
	EXAMINATIONS 40%	COURSEWORK ASSESSMENT 60%	
Engine and Plant Maintenance 319/22/M01	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical Assignment 20% • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME	TOPICS	WEIGHTING%
1	Prepare Maintenance Schedule	3
2	Conduct visual inspection	12
3	Service/repair engine/plant	80
4	Test run the engine/plant/machine	5
	TOTAL	**100%**

11. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

1. Reference Materials (recommended textbooks, recommended readings)
1. Asmus A.(1981) Diesel engines and fuel system Butterworths London
2. Bland S.(1980) Diesel engines Longman London
3. Cookery A.J (1982) Graded Exercise in Technical Longman London Drawing
4. Crouse(1981) Automotive Electrical Systems Newness Basingstoke
5. Flood C.R(1985) Farm Machinery Granada London
6. Schultz (1983) Diesel Mechanics McGraw-Hill London
7. Stroud K (1995) Engineering Mathematics Bath Press London
8. Schultz E.J (1982) Diesel Equipment I: Lubrication, Hydraulics and Brakes McGraw- Hill New York
9. Maleckv V.I (1982) Motor Vehicle Calculations and Science (Book 2)Chapman & Hall New York
10 Ben Watson (2011) Modern Diesel Technology Mobile Equipment Hydraulics Delma Cengage New York

11. Caterpillar (2008) Global Service Learning Service 1865 New York

12. Caterpillar (2004) Basic Hydraulic System Caterpillar Hand out New York

13. Hillier/Nelson Thorne (2012) Fundamentals of Motor Vehicles Six Edition Calex London UK

14. Robert Huzij (2012) Heavy Equipment Second Edition Delma Cengage New York
Angelo Sparo
Sean Bennet

15. D.J. Leeming and R. Hartley (1989) Heavy Vehicle Technology Stanley Thornes London UK

Module Code	**319/22/M04**
Module Title	**POWER TRAIN MAINTENANCNE**
ZNQF Level	**4**
Credits	**20**
Duration	**200** hours
Relationship with Qualification Standards	Based on Unit Standard **319/22/M03** Power Train Maintenance of Qualification Standard for Diesel Plant Fitting Artisan
Pre-requisite modules	**346/22/M03** Safe, Health & Environment and Fitting & Machining Processes
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain power train. This includes prepare service schedule, carry out trouble shooting, service/repair components and test for functionality. The advantages of maintaining power train include reduced down time, long life, reduced running costs, reduce breakdowns. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintain Power Train.
List of Learning Outcomes	**LO1: Prepare service schedule** **LO2: Carry out trouble shooting** **LO3: Service/repair components** **LO4: Test for functionality**
Learning Outcome 01	**LO1: Prepare Service Schedule**
Assessment Criteria	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Identify and prepare installation site 1.6 Analyse service record book/checklist
Content	**LO1: Prepare Service Schedule** **1.1 Prepare a service program based on the machine time/mileage and with service intervals** • **Service program**

	✓ In general +/-1000hrs for automatic transmission ✓ About +* 20000km for manual gearboxes • Inspection and repair ✓ Clutch assembly ✓ Gearboxes ✓ Propeller shafts ✓ Final drive/diff ✓ Half shafts **1.2 Define specific tasks for each service interval and time frame** • +/-1000hrs for automatic transmission ✓ Transmission oil and filters. ✓ Oil strainers ✓ Tribology • +* 20000km for manual gearboxes ✓ gearbox manual ✓ Filters **1.3 Identify service kits and tools for each service interval** • **+/-1000hrs for automatic transmission** ✓ Service Kits ✓ Epicyclic Gear systems • **+* 20000km for manual gearboxes** ✓ Friction ✓ Laws of Friction ✓ Wet and Dry Clutches ✓ Friction Calculations **1.4 Identify relevant equipment and human resources** • Equipment and tools ✓ Standard tools box ✓ Service manual ✓ Measuring equipment ✓ Lifting equipment ✓ Pulling equipment ✓ Electrical and Electronic equipment ✓ Hydraulic equipment ✓ Pneumatic equipment **1.5 Analyse service record book/checklist** • **Service record and checklist** ✓ Checklist and record book ✓ Job card ✓ Logbook
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare service schedule based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and

	tools for each service interval, and analyse service record book/checklist. 2. Practical assessment on preparing of service schedule conducting plant maintenance on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Injector tester • Parts catalogue • Plant service manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher
Learning Outcome 02	**LO2 Carry Out Trouble Shooting**
Assessment Criteria	2.1 Connect necessary instruments to determine nature of failure 2.2 Analyse printed results 2.3 Determine nature of problem 2.4 Outline/describe course of action 2.5 Remove magnetic screen to inspect debris 2.6 Conduct scientific wear analysis

Content	**LO2: Carry Out Trouble Shooting** 2.1 Connect necessary instruments to determine nature of failure. • Handling and use of test instruments ✓ How to locate testing ports ✓ How to extract measurements from test instruments ✓ Adhering to testing procedures **2.2 Analyse printed results** • **Print out** ✓ Interpreting fault codes ✓ Clearing fault codes **2.3 Determine nature of problem** • **Problem Indicators** ✓ **Diagnosis** ✓ **Scanning Tools** **2.4 Outline/describe course of action** • Rectification • Fault codes **2.5 Remove magnetic screen to inspect debris** • Principles of Magnetism • Electromagnetism • Debris implications **2.6 Conduct scientific wear analysis** • Scientific wear analysis ✓ Its advantages ✓ Oil contamination ✓ Wear Resistance ✓ Sample for analysis
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to carry out trouble shooting as outlined in the assessment criteria; source operation manual and appropriate tools and equipment, connect necessary instruments to determine nature of failure, analyse printed results, determine nature of problem, outline/describe course of action, remove magnetic screen to inspect debris, conduct scientific wear analysis. 2. Practical assessment on troubleshooting based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution.

	3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Service Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Valve adjustment set • Injector tester • Parts catalogue • Torque wrench • Hydraulic press • Measuring instruments • Measuring tools
Learning Outcome 03	**LO3 Service/Repair Components**
Assessment Criteria	3.1 Gather necessary resources (tools, equipment, manuals, HR and materials) 3.2 Follow appropriate servicing/repairing procedure 3.3 Carry out necessary checks 3.4 Conduct pre-start procedure e.g. priming, bearings 3.5 Connect necessary running instruments
Content	**LO3: Service/Repair Components** **3.1 Gather necessary resources (tools, equipment, manuals, HR and materials)** • **Tools** ✓ Standard tools box ✓ Measuring tools • Equipment ✓ Lifting equipment ✓ Pulling equipment ✓ Pressing equipment ✓ Testing equipment **3.2 Follow appropriate servicing/repairing procedure** • **Types of services** ✓ Minor service procedure ✓ Major service procedure **3.3 Carry out necessary checks** • **Checks done on an engine** ✓ Oil checks/tribology ✓ Check belts/chains ✓ Bearings

	✓ Cracks ✓ Leakages **3.4 Conduct pre-start procedure e.g. priming, bearings** • Air lock • Bearing pre-loading **3.5** Connect necessary running instruments • **Procedure for connecting running instruments** ✓ Dynamometer ✓ Rev counter ✓ Speedometer ✓ Compression test kit ✓ Engine Capacity ✓ BMEP Calculations ✓ BMIP Calculations ✓ Frictional Calculations
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to Service/Repair components gather necessary resources (tools, equipment, manuals, HR and materials), follow appropriate servicing/repairing procedure, carry out necessary checks, conduct pre-start procedure e.g. priming, bearings and connect necessary running instruments. 2. Practical assessment on service/repair components based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. 2 Artisan's toolbox 16. Plant manual 17. Torque wrench 18. Dynamometer 19. Jack and axle stands 20. Hydraulic press 21. Measuring instruments 22. Work bench 23. Diagnostic machine 24. Overhead crane and lifts 25. Stocks and dies, hacksaws 26. Valve adjustment set

	27. Injector tester 28. Parts catalogue 29. Fire extinguisher 30. Marking instruments
Learning Outcome O4	**LO4: Test For Functionality**
Assessment Criteria	4.1 Analyse/conduct necessary checks 4.2 Connect appropriate instruments 4.3 Run plant/machine according to specifications 4.4 Compare operating specifications against manufacture's specifications 4.5 Carry out necessary adjustments 4.6 Produce plant/machine service/repair report
Content	**LO4: Test For Functionality** **4.1 Analyse/conduct necessary checks** • Checks done on each component ✓ Clutch assembly ✓ Gearboxes ✓ Propeller shafts ✓ Final drive/diff ✓ Half shafts ✓ Hubs **4.2 Connect appropriate instruments** • Instruments used to measure and test the powertrain ✓ Backlash ✓ Bearing pre-loads ✓ Run out **4.3 Run plant/machine according to specifications** ✓ Basic Engine Operation ✓ Fuel, oil and water consumption ✓ Knocks ✓ Vibrations **4.4 Compare operating specifications against manufacture's specifications** ✓ End float **4.5 Carry out necessary adjustments** ✓ Pressures ✓ Idling ✓ Mechanism adjustments **4.6 Produce plant/machine service/repair report** ✓ Log writes
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to Test for functionality as outlined in the assessment

	criteria analyse/conduct necessary checks, connect appropriate instruments, run plant/machine according to specifications, compare operating specifications against manufacture's specifications, carry-out necessary adjustments and produce plant/machine service/repair report. 2. Practical assessment on testing for functionality based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Injector tester • Parts catalogue • Fire extinguisher

Approach to Teaching and Learning:

1. Observation of adult learning principles.
2. Both institution-based and work-based learning to facilitate the integration of theory and practice.
3. Face-to-face education and learning.
4. Problem-based learning.
5. Online/distance education and learning.
6. Blended/hybrid education and learning.
7. Use of social media.

Approach to Assessment:

1. Weighting of practical and theory assessment: 70% theory and 30% practical.
2. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
3. Oral assessment to be conducted by a panel of two or more assessors.
4. RPL assessment.
5. Portfolio of evidence.
6. Assessment of work conducted by both individual learners and teams of learners.

Resources:

2. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

3. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

MODE OF ASSESSMENT

EXAMINABLE MODULE	MODE OF ASSESSMENT		TOTAL
	EXAMINATIONS 40%	COURSEWORK ASSESSMENT 60%	
Power Train Maintenance (319/22/M03)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical Assignment 20% • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME		WEIGHTING%
1	**Prepare service schedule**	**3**
2	**Carry out trouble shooting**	**12**
3	**Service/repair components**	**80**
4	**Test for functionality**	**5**
	TOTAL	**100%**

4. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

5. Reference Materials (recommended textbooks, recommended readings)

1.Asmus A. (1981) Diesel engines and fuel system Butterworths London

2. Bland S. (1980) Diesel engines Longman London

3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London

4. Crouse (1981) Automotive Electrical Systems Newness Basingstoke

5. Flood C.R (1985) Farm Machinery Granada London

6. Schultz (1983) Diesel Mechanics McGraw-Hill London

7. Stroud K (1995) Engineering Mathematics Bath Press London

8. Schultz E.J (1982) Diesel Equipment I: Lubrication, Hydraulics and Brakes McGraw- Hill New York

9. Maleckv V.I (1982) Motor Vehicle Calculations and Science (Book 2) Chapman & Hall New York

10 Ben Watson (2011) Modern Diesel Technology Mobile Equipment Hydraulics Delma Cengage New York

11. Caterpillar (2008) Global Service Learning Serv 1865 New York

12. Caterpillar (2004) Basic Hydraulic System Caterpillar Hand out New York

13. Hillier/Nelson Thorne (2012) Fundamentals of Motor Vehicles Six Edition Calex London UK

14. Robert Huzij (2012) Heavy Equipment Second Edition Delma Cengage New York
Angelo Sparo
Sean Bennet

15. D.J. Leeming and R. Hartley (1989) Heavy Vehicle Technology Stanley Thornes London UK

Module Code	**319/22/M02**
Module Title	**HYDRAULIC AND BRAKING SYSTEMS MAINTENANCE**
ZNQF Level	**4**
Credits	**20**
Duration	**200** hours
Relationship with Qualification Standards	Based on Unit Standard **319/22/M05 Hydraulics and Braking Systems Maintenance** of Qualification Standard for Diesel Plant Fitting Artisan
Pre-requisite modules	**346/22/M03** Safe, Health & Environment and Fitting & Machining Processes
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain plant. This includes prepare maintenance schedule, conduct visual inspection, service/repair plant and test run plant. The advantages of maintaining plant include reduced down time, long life, reduced running costs, reduce breakdowns. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintaining Plant.
List of Learning Outcomes (Hydraulics System PART A)	**LO1: Prepare service schedule** **LO2: Carry out trouble shooting** **LO3: Service/repair units** **LO4: Test run the system**
Learning Outcome 01	**Prepare service Schedule**
Assessment Criteria	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Analyse service record book/checklist

Content	**LO1: Prepare service schedule** **1.1 Prepare a service program based on the machine time/mileage and with service intervals** • **Service program** ✓ Minor service ✓ Major service **1.2 Define specific tasks for each service interval and time frame** • **Minor service** ✓ Changing filters, oils, leakages • **Major service** ✓ Inspect reservoir ✓ Overhaul hydraulic control valves ✓ Overhaul hydraulic actuators e g motors, cylinders ✓ Overhaul hydraulic pumps ✓ Overhaul signalling systems **1.3 Identify service kits and tools for each service intervals** • **Minor service** ✓ Filters ✓ Oils ✓ Service manual ✓ Standard tool box • **Major service** ✓ Filters ✓ Oils ✓ gauges ✓ Service manual **1.4 Identify relevant equipment and human resources** • **Equipment and tools** ✓ Lifting equipment ✓ gauges ✓ Service manual ✓ Standard tool box **1.5 Analyse service record book/checklist** • **Service record and checklist** ✓ Checklist and record book ✓ Job card

Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare service schedule as outlined in the assessment criteria prepare a service program based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and tools for each service interval, identify relevant equipment and human resources, identify and prepare installation site, test-run and commission plant and analyse service record book/checklist. 2. Practical assessment on preparing service schedule based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Control Valves adjustment set • C-spanners • Hydraulic circuit model • Parts catalogue • Fire extinguisher
Learning Outcome 02	**Carry out trouble shooting**

Assessment Criteria	**2.1 Connect necessary instruments to determine nature of failure** **2.2 Analyse printed results** **2.3 Determine nature of problem** **2.4 Describe/outline course of action** **2.5 Remove magnetic screen to inspect debris** **2.6 Conduct scientific wear analysis on the oil**
Content	**LO2: Carry out trouble shooting** **2.1 Connect necessary instruments to determine nature of failure** • **Correct tool and equipment handling/usage** ✓ Hydraulic analyser ✓ guages **2.2 Analyse printed results** • **Hydraulic system applications** • **Print out** ✓ Fault codes **2.3 Determine nature of problem** • **Problem Indicators** ✓ Diagnosis ✓ Scan tools ✓ Aeration ✓ Cavitation **2.4 Describe/outline course of action** • Rectification procedures • Fault codes Interpretation **2.5 Remove Magnetic screen to inspect debris** • Magnetism • Electromagnetism • Debris implication **2.6 Conduct scientific wear analysis on the hydraulic oil** • Scientific wear analysis ✓ Advantages ✓ Collection and interpretation of results
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to carry out trouble shooting as outlined in the assessment criteria **connect** necessary instruments to determine nature of failure, analyse printed results, determine nature of problem, describe/outline course of action, remove magnetic screen to inspect debris, and conduct scientific wear analysis on oil.

	2. Practical assessment on carrying out trouble shooting based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant service manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Valve adjustment set • Parts catalogue • Torque wrench • Hydraulic press • Hydraulic crimping machines • Measuring instruments • Measuring tools
Learning Outcome LO3	**Service/repair units**
Assessment Criteria	3.1 Check implement cycles 3.2 Observe safety precautions due to high pressure and raised implements 3.3 Gather necessary resources[tool, equipment, manual, hr and materials] 3.4 Follow appropriate servicing/repairing procedure 3.5 Carry out necessary checks 3.6 Conduct prestart procedure [e g priming, bearings]
Content	**LO3: Service/repair units** **3.1 Check Implements Cycles** ✓ Hydraulic pumps construction and operation ✓ Hydraulic motors construction and operation ✓ Actuators

	• Gears ✓ Gear terms and calculations ✓ Pascal's law ✓ Cycloid ✓ Involute **3.2 Observe safety precautions due to high pressure and raised implements** • Hazards associated with pressurised fluids • Locking devices • Hydraulic systems Operations **3.3 Gather necessary resources [tools, equipment, manual, hr and materials]** • Tool and equipment handling and usage ✓ Lifting tools ✓ Measuring tools ✓ Gauges **3.4 follow appropriate servicing/repairing procedure** ✓ operation of hydraulic systems and specifications ✓ measurements and adjustments ✓ removal and installation of hydraulic components ✓ hydraulic system applications **3.5 Carry out necessary checks** • checks done on components ✓ reservoir ✓ hydraulic pump ✓ valves ✓ actuators ✓ fittings and connections **3.6 Prestart procedure [e g priming, bearings]** ✓ hydraulic pumps ✓ hydraulic motors ✓ cylinders ✓ valves
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to service/repair units as outlined in the assessment criteria; check implement cycles, observe safety precautions due to high pressure and raised implements, gather necessary resources, follow appropriate servicing/repairing procedure, carry out necessary checks and conduct prestart procedure. 2. Practical assessment on service/ repair of units based on the performance criteria of the Qualification Standard Diesel Plant Fitter.

Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant service manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Hydraulic Valve adjustment set • Parts catalogue • Torque wrench • Hydraulic press • Measuring instruments • Measuring tools • Pressure gauges • Pressure laws and calculations
Learning Outcome 04	**Test run the system**
Assessment Criteria	4.1 Analyse/conduct necessary checks 4.2 Connect appropriate instruments 4.3 Start plant/machine according to specifications 4.4 Carry out necessary adjustments 4.5 Produce plant/machine service/repair report
Content	**LO4: Test run the system** **4.1 Analyse/conduct necessary checks** • Hydraulic Components ✓ reservoir ✓ hydraulic pump ✓ valves ✓ actuators ✓ fittings and connections ✓ hydraulic circuits ✓ hydraulic symbols ✓ Electrical and electronic symbols

	✓ Drawing of hydraulic and electrical and electronic symbols circuits, **4.2 Connect appropriate instruments** • **Tools and Equipment** ✓ Hydraulic analyser ✓ Gauges **4.3 Start plant/machine according to specifications** • Power output calculations ✓ Basic Hydraulic Operation ✓ Oil consumption ✓ Vibrations **4.4 Carry out necessary adjustments** ✓ Pressures ✓ Mechanism adjustments **4.5 Produce plant/machine service/repair report.** ✓ Log write ups ✓ Job cards ✓ Schematic diagram worksheet
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to test run the system as outlined in the assessment criteria analyse/conduct necessary checks, connect appropriate instruments, start plant/machine according to specifications, and carry out necessary adjustments, produce plant/machine service/repair report. 2. Practical assessment on test running the system based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench

	• Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Parts catalogue • Fire extinguisher

Approach to Teaching and Learning:

8. Observation of adult learning principles.
9. Both institution-based and work-based learning to facilitate the integration of theory and practice.
10. Face-to-face education and learning.
11. Problem-based learning.
12. Online/distance education and learning.
13. Blended/hybrid education and learning.
14. Use of social media.

Approach to Assessment:

7. Weighting of practical and theory assessment: 70% theory and 30% practical.
8. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
9. Oral assessment to be conducted by a panel of two or more assessors.
10. RPL assessment.
11. Portfolio of evidence.
12. Assessment of work conducted by both individual learners and teams of learners.

Resources:

6. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

7. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape

- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

8. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

9. Reference Materials (recommended textbooks, recommended readings)

1.Asmus A. (1981) Diesel engines and fuel system Butterworths London

2. Bland S. (1980) Diesel engines Longman London

3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London

4. Crouse (1981) Automotive Electrical Systems Newness Basingstoke

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7. Stroud K (1995) Engineering Mathematics Bath Press London

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9. Maleckv V.I (1982) Motor Vehicle Calculations and Science (Book 2) Chapman & Hall New York

10 Ben Watson (2011) Modern Diesel Technology Mobile Equipment Hydraulics Delma Cengage New York

11. Caterpillar (2008) Global Service Learning Serv 1865 New York

12. Caterpillar (2004) Basic Hydraulic System Caterpillar Hand out New York

13. Hillier/Nelson Thorne (2012) Fundamentals of Motor Vehicles Six Edition Calex London UK

14. Robert Huzij (2012) Heavy Equipment Second Edition Delma Cengage New York

Angelo Sparo

Sean Bennet

15. D.J. Leeming and R. Hartley (1989) Heavy Vehicle Technology Stanley Thornes London UK

BRAKING SYSTEM PART B

List of Learning Outcomes (Braking Systems PART B)	**LO1: Prepare service schedule** **LO2: Conduct visual inspection** **LO3: Service/repair components** **LO4: Test run the system**
Learning Outcome 01	**Prepare Service Schedule**
Assessment Criteria	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Analyse service record book/checklist

Content	**LO1: Prepare Service Schedule** **1.6 Prepare a service program based on the machine time/mileage and with service intervals** • Types of services ✓ Minor service ✓ Major service ✓ ABS Circuits ✓ Brake circuits **1.2 Define specific tasks for each service interval and time frame** • **Minor service** ✓ Hydraulic brake circuits ✓ Pneumatic brake circuits ✓ Brakes adjustment ✓ Bleeding brakes ✓ **Major service** ✓ Disassembling of components ✓ Inspection of components ✓ Assembling of components ✓ Brake ratio ✓ Brake fade ✓ Self- servo action ✓ Factors affecting braking/ stopping distance ✓ Fault diagnosis ✓ ABS **1.3 Identify service kits and tools for each service interval** • Minor service • Standard tool box • Service manual • Brake fluid • Major service ✓ Standard tool box ✓ Manual ✓ Measuring tools **1.4 Identify relevant equipment and human resources** • Equipment and tools ✓ Standard tools box ✓ Service manual **1.5 Analyse service record book/checklist** • Service record and checklist ✓ Checklist and record book ✓ Job card

Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare service schedule as outlined in the assessment criteria prepare a service program based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and tools for each service interval, identify relevant equipment and human resources, analyse service record book/checklist and test-run and commission plant 2. Practical assessment on prepare service schedule based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2 The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3 The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Parts catalogue • Fire extinguisher
Learning Outcome 02	**Conduct Visual Inspection**
Assessment Criteria	**2.1 Inspect components visual** **2.2 Apply tooling and refer to specs and recommendations** **2.3Determine necessary course of action**
Content	**LO2: Conduct Visual Inspection** **2.1 Inspect components visually** • Leakages • Wear and tear

	• Brake fluid • Friction **2.2 Apply tooling and refer to specs and recommendations** • Inspection of components • Measuring • Visual inspection • Instruments **2.3 Determine necessary course of action** • Reconditioning of components ✓ Skimming ✓ Realigning ✓ Replacing ✓ Adjusting mechanisms ✓ Bleeding ✓ Flashing ✓ Greasing
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to conduct visual inspection as outlined in the assessment criteria; inspect components visual, apply tooling and refer to specs and recommendations and determine necessary course of action 2. Practical assessment on conducting visual inspection based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Measuring tools
Learning Outcome 03	**Service/Repair Components**

Assessment Criteria	**3.1 Check implemented cycles** **3.2 Observe safety precautions due to high pressure and raised** **Implements** **3.3 Gather necessary resources[tools , equipment ,manuals ,HR and materials** **3.4 Follow appropriate servicing/ repairing procedure** **3.5 Carry out necessary checks** **3.6 Conduct pre start procedure[e.g. priming , bearings]** **3.7 Connect necessary running instruments**
Content	**LO3: Service /Repair components** **3.1 Check implement cycles** • Brake system Operation ✓ Conventional System ✓ ABS ✓ Hydraulic System ✓ Pneumatic ✓ Engine Braking ✓ Brake Retardation (Retarders) ✓ Electronic Braking ✓ Exhaust brakes **3.2 Observe safety precautions due to high pressure and raised implements** • hazards associated with pressurised fluids • dangers posed by raised implements • locking devices • brake boosters **3.3 Gather necessary resources [tools, equipment, manuals, human resources and materials]** • **components to be serviced** ✓ master cylinder ✓ wheel cylinders ✓ brake shoes ✓ brake pads ✓ brake drum ✓ springs ✓ s- cam ✓ compressor ✓ air tanks ✓ valves ✓ lines ✓ slack adjuster ✓ brake chambers ✓ air gauge • **special tools**

	✓ horning tool ✓ service/repair manual ✓ lifting equipment ✓ measuring tools ✓ repair kits ✓ Caging Bolt **3.4 Follow appropriate servicing/repairing procedure** • Servicing and repairing procedures **3.5Carry out necessary checks** • Areas to be checked ✓ Pads ✓ Shoes ✓ Drums ✓ Connections ✓ Master cylinder ✓ Wheel cylinders ✓ Brake chamber ✓ Compressor ✓ Valves ✓ Air tanks ✓ Air lines ✓ Slack adjusters ✓ S- cam ✓ Springs and rollers ✓ Fluid level ✓ Air dryer ✓ Reservoirs ✓ Servo **3.6 Conduct prestart procedure[e g priming ,bearings]** • Key areas to be checked after servicing brakes ✓ Gauges ✓ Leaks ✓ Connections ✓ Air in the system **3.7 Connect necessary running instruments** • Measuring instruments
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to Service /Repair components as outlined in the assessment criteria; check implemented cycles, observe safety precautions due to high pressure and raised Implements, gather necessary resources[tools , equipment ,manuals ,HR and materials, follow appropriate servicing/ repairing procedure, carry out necessary checks, conduct pre start procedure[e.g. priming , bearings] and connect necessary running instruments

	2. Practical assessment on service/repair plant based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant service manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Control Valves adjustment set • Transparent pipes and jars • Parts catalogue • Torque wrench • Hydraulic press • Measuring instruments • Measuring tools
Learning Outcome 04	**Test run the system**
Assessment Criteria	**4.1 Analyse /conduct necessary checks** **4.2 Connect appropriate instruments** **4.3 Start plant/machine according to specifications** **4.4 Compare operating specifications against manufacturer's specifications** **4.5 Carry out necessary adjustments** **4.6 Produce plant/machine service/repair report**
Content	**LO4: Test- Run The System** **4.1 Analyse /conduct necessary checks** • **Areas to be checked** ✓ Pads ✓ Shoes ✓ Drums

	✓ Connections ✓ Master cylinder ✓ Wheel cylinders ✓ Brake chamber ✓ Compressor ✓ Valves ✓ Air tanks ✓ Air lines ✓ Slack adjusters ✓ S- cam ✓ Springs and rollers ✓ Fluid level **4.2 Connect appropriate instruments** • Compressor ✓ air line ✓ air gauge **4.3 Start plant/machine according to specifications** ✓ Air/Hydraulic Brake Operation **4.4 Compare operating specifications against manufacturer's specifications** • working parameters ✓ drum to shoe clearance ✓ minimum wear on pads and shoes ✓ drum thickness ✓ pedal travel ✓ spring tension **4.5 Carry out necessary adjustments** • adjustments done on brakes • working parameters ✓ drum to shoe clearance ✓ minimum wear on pads and shoes ✓ drum thickness ✓ pedal travel ✓ spring tension
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to test run system as outlined in the assessment criteria analyse /conduct necessary checks, connect appropriate instruments, start plant/machine according to specifications, compare operating specifications against manufacturer's specifications, carry out necessary adjustments and produce plant/machine service/repair report

	2. Practical assessment on test run system based on the performance criteria of the Qualification Standard Diesel Plant Fitter
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. **1** The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 2 The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant service manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Brake Fluid • Parts catalogue • Fire extinguisher

MODE OF ASSESSMENT

EXAMINABLE MODULE	**MODE OF ASSESSMENT**		**TOTAL**
	EXAMINATIONS 40%	**COURSEWORK ASSESSMENT 60%**	
Hydraulics and Braking Systems (319/22/M05)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical assignment 20% • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME (HYDRAULICS - PART A: 65marks)		WEIGHTING%
1	Prepare service schedule	2
2	Carry out trouble shooting	10
3	Service/repair units	50
4	Test run the system	3
LEARNING OUTCOME (BRAKING - PART B: 35marks)		**WEIGHTING%**
1	Prepare service schedule	2
2	Conduct visual inspection (troubleshooting)	5
3	Service/repair components	25
4	Test run the system	3
TOTAL		**100**

Approach to Teaching and Learning:

15. Observation of adult learning principles.
16. Both institution-based and work-based learning to facilitate the integration of theory and practice.
17. Face-to-face education and learning.
18. Problem-based learning.
19. Online/distance education and learning.
20. Blended/hybrid education and learning.
21. Use of social media.

Approach to Assessment:

13. Weighting of practical and theory assessment: 70% theory and 30% practical.
14. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
15. Oral assessment to be conducted by a panel of two or more assessors.
16. RPL assessment.
17. Portfolio of evidence.
18. Assessment of work conducted by both individual learners and teams of learners.

Resources:

10. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

11. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents

- PPC
- Cables
- Cable enclosures
- Electrical accessories

12. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

13. Reference Materials (recommended textbooks, recommended readings)

1. Asmus A. (1981) Diesel engines and fuel system Butterworths London
2. Bland S. (1980) Diesel engines Longman London
3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London
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14. Robert Huzij (2012) Heavy Equipment Second Edition Delma Cengage New York
    Angelo Sparo
    Sean Bennet
15. D.J. Leeming and R. Hartley (1989) Heavy Vehicle Technology Stanley Thornes London UK

Module Code	**319/22/M05**
Module Title	**UNDERCARRIAGE AND GROUND ENGAGING EQUIPMENT MAINTENANCE**
ZNQF Level	**4**
Credits	**20**
Duration	**200** hours
Relationship with Qualification Standards	Based on Unit Standard **319/22/M07 Undercarriage and Ground Engagement Equipment Maintenance** of Qualification Standard for Diesel Plant Fitting Artisan
Pre-requisite modules	**346/22/M03** Safe, Health & Environment and Fitting & Machining Processes
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain undercarriage**.** This includes prepare maintenance schedule, conduct visual inspection, service/repair plant and test run plant. The advantages of maintaining undercarriage include; reduced down time, long life, reduced running costs, reduce breakdowns. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintaining Plant.
List of Learning Outcomes (Undercarriage - PART A)	**LO1: Prepare service schedule.** **LO2: Inspect the components.** **LO3: Service/repair units.** **LO4: Test run the system.**
Learning Outcome 01	**LO1 Prepare Service Schedule**
Assessment Criteria:	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Analyse service record book/checklist 1.6 Test-run and commission plant
Content	**LO1: Prepare Service Schedule.** **1.1 Prepare a service program based on the machine time/mileage and with service intervals** ✓ Service program

	✓ Minor service ✓ Major service **1 .2 Define specific tasks for each service interval and time frame** ✓ Minor service ✓ Greasing ✓ Major service ✓ Inspect sprockets ✓ Inspect hydraulic cylinder and idler wheel ✓ Inspect carrier and track rollers ✓ Inspect grouser teeth and shoes ✓ Inspect steering clutches and reaction plates ✓ Inspect track chain tension **1.3 Identify service kits and tools for each service interval** ✓ Service kits and tools ✓ Grease gun ✓ Heavy duty grease ✓ Service manual ✓ Standard tool box ✓ Major service ✓ Straightedge ✓ Tape measure/depth gauge ✓ Service manual ✓ Standard tool box ✓ Lifting equipment **1.4 Identify relevant equipment and human resources** ✓ Equipment and tools ✓ Standard tools box ✓ Service manual ✓ Lifting equipment ✓ Tape measure/depth gauge **1.5 Test-run and commission plant** ✓ Test-run and commissioning ✓ Ability to detect unusual operating sounds ✓ Ability to detect operating behaviour **1.6 Analyse service record book/checklist** ✓ **S**ervice record and checklist ✓ Filling in checklist and record book ✓ Generating a job card
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare service schedule as outlined in the assessment criteria prepare a service program based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and tools for each service interval, identify relevant

	equipment and human resources, analyse service record book/checklist and test-run and commission plant 2. Practical assessment on prepare service schedule based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2 The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3 The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant service manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Parts catalogue • Fire extinguisher • Wooden blocks
Learning Outcome 02	**LO2 Inspect the components**
Assessment Criteria	2.1 Inspect components visually 2.2 Compare results against manufacturer's specs and recommendations. 2.3 Recommend replacement of defective components
Content	**LO2: Inspect the components** **2.1 Inspect components visually.** • Major components ✓ Misalignments ✓ Wear and tear effects • Minor components ✓ Leakages

	✓ Linkages operations • Drawing ✓ Schematic ✓ Circuit • Simple Machines Calculations **2.5 Compare results against manufacturer's specs and recommendations** • Misalignments ✓ Measurements (instruments and tools) ✓ Qualifying components • Calculations ✓ Torque ✓ Pressure ✓ Brakes and steering clutch principles **2.6 Recommend replacement of defective components** • Cleaning Methods ✓ Sand blasting ✓ Pressurised system ✓ Common defects ✓ Common effects
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to inspect the components as outlined in the assessment criteria; Inspect components visually, compare results against manufacturer's specs and recommendations and recommend replacement of defective components. 2. Practical assessment on inspecting components based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Hand control grease gun

	• Measuring tools • Caterpillar tool
Learning Outcome 03	**LO3 Service/Repair Plant**
Assessment Criteria	3.1 Observe SHEQ and HIRA 3.2 Mobilise necessary resources 3.3 Repair and/or replace components according the manufacturer's specifications. 3.4 Conduct test run 3.5 Necessary adjustments carried out
Content	**LO3: Service/Repair Plant** **3.1 Observe SHEQ and HIRA.** • Safety Precautions ✓ Safety rules and precautions pertaining to undercarriage. **3.6 Mobilise necessary resources** • Job cards and reports • Lubrication ✓ Welding ✓ Blazing ✓ Gas Welding ✓ Impact range ✓ Plump hook ✓ Straightedge ✓ Engineer's Blue or Red oxide ✓ Grease **3.7 Repair and/or replace components according the manufacturer's specifications** • Manufacturer's Manual ✓ Symbols ✓ Specifications • Tools and Equipment ✓ Hydraulic tools/equipment ✓ Mechanical Tools/Equipment • Minor Components ✓ Function ✓ Operation ✓ Faulty diagnosis ✓ Disassembling and assembling of components • Major Components ✓ Function ✓ Operation

	✓ Faulty diagnosis ✓ Disassembling and assembling of components **3.8 Conduct Test Run** ✓ Undercarriage principles of operation ✓ Hunting Teeth concept **3.9 Necessary Adjustments Carried Out** ✓ Faulty diagnosis
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to service/repair plant as outlined in the assessment criteria; observe SHEQ and HIRA, mobilise necessary resources, repair and/or replace components according the manufacturer's specifications, conduct test run and necessary adjustments carried out. 2. Practical assessment on service/repair plant based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Valve adjustment set • Grease gun • Parts catalogue • Torque wrench • Hydraulic press • Measuring instruments • Measuring tools
Learning Outcome 04	**LO4 Test run the system**

Assessment Criteria	4.1 Conduct and Analyse relevant checks. 4.2 Connect appropriate instruments 4.3 Compare operating specifications against manufacturer's specifications. 4.4 Carry out adjustments 4.5 Produce plant/machine service/repair report.
Content	**LO4: Test run System** **4.1 Conduct and Analyse relevant checks** • Function ✓ Lubrication ✓ Electrical and electronics ✓ Mechanical s ✓ Hydraulic ✓ Pneumatic **4.6 Connect appropriate instruments** • Measuring Instruments eg gauges **4.7 Compare operating specifications against manufacturer's specifications** ✓ Basic Undercarriage Operation ✓ Oil consumption ✓ Knocks ✓ Vibrations **4.8 Carry out adjustments** ✓ Pressures ✓ Mechanism adjustments **4.9 Produce plant/machine service/repair report.** ✓ Log write ups
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to test run the system as outlined in the assessment criteria conduct and analyse relevant checks, connect appropriate instruments, compare operating specifications against manufacturer's specifications, carry out adjustments And produce plant/machine service/repair report. 2. Practical assessment on test run the plant based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees.

	2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. 3 Artisan's toolbox 31. Plant service manual 32. Torque wrench 33. Dynamometer 34. Jack and axle stands 35. Hydraulic and or pneumatic press 36. Measuring instruments 37. Work bench 38. Diagnostic machine 39. Overhead crane and lifts 40. Stocks and dies, hacksaws 41. Valve adjustment set 42. Injector tester 43. Parts catalogue 44. Fire extinguisher 45. Marking instruments

ASSESSMENT SPECIFICATION GRID

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TOPIC NO.	TOPIC	WEIGHTING%
1	**PREPARE SERVICE SCHEDULE**	5
2	**INSPECT THE COMPONENTS.**	10
3	**SERVICE/REPAIR UNITS.**	70
4	**TEST RUN THE SYSTEM**	15
	TOTAL	**100%**

Approach to Teaching and Learning:

22. Observation of adult learning principles.
23. Both institution-based and work-based learning to facilitate the integration of theory and practice.
24. Face-to-face education and learning.
25. Problem-based learning.
26. Online/distance education and learning.
27. Blended/hybrid education and learning.
28. Use of social media.

Approach to Assessment:

19. Weighting of practical and theory assessment: 70% theory and 30% practical.
20. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
21. Oral assessment to be conducted by a panel of two or more assessors.
22. RPL assessment.
23. Portfolio of evidence.
24. Assessment of work conducted by both individual learners and teams of learners.

Resources:

14. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

15. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

16. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

17. Reference Materials (recommended textbooks, recommended readings)

1. Asmus A. (1981) Diesel engines and fuel system Butterworth London
2. Bland S. (1980) Diesel engines Longman London
3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London
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Sean Bennet

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(**GROUND ENGAGING EQUIPMENT: PART B)**

Module Title	**UNDERCARRIAGE AND GROUND ENGAGING EQUIPMENT MAINTENANCE**
List of Learning Outcomes (PART B)	**LO1: Prepare service schedule** **LO2: Inspect the components** **LO3: Service/repair units**
Learning Outcome O1	**LO1Prepare service Schedule**
Assessment Criteria	1.1 Prepare a service program based on the machine time/mileage and with service intervals 1.2 Define specific tasks for each service interval and time frame 1.3 Identify service kits and tools for each service interval 1.4 Identify relevant equipment and human resources 1.5 Analyse service record book/checklist
Content	**LO1: Prepare Service Schedule** 1.1 Prepare a service program based on the machine time/mileage and with service intervals • Service program ✓ Minor service ✓ Major service

	1.2 Define specific tasks for each service interval and time frame • Minor service ✓ Inspect ripper ✓ Inspect dozer/grader blades ✓ Inspect bucket ✓ Greasing • Major service ✓ Service ripper ✓ Service bucket ✓ Service dozer/grader blades ✓ Replace worn components 1.3 Identify service kits and tools for each service interval • Minor service ✓ Grease gun ✓ Service manual ✓ Standard tool box • Major service ✓ Standard tool box ✓ Service manual ✓ Lifting equipment ✓ Measuring tools 1.4 Identify relevant equipment and human resources • Equipment and tools ✓ Standard tools box ✓ Service manual ✓ Standard tool box 1.5 Analyse service record book/checklist • Service record and checklist ✓ Checklist and record book ✓ Job card • Schematic worksheets ✓ Hydraulic ✓ Pneumatic ✓ Mechanical
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to prepare service schedule as outlined in the assessment criteria prepare a service program based on the machine time/mileage and with service intervals, define specific tasks for each service interval and time frame, identify service kits and tools for each service interval, identify relevant equipment and human resources and analyse service record book/checklist

	2. Practical assessment on preparing service schedule based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workshop, classrooms or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant/Service manual • Torque wrench • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Parts catalogue • Fire extinguisher
Learning Outcome 02	**LO2 Inspect the components**
Assessment Criteria	**2.1** Connect necessary instruments to determine nature of failure 2.2 Analyse printed results 2.3 Determine nature of problem 2.4 Describe/outline course of action 2.5 Remove magnetic screen to inspect debris 2.6 Conduct scientific wear analysis on oil
Content	**LO2: Inspect components** **2.**1 Connect necessary instruments to determine nature of failure • Correct tool and equipment handling/usage 2.2 Analyse printed results • Pressure laws • Fault codes 2.3 Determine nature of problem • Problem Indicators

	✓ Diagnosis ✓ Scan tools • Materials ✓ Properties of Materials **2.4 Describe/outline course of action** • Rectification procedures • Fault codes Interpretation **2.5 Remove magnetic screen to inspect debris** • Magnetism • Electromagnetism • Debris implication **2.6 Conduct scientific wear analysis on oil** • Scientific wear analysis ✓ Advantages and disadvantages ✓ Collection and interpretation of results
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to inspect the components outlined in the assessment criteria connect necessary instruments to determine nature of failure, analyse printed results, determine nature of problem, describe/outline course of action, remove magnetic screen to inspect debris and conduct scientific wear analysis on oil 2. Practical assessment on inspecting components based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Plant service manual • Jack and axle stands • Overhead crane and lifts • Fire extinguisher • Work bench • Diagnostic machine • Overhead crane and lifts • Valve adjustment set • Parts catalogue • Torque wrench • Hydraulic press

	• Measuring instruments • Measuring tools
Learning Outcome 03	**LO3 Service/repair units**
Assessment Criteria	**3.1 Check implement cycles** **3.2 Observe safety precautions due to high pressure and raised implements** **3.3 Service/Repair/Replace worn out components**
Content	**LO3: Service/repair units** **3.1 Check implement cycles** ✓ Construction and operation ✓ PTO, Transfer box operation ✓ Pneumatic implements ✓ Hydraulic implements ✓ Mechanical implements ✓ Electronic implements **3.2 Observe safety precautions due to high pressure and raised implements** • hazards associated with pressurised fluids • dangers posed by raised implements • locking devices • safety precautions of specific ground engaging tools **3.3 Service/Repair/ Replace worn out components** • Safety precautions • Correct tool and equipment handling and use • Disassembling and assembling procedure • Trouble shooting Rectification
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to service/repair units criteria check implement cycles, observe safety precautions due to high pressure and raised implements and service/Repair/Replace worn out components 2. Practical assessment on service/replace units based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. **1.** The practical assessment will be conducted in the workplace or simulated work environment in the training institution.

	2. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant/Service manual • Torque wrench • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench • Diagnostic machine • Overhead crane and lifts • Stocks and dies, hacksaws • Valve adjustment set • Parts catalogue • Fire extinguisher • Grease gun • Impact range • Plastic-gauge • Torque multiplier

MODE OF ASSESSMENT

EXAMINABLE MODULE	MODE OF ASSESSMENT		TOTAL
	EXAMINATIONS 40%	**COURSEWORK ASSESSMENT 60%**	
Undercarriage And Ground Engaging Equipment Maintenance (319/22/M04)	3 hour paper	A Minimum of: • 2 Assignments 20% • Practical project Submit project component (20%) • 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

LEARNING OUTCOME (Undercarriage - PART A: 60marks		**WEIGHTING%**
1	Prepare service schedule	2
2	Carry out trouble shooting	15
3	Service/repair units	40
4	Test run the system	3
LEARNING OUTCOME (Ground Engaging Equipment - PART B: 40marks)		**WEIGHTING%**
1	Prepare service schedule	2
2	Inspect the components	8
3	Service/repair units	30
TOTAL		**100**

Approach to Teaching and Learning:

29. Observation of adult learning principles.
30. Both institution-based and work-based learning to facilitate the integration of theory and practice.
31. Face-to-face education and learning.
32. Problem-based learning.
33. Online/distance education and learning.
34. Blended/hybrid education and learning.
35. Use of social media.

Approach to Assessment:

25. Weighting of practical and theory assessment: 70% theory and 30% practical.
26. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
27. Oral assessment to be conducted by a panel of two or more assessors.
28. RPL assessment.
29. Portfolio of evidence.
30. Assessment of work conducted by both individual learners and teams of learners.

Resources:

18. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

19. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine
- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

20. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

21. Reference Materials (recommended textbooks, recommended readings)

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Module code:	**346/22/M08**
Module title:	**AUTOMOTIVE ENGINEERING MATHEMATICS & SCIENCE**
ZNQF level:	**4**
Credits:	**20**
Duration:	**200** hours
Relationship with qualification standards:	Based on Unit Standard of Qualification for Automotive Engineering Trades or Artisans.
Pre-requisite modules:	None
Purpose of module:	This module provides the skills, knowledge, competencies and attitudes required by an **Automotive Artisan** to be able to effectively apply scientific skills and related principles in solving related problems in Automotive Engineering and related trades.
List of learning outcomes:	**At the end of covering the Module content, the student should be able to:** **L01: a) Explain application of mathematical principles in engineering related areas.** **b) Apply mathematical principles to solve engineering related problems.** **L02: a) Explain application of scientific principles in engineering related areas.** **b) Apply scientific principles to solve engineering related problems.**
Learning outcome 01	**a) Explain application of mathematical principles in engineering related areas.** **b) Apply mathematical principles to solve engineering related problems.**
Assessment criteria:	**Demonstrate Knowledge and Understanding of:** **a)** Number Systems **b)** Equations and Transposition **c)** Polynomial Evaluation and Factorisation. **d)** Indices and Logarithms **e)** Areas, Volumes, Capacity, Mass and Specific Gravity and Ratios F. **f)** Angles and Trigonometry **g)** Co-ordinate Geometry and Introduction to Differentiation and Integration.

	h) Matrices **i)** Vectors
Content:	**2.1 NUMBER SYSTEMS** • Define natural, real, rational and irrational numbers. • Solve problems relating to approximation. - Round off the numbers to the required decimal place. - Round off the numbers to the required significant figure. • Solve problems relating to number systems. - Convert the numbers to denary, binary, octal, duodecimal and hexadecimal systems. - Express denary numbers into octal, binary and hexadecimal form through the use of octals as an intermediate step. **2.2 EQUATIONS AND TRANSPOSITION** • Solve problems pertaining to laws of arithmetic and algebra. - Define and apply cumulative, associative and distributive laws to solve Mathematical problems. - Use rules of precedence (BODMAS) in simplifying Arithmetic expressions • Understand the basic rules of solving problems and relating to equations and transposition. - Define an equation. - Construct equations of letters and numbers. - State and apply rules of equations. - Distinguish between an expression and equation. - Relate equations to formulae. - Transpose formulae relating to Motor Vehicle Technology and Science. • Simplify algebraic expression relating multiplication and division of polynomials. Evaluate algebraic expressions involving: - Whole number indices. - Fractional indices. - Decimal indices. • Solve problems relating to the factorisation of algebraic expressions. - Multiply an algebraic expression of a single variable. - Divide an algebraic expression by another. - Factorise algebraic expressions by common grouping and difference of two square. - Factorise quadratic expressions - Determine whether the quadratic expression is a perfect square.

- Solve problems relating to linear equations and simultaneous linear equations.
  - simultaneous equations by substitution.
  - linear equations with two unknowns by equating coefficients.
  - linear equations with three unknowns.
- Solve problems relating to quadratic equations by:
  - using factors.
  - completing the square.
  - using the quadratic formula.

2.3 POLYNOMIAL EVALUATION AND FACTORISATION

- Evaluate polynomial expressions.
  - Define function notation.
  - Define polynomial function.
- Apply the "nesting" method to various polynomial expressions.
  - Evaluate polynomial expressions by "nesting" method.
- Apply the Remainder theorem and Factor theorem to evaluate polynomial expressions.
- Apply either Remainder theorem or Factor theorem to evaluate the polynomial expressions.
  - Factorise cubic and quadratic expressions having linear factors.

2.4 INDICES AND LOGARITHMS

- Solve the problems relating to indices.
  - Define an index.
  - State the parts of an index.
  - State the rules of indices.
  - Apply the rules of indices to simplify expressions.
  - Express numbers in standard form.
  - Evaluate expressions in standard form.
  - Evaluate expressions in preferred standard form.
- Solve the problems relating to logarithms.
  - Define logarithms. - State the parts of logarithm.
  - Apply the rules of algorithms to simplify expressions.
  - Convert logarithms to anti-logarithms.
  - Convert a base of logarithms to another form.
  - Convert numbers to natural (Napierian) logarithms. 64
  - Apply the rules of logarithms to solve indical equations

2.5 AREAS, VOLUMES, CAPACITY, MASS AND SPECIFIC GRAVITY AND RATIOS

- Solve problems relating to Areas, Volume, Capacity, Mass and specific gravity:

a) Solve problems of:

- Areas of circles
- Annulus
- Cone
- Sphere
- Hemisphere
- Ellipse

b) Sketch the figures mentioned in (a) above and state the formulae for finding their areas

c) Calculate the volumes of a:
- Cylinder
- Cube
- Hollow cylinder
- Sphere
- Cone

d) Solve problems pertaining to engine and transmission systems by calculating
- Swept volume
- Total volume
- Clearance volume
- Compressions ratios
- Camshaft drives
- Air-fuel ratio
- Gear ratios (manual gearbox and final drive)
- Belt drive ratios in relation to gear ratios

e) Define:
- Mass
- Specific gravity
- Relative density

1.6 ANGLES AND TRIGONOMETRY

Identify types of properties of triangles and angles and solve problems relating to them.

- State and sketch types of angles
- Describe and identify the different angles.
- Define a triangle.
- List, describe and sketch types of triangles:
  - Acute angled
  - Right angled
  - Obtuse angled
  - Equilateral
  - Isosceles
- Solve problems involving Right Angled triangles using Pythagoras' Theorem and Trigonometrically ratios of sine, cosine, tangent and cotangent.
- Convert radians to degrees and vice-versa.

- Determine the length of a given arch from the angle formed at the arc centre and vice-versa.
- Solve angular problems concerning:
  - Valve timing
  - Injection and ignition timing.
- Calculate:
  - Piston travel
  - Angle of obliquity
  - Crank angle Using sine and cosine formulae.
- Solve angular problems concerning steering geometry and taper angle and length on given tapered shaft.
- Solve problems involving angles of elevation and depression.

1.7 CO-ORDINATIONATE GEOMETRY, INTRODUCTION TO DIFFERENTIATION AND INTEGRATION

- Understand the principles of co-ordinate geometry (Cartesian co-ordinates) in a horizontal plane.
  - Specify a definite point in a horizontal plane.
  - Calculate the length of a straight line.
  - Calculate the mid-point of a straight line.
  - Calculate the slope or gradient of a straight line. - Find the equation of a tangent of a curve at a point.
  - Sketch straight line graphs.
  - Sketch quadratic graphs (use of maxima and minima).
- Understand the basic principles of differentiation.
  - Determine the slope of a curve algebraically.
  - Differentiate coefficients of powers of x and polynomials only.
  - Determine the velocity and acceleration through the use of differentiation at a particular time.
- Understand the basic principles of integration.
  -Determine indefinite integrals of polynomial
  -Determine the constant (c) of integration.

1.8 MATRICES

- Solve problems pertaining matrices.
  - Define a matrix.
  - State the types of matrices.
  - Denote a matrix by a notation.
- Evaluate matrices.
- - Perform the addition and subtraction of matrices.
- Perform the multiplication of matrices by:
- - Scalar.
- - Two matrices.
- Solve the simultaneous equations with two and three unknowns using the matrices.

	1.9 VECTORS Understand the principles of vectors and scalar quantities. • Differentiate between a scalar and vector quantity. • Denote a vector by a notation. • State types of vectors. • Perform addition of vectors (without proofs).
Assessment tasks:	5. Written and/or oral assessment on the skills and knowledge required in demonstrating knowledge of solving engineering mathematical problems and as outlined in the assessment criteria and content above.
Conditions/context of assessment	7. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees.
Learning outcome 02	**a) Explain application of scientific principles in engineering related areas.** **b) Apply scientific principles to solve engineering related problems.**
Assessment criteria	**Demonstrate Knowledge and Understanding of:** **a)** Linear and Angular Motion **b)** Forces **c)** Moments **d)** Work **e)** Power **f)** Friction **g)** Stress and Strain **h)** Machines **i)** Heat and Temperature **j)**
Content	**ENGINEERING SCIENCE** **2.1** LINEAR AND ANGULAR MOTION • Solve problems involving velocity, acceleration and braking efficiency with particular reference to vehicles. **a)** Describe the relationship between distance, time and speed and state their SI units. **b)** Describe velocity as a vector quantity. **c)** Develop formulae for distance, time and speed for both linear and angular motion. **d)** Calculate distances covered by vehicles for given speeds and times. **e)** Represent distance covered by a motor vehicle by velocity-time graphs and also represent velocity by distance-time graphs. **f)** Define linear and angular acceleration and deceleration

and state their formulae.

g) Solve problems involving:
- Linear and angular acceleration and deceleration.
- Braking distance.
- Braking efficiency.

h) State Newton's three Laws of motion

i) Solve problems pertaining to Newton's Laws of motion.

- Solve problems pertaining to force and acceleration.

a) State factors affecting
- Braking distance and
- Braking efficiency

b) Distinguish between uniform velocity and variable velocity.

2.2 FORCES

Determine the resultant or equilibrium of forces acting at a point and resolve forces into their components, using Parallelogram, Triangle, Polygon and components of force rules/methods:

- Define Force and state its characteristics
- Differentiate between equilibrant and resultant.
- Describe forces in a straight line.
- Define "Parallelogram of Forces".
- Solve problems involving parallelogram of forces, graphically.
- Define triangle of forces.
- Describe "Bow's Notation" with reference to Space and Vector diagrams.
- Solve problems involving triangle of forces graphically.
- Define "Polygon of forces"
- Solve problems involving polygon of forces graphically.
- Resolve forces into vertical and horizontal components using trigonometry.

2.3 MOMENTS

Use the principle of moments to solve problems relating to levers, beams and centre of gravity.

- State types of levers.
- Describe each type of lever and sketch it.
- Define:
  - Moment of a force.
  - Turning moment.
  - Torque.
  - Fulcrum.
  - Pivot.
- State the principle of moments and conditions for equilibrium.
- Solve problems on simple levers.

	• State and explain Newton's 3rd law of motion – "To every action there is an equal and opposite reaction". • Name common engineering applications of the 3rd law of motion. • Solve problems involving Reaction on Beams. • Define Centre of Gravity. • Identify ways of determining the Centre of Gravity and determine the position of the centre of graft on: 1. Wheelbase 2. Track • Explain the importance of knowing the position of Centre of Gravity when lifting and transporting loads. **2.4** WORK Recognise that work done is a form of energy and solve problems relating to work done in motor vehicles. • State the SI units for work done, force and torque. • Define work as a form of energy. • State the formulae for work done in a straight line, on lifting objects and on an incline. • Solve problems involving work done in straight line and against gravity • Define Energy and state the different forms energy. • Solve problems involving Potential and Kinetic energy. • Define Tractive effort and resistance. • Solve problems involving Tractive effort and resistance on: a) Level ground or track b) Inclined plane • Define work done in rotation. • Relate work done in rotation to motor vehicles. • Represent work done on force – distance graphs. **2.5** POWER Use knowledge of power to diagnose or determine mechanical performance problems. • Define power. • State the SI unit for power. • Relate the Watt to the horse power. • Solve simple problems involving power (work done and time taken). • Describe how power is produced in the engine cylinder. • Define: - Indicated power. - Brake power.

... and give formulae for each.

- Calculate indicated power produced by:
  - One cylinder.
  - Entire engine.
- Calculate brake power out through engine flywheel.
- Describe determination of power by the Farnborough indicator.
- Describe and explain the Morse test procedure.
- Determine:
  - Indicated power.
  - Brake power.
  - Friction power.

  ... from a dynamometer, using the Morse test procedure.
- Calculate the mechanical efficiency of an engine.
- Describe and explain:
  a) Fuel consumption
  b) Thermal efficiency

2.6 FRICTION

Solve problems involving friction.

- Define friction.
- State and describe the under-listed types of friction:
- - Boundary.
- - Dry.
- - Fluid.
- ...and give examples of the occurrence of each of them on a motor vehicle.
- State factors affecting frictional resistance on two materials (one sliding over the other).
- State and explain laws of friction.
- Solve problems involving frictional resistance, coefficient of friction and load.
- Describe and explain friction in bushed and shell bearings.
- Solve problems involving frictional torque in bearings (Shell and Bush).
- Describe torque transmission by a clutch.
- State factors affecting torque transmitted by a clutch.
- Solve problems involving torque transmitted by a clutch.
- Describe and calculate the clutch safety factor.
- Explain the effect of intensity of pressure on clutch friction material.
- Describe and explain effects of lubricants on frictional surfaces.
- Explain the requirements for Extreme Pressure (EP) or Hypoid oil types for heavy loads

2.7 STRESS AND STRAIN

Outline the effect of force on materials and solve problems concerning:

a) Stress
b) Strain
c) Elasticity

- Name the types of forces acting on motor vehicle equipment --Tensile
  - Compressive
  - Shear
  - Compound
  - Torsion
- Describe each of the forces listed in above with aid of sketches.
- Give examples of Tensile, Compressive, Shear, Compound, Torsion forces on a motor vehicle.
- Define stress (normal or direct)
- State the formula and units and for stress.
- Define direct strain as change in length:- Original length.
- State the effects of overloading on materials.
- Solve problems involving stress and strain.
- State the relationship between stress and strain.
- Define and identify the following points, given a load-extension diagram:
  - Limit of proportionality.
  - Maximum load.
  - Yield point.
  - Elastic limit.
  - Fracture point.
- State the elastic limits for materials normally used in engineering.
- Solve problems relating to Young's Modulus.
- Explain the importance of safety factor on materials
- Define shear stress, state its formula and units.
- Define shear strain and state the formula
- State the relationship between shear stress and shear strain, and solve related problems.

2.8 MACHINES

Solve problems relating to various types of machines.

- Define a simple machine.
- State and describe common types of machines to include:
  - Lever.
  - Inclined plane.
  - Screw jack.

- Hydraulic Jack and Press.
- Pulley block system.
- Gear systems as used to lift or operate loads

- Describe principles of operation of machines mentioned above using drawings.
- Define:
  -Mechanical Advantage (MA).
  -Velocity Ratio (VR).
  -Mechanical Efficiency (ME).
- Solve problems relating to the type machines named above.
- Solve problems involving gearbox, steering box and final drive ratios

2.9 HEAT AND TEMPERATURE

Use principles of heat to solve automotive engineering problems.

- Define heat as a form of energy.
- State the SI unit of heat.
- Define temperature
- Distinguish the difference between heat and temperature.
- Explain the effects of heat on materials:
  - Shape/ Size
  - Condition.
  - Composition.
  - Colour
  -Electrical effect
- Give examples of each of the effects of heat on Motor Vehicles.
- Describe the methods of heat transfer with reference to Motor Vehicles.
- Explain measurement of heat by:
  - Conduction.
  - Temperature gauges on engines.
- Name metric and imperial temperature scales.
- Convert ^{0}C to ^{0}F; ^{0}C to K and vice versa.
- Describe a Mercury-in-Glass thermometer.
- Explain effects of temperature change on diesel fuel, petrol, electrolyte, brake, fluid, oils, water in radiator, e.t.c.
- Determine the quantity of heat in materials using various methods
- State factors affecting the quantity of heat in a body.
- Explain heat transfer in mixtures.
- Solve problems involving heat lost and heat gained by materials.
- Describe and explain change of state of substances.
- Define latent and sensible heat with reference to change of state of quantity of heat.

	• Solve problems involving change of state and latent heat. • State and explain the effects of temperature change on Solids and Liquids • Define the co-efficient of linear, superficial and cubical expansion. • Solve problems involving linear, superficial and cubical expansion • Compare materials' expansion rates. • Select materials for use on vehicles taking consideration of the expansion rate. • Identify motor vehicle components fitted by expansion or contraction
Assessment tasks	5. Written and/or oral assessment on the skills and knowledge required in demonstrating knowledge of solving engineering scientific problems and as outlined in the assessment criteria and content above.
Conditions/context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees.

MODE OF ASSESSMENT

EXAMINABLE SUBJECT	MODE OF ASSESSMENT		TOTAL
	EXAMINATION 40%	COURSEWORK ASSESSMENT 60%	
Automotive Engineering Related Studies	3 Hour Paper (*Paper A*) 3 Hour Paper (*Paper B*)	A minimum of 2 Assignments 20% 2 Practical Assignments 20% 2 Tests 20%	100%

ASSESSMENT SPECIFICATION GRID

	TOPIC	WEIGHTING %	PAPER WEIGHTING
PAPER A			
PAPER 1 SECTION A [40 Marks] Question 1 **Answer All Questions** -Short response type of questions -Covers all concepts of Engineering Mathematics	**1.** Number Systems **2.** Equations and Transposition **3.** Polynomial Evaluation and Factorisation. **4.** Indices and Logarithms **5.** Areas, Volumes, Capacity, Mass and Specific Gravity and Ratios. **6.** Angles and Trigonometry **7.** Co-ordinate Geometry and	5 5 5 10 10 15	THEORY PAPER A

SECTION B [60] Marks **Answer Any 4 Questions** Each question carries 15 marks	Introduction to Differentiation and Integration. **8.** Matrices **9.** Vectors	 30 15 5	100%
PAPER B			
SECTION A [40 Marks] Question 1 **Answer All Questions** -Short response type of questions -Covers all concepts of Engineering Science	**1.** Linear and Angular Motion **2.** Forces **3.** Moments **4.** Work **5.** Power **6.** Friction **7.** Stress and Strain **8.** Machines **9.** Heat and Temperature	10 15 10 10 10 10 10 15 15	THEORY PAPER B 100%
SECTION B [60 Marks] **Answer Any 4 Questions** Each Question carries 15 Marks			
FINAL MARK OF PAPER A & B			100%

Approach to teaching and learning:

36. Observation of adult learning principles.
37. Both institution-based and work-based learning to facilitate the integration of theory and practice.
38. Face-to-face education and learning.
39. Problem-based learning.
40. Online/distance education and learning.
41. Blended/hybrid education and learning.
42. Use of social media.

Approach to assessment:

31. Weighting of 60% continuous assessment and 40% examination.
32. Oral assessment to be conducted by a panel of two or more assessors.
33. RPL assessment.
34. Portfolio of evidence.
35. Assessment of work conducted by both individual learners and teams of learners.

Resources:

22. Qualifications and experience of trainers, assessors and moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

23. Facilities, tools, equipment and materials

- Laptop
- Scientific calculator

24. Learning resources

Relevant training manual (learners' guide) and facilitators' guide

25. Reference materials (recommended textbooks, recommended readings)

Engineering Mathematics

1. Greer A. et al (2018) Tables, data & formulae for Engineers London Stanley Thorne

2. Hurst J. (2016) Motor Vehicle Craft Studies Part 2: Engines & Electrics London MacMillan

3. Kett P. W. (2017) Motor Vehicle Science Part Two London Chapman & Hall

4. Moore G. (2015) Practical Problems in Mathematics: For Automotive Technicians Albany, NY Delmar

5. Pritchard R.T. (2016) General Course Workshop Processes & Materials London Hodder & Staunton

6. Stroud K.A. (2015) Engineering Mathematics Hampshire MacMillan

Engineering Science

1. Greer A. et al (2018) Tables, data & formulae for Engineers London Stanley Thorne

2. Hurst J. (2016) Motor Vehicle Craft Studies Part 2: Engines & Electrics London MacMillan

3. Kett P.W. (2017) Motor Vehicle Science Part Two London Chapman & Hal

4. S.J Zammit (1996) Motor Vehicle Engineering Science for Technicians, Longman Group UK Ltd

5. Allan Bonnick (2008) Automotive Science and Mathematics, Elsevier Ltd.

Module Code	**346/19/22/M11**
Module Title	**AUTOMOTIVE ELECTRICALS AND ELECTRONIC SYSTEMS MAINTENANCE**
ZNQF Level	**4**
Credits	**10**
Duration	**100** hours
Relationship with Qualification Standards	Based on Unit Standard **346/19/22/M09 AUTOMOTIVE ELECTRICALS AND ELECTRONIC SYSTEMS** MAINTENANCE of Qualification Standard for Diesel Plant Fitting Artisan
Pre-requisite modules	NIL
Purpose of Module	This module describes the skills, knowledge and attitudes required by a Diesel Plant Fitter Artisan to maintain electrical and electronic systems. This includes; inspect electrical and electronic systems, dismantle starter motor, inspect components, re-assemble starter motor, dismantle alternator, re-assemble alternator, perform electrical tests on circuits and components and Repair electrical circuits and components. The advantages of maintaining electrical and electronic systems include reduced down time, long life, reduced running costs, reduce breakdowns. Access to this module is open to all target groups including unemployed youths, women and men wishing to establish or improve SMEs in Maintaining Plant.
List of Learning Outcomes	**LO1: Solve Basic Electrics and electronics circuit faults** **LO2: Inspect electrical and electronic components** **LO3: Use basic electrical measuring instruments and tools** **LO4: Inspect sensors and actuators** **LO5: Perform battery service** **LO6: Inspect major electrical systems** **LO7: Carryout On Board Diagnosis**
Assessment Criteria	1.1 Trace faults basic electrical and electronics circuits. 1.2 Insulate faults and secure wiring.
Content	**LO1: Solve Basic Electrics and electronics circuit faults** 1.1 Electricity • Nature of Electricity ✓ Conductors ✓ Insulators

	✓ Current ✓ EMF ✓ PD ✓ Resistance ✓ Power ✓ Electrical circuits and related laws • DC and AC Theory • Motors and solenoids • Magnetism • AC Theory • Basic Electronics ✓ Electronic components ✓ Electronic switching devices ✓ Logic Gates 1.2 Insulate faults and secure wiring • Insulators • Conductors • Resistance • Types of faults • Circuit faults
Learning Outcome 02	**LO2 Inspect electrical and electronic components**
Assessment Criteria	2.1 Inspect electrical and electronic components for functionality 2.2 Establish functionality of warning light and gauges
Content	**2.1 Inspect electrical components for functionality** • Major Components ✓ Alternator ✓ Starter Motor ✓ Wiper Motor ✓ Coil packs ✓ Regulator • Minor Components ✓ Bulbs ✓ Flasher Unit ✓ Auxilliary basic units **2.2 Establish functionality of warning light and gauges** • Bulbs • Instrumentation panel
Learning Outcome 03	**LO3: Use basic electrical measuring instruments and tools**
Assessment Criteria	3.1 Visual check electrical and electronic components 3.2 Carry out basic electrical and electronic measurements

Content	3.1 Visual check electrical and electronic components • Faults ✓ Short circuit ✓ Open circuit ✓ Dead circuit 3.2. Carry out basic electrical and electronic measurements • Measurements ✓ Ohm's law ✓ Kirchhoff's laws ✓ Analogue meters ✓ Digital meters ✓ Logic Probes
Learning Outcome 04	**Inspect sensors and actuators**
Assessment Criteria	4.1 Identify sensors and actuators 4.2 Check sensors and functionality for functionality
Content	**4.1 Identify sensors and actuators** • ECU • Sensors • Actuators • Digital Circuits • Microprocessors • Switching circuits
Learning Outcome 05	**LO5: Perform battery service** 5.1 Carry out battery visual checks 5.2 Identify battery terminals 5.3 Carry out battery voltage measurements 5.4 Use hydrometer to check electrolyte strength 5.5 Charge the battery
Assessment Criteria	5.1 Carry out battery visual checks • Types of batteries 5.2 Identify battery terminals • Battery connections • Battery charging and discharging Operations 5.3 Carry out battery voltage measurements • Battery tests 5.4 Use hydrometer to check electrolyte strength • Electrolyte • Specific Gravity • Hydrometer 5.5 Charge the battery • Battery precautions

	• Battery safety precautions • Charging and discharging process
Learning Outcome 06	**LO6: Inspect major electrical systems**
Assessment Criteria	**6.1 Identify major electrical systems** **6.2 Outline major electrical faults**
Content	**6.1 Identify major electrical systems** • Operation ✓ Ignition ✓ Charging ✓ Starting ✓ Lighting • Auxilliary Systems ✓ Wiper ✓ Indicator ✓ Warning systems **6.2 Outline major electrical faults** • Common Faults ✓ Ignition ✓ Charging ✓ Starting ✓ Lighting ✓ Wiper ✓ Indicator ✓ Warning systems
Learning Outcome 07	**LO7: Carryout On Board Diagnosis**
Assessment Criteria	**7.1 Demonstrate use of Diagnostic machine** **7.2 Interpret On Board Diagnostic codes**
Assessment Criteria	**7.1 Demonstrate use of Diagnostic machine** • **On Board Diagnostic Machines** • **Faults** **7.2 Interpret On Board Diagnostic codes** • **Codes** • **Internet**
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to maintain electrical and electronic systems as outlined in the assessment criteria to include; select suitable tools and equipment, follow safety precautions, test starting and charging systems for functionality, establish functionality of warning light and gauges, check wires and connections for tightness and damages, check operation of all lights and accessories and check battery.

	2. Practical assessment on maintenance of electrical and electronic systems to include the following, fault finding, problem solving, workshop safety, electrical and electronic principles the consideration of environmental factors which affect maintenance of electrical and electronic systems based on the performance criteria of the Qualification Standard Diesel Plant Fitter.
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials listed below. • Artisan's toolbox • Plant manual • Torque wrench • Dynamometer • Jack and axle stands • Hydraulic press • Measuring instruments • Work bench with vice • Diagnostic machine • Overhead crane and lifts • Growler • Hydrometer • Battery load tester and charger • Soldering iron • Bearing puller • Beam setter • Soldering wire • Degreaser • Grease • Mutton cloth • Insulation tape • Water paper • Stocks and dies, hacksaws • Valve adjustment set • Injector tester • Parts catalogue • Fire extinguisher

ASSESSMENT SPECIFICATION GRID

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TOPIC NO.	TOPIC	WEIGHTING%
1	**SOLVE BASIC ELECTRICS AND ELECTRONICS CIRCUIT FAULTS**	15
2	**INSPECT ELECTRICAL AND ELECTRONIC COMPONENTS**	10
3	**USE BASIC ELECTRICAL MEASURING INSTRUMENTS AND TOOLS**	10
4	**INSPECT SENSORS AND ACTUATORS**	10
5	**PERFORM BATTERY SERVICE**	15
6	**INSPECT MAJOR ELECTRICAL SYSTEMS.**	20
7	**CARRYOUT ON BOARD DIAGNOSIS**	20
	TOTAL	**100%**

Approach to Teaching and Learning:

43. Observation of adult learning principles.
44. Both institution-based and work-based learning to facilitate the integration of theory and practice.
45. Face-to-face education and learning.
46. Problem-based learning.
47. Online/distance education and learning.
48. Blended/hybrid education and learning.
49. Use of social media.

Approach to Assessment:

36. Weighting of practical and theory assessment: 70% theory and 30% practical.
37. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
38. Oral assessment to be conducted by a panel of two or more assessors.
39. RPL assessment.
40. Portfolio of evidence.
41. Assessment of work conducted by both individual learners and teams of learners.

Resources:

26. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

27. Facilities, Tools, Equipment and Materials

- Electrical tool box
- Ladder
- PPE
- Drilling machine

- Welding machine
- Megger
- Insulation tape
- Mutton cloth
- Detergents
- PPC
- Cables
- Cable enclosures
- Electrical accessories

28. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

29. Reference Materials (recommended textbooks, recommended readings)

1. Reference Materials (recommended textbooks, recommended readings)

1. Asmus A. (1981) Diesel engines and fuel system Butterworths London
2. Bland S. (1980) Diesel engines Longman London
3. Cookery A.J (1982) Graded Exercise in Technical Drawing Longman London
4. Crouse (1981) Automotive Electrical Systems Newness Basingstoke
5. Flood C.R (1985) Farm Machinery Granada London
6. Schultz (1983) Diesel Mechanics McGraw-Hill London
7. Stroud K (1995) Engineering Mathematics Bath Press London
8. Schultz E.J (1982) Diesel Equipment I: Lubrication, Hydraulics and Brakes McGraw- Hill New York
9. Maleckv V.I (1982) Motor Vehicle Calculations and Science (Book 2) Chapman & Hall New York

Module Code:	**402/22/M01**
Module Title:	**ENTREPRENEURSHIP SKILLS DEVELOPMENT**
ZNQF Level:	**4**
Credits:	**8**
Duration:	**80 HOURS**
Relationship with Qualification Standards:	Based on Unit Standard **ENTREPRENEURSHIP SKILLS DEVELOPMENT OF UNIT STANDARD FOR AN ENTREPRENEUR**

Pre-requisite modules:	N/A
Purpose of Module:	This module describes the skills, knowledge and attitudes required by an entrepreneur to acquire leadership, business and time management, creative thinking and problem-solving in a job role and industries. This module will ensure that the entrepreneur will formulate a business plan, register a company and operate a business. The advantages of entrepreneurship skills development are that growth and development are constant, beneficial network is developed and work life autonomy is possible. Access to this module is open to all youth, man and woman who want to own a business.
List of Learning Outcomes:	**LO1: Formulate a business** **LO2: Register a company** **LO3: Operate a business**
Learning Outcome 01	**Formulate a business**
Assessment Criteria:	1.1 Formulate a business idea 1.2Produce business plan 1.3 Research on business market 1.4 Compile a financial plan 1.5 Position a product/service 1.6 Envelope survival strategies 1.7 Establish a business environment 1.8 Mobilise financial resources
Content:	**1.1.Formulate a business idea** 1.1.1Define an entrepreneur 1.1.2 Discuss the various concepts of entrepreneurship 1.1.3 Analyse the various forms of business ownership **1.2. Produce business plan** 1.2.1 Define a business plan 1.2.2Produce an executive summary of your business 1.2.3Describe the business 1.2.4 Provide the organisational structure of the business 1.2.5Describe product/services 1.2.6 Provide market analysis 1.2.7 Give marketing strategies 1.2.8 Provide a financial plan **1.3 Research on business market** 1.3.1 Define business market 1.3.2 Study market trends 1.3.3 Analyse market segmentation 1.3.4 Analyse competitors in the market

	1.4 Compile a financial plan 1.4.1Plan for staffing and employees 1.42 Forecast on profit and loss 1.4.3 Analysis of cashflow 1.4.5 Prepare a balance sheet **1.5 Position products/services** 1.5.1 Define positioning of products and services 1.5.2 Describe the types of product and services positioning 1.5.3 Discuss the importance of product/service positioning **1.6 Envelope survival strategies** 1.6.1 Define survival strategies 1.6.2Describe the types of survival strategies 1.6.3Discuss the importance of survival in business **1.7 Establish a business environment** 1.7.1Conduct SWOT analysis 1.7.2Discuss price and position products/ services 1.7.3Conduct viable promotions **1.8 Mobilise Financial resources** 1.8.1Provide a detailed account of how to bring revenue and funding to get started 1.8.2Balancing financial statement
Assessment Tasks:	6. Written and/or oral assessment on the skills and knowledge required to formulate a business as outlined in the assessment criteria and content above. 7. Practical assessment on the formulation of a business plan
Conditions/Context of assessment	8. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 9. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 10. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation.
Learning Outcome 02	**Register a company**
Assessment Criteria	2.1Prepare company documents

	2.2 Process business registration 2.3Secure a place of business operation 2.4Compile rules and regulations
Content	**2.1Prepare company documents** 2.1.1 Identify business documents 2.1.2 Explain the purpose of books of accounts (cashbooks, ledger,etc) 2.1.3 Explain the importance of business documents **2.2 Process business registration** 2.2.1Define company registration 2.2.2Identify the types of companies that can be registered 2.2.3 Describe the requirements needed to register different companies 2.2.4 Discuss the procedures for company registration 2.2.5 Describe the documents that are received after company registration **2.3 Secure a place of business operation** 2.3.1 Identify factors that influence an entrepreneur in securing a place of business operation 2.3.2 Discuss the macro and micro environmental factors affecting entrepreneurship 2.3.3 Define SMEs(Small and Medium Enterprises) 2.3.4 Discuss the roles of SMEs 2.**4Compile rules and regulations** 2.4.1 Define rules and regulations in business 2.4.2 Compile guiding rules and regulations in business 2.4.3 Explain the importance of rules and regulations in business
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to registering a company as outlined in the assessment criteria and content above. 2. Practical assessment on the registering of a business plan
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation
Learning Outcome 03	**Operate a business**
Assessment Criteria	3.1Manage a business according to organisation policy 3.2Allocate resources according to line of business

	3.3 Cost products in line with procedures 3.4 Price products according to company procedures 3.5 Update and maintain records 3.6 Control stock in line with organisation requirements 3.7 Formulate market plans 3.8 Manage risks in line with organisation requirements 3.9 Adopt growth strategies 3.10 Observe business and give social responsibility 3.11 Practise customer care 3.12 Motivate employees in line with organisational requirements
Content	**3.1Manage a business according to organisation policy** 3.1.1Define business management 3.1.2 Explain the roles of management in a business 3.1. Discuss the importance of computers as a business management tool 3**.2 Allocate resources according to line of business** 3,2.1 Define resource allocation 3.2.2 Explain the importance of properly allocating resources (human, capital, material) **3.3 Cost products in line with procedures** 3.3.1 Define various costing terms 3.3.2 Explain the importance of costing to a business 3.3.3 Describe the costing processes of a business 3.3.4 Calculate using the basic cost - pricing and profit methods in relation to products/ services **3.4 Price products in line with business policy** 3.4.1 Define various pricing terms 3.4.2 Explain the importance of pricing to a business 3.4.3 Analyse the pricing processes of a business 3.4.4 Calculate prices of products 3.4.5 Describe pricing strategies **3.5 Update and maintain records** 3.5.1Define record keeping in business 3.5.2 Identify source business documents 3.5.3 Explain the importance of record keeping 3.5.4 Describe the purposes of books of accounts **3.6 Control stock in line with organisation requirements** 3.6.1Define stock control in business 3.6.2Describe the importance of stock control 3.6.3 Outline effective stock control procedures **3.7 Formulate market plans**

	3.7.1Define marketing 3.7.2 Devise a marketing plan for a business 3.7.3 Explain the Ps of marketing 3.7.4 Discuss the marketing mix strategies **3.8 Manage risks in line with organisation requirements** 3.8.1 Define risk management 3.8.2 Discuss the importance of risk covers in entrepreneurship 3.8.3Explain the principles of risk management to a business 3.8.4 Analyse the steps involved in risk management process 3.8.4Identify the various risk management strategies in business **3.9 Adopt growth strategies** 3.9.1 Define business growth strategies 3.9.2 Explain the four business growth strategies **3.10 Observe business ethics and give social responsibility** 3.10.1 Define business ethics and social responsibility 3.10.2 Explain the importance of business ethics to entrepreneurs 3.10.3 Outline social responsibility principles 3.10.4 Explain the importance of social responsibility to the entreptreneur 3.10.5 Illustrate acts of social responsibility by an entrepreneur in a community **3.11 Practise customer care** 3.11.1 Define customer care 3.11.2 Discuss ten tips of customer care 3.11.3 Explain benefits of customer care **3.12 Motivate employees in line with organisational requirements** 3.12.1 Define motivation 3.12.2 Outline theories of staff motivation in business 3.12.3 Discuss the importance of motivation
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to operate a business as outlined in the assessment criteria and content above. 2. Practical assessment on operating a business
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution.

	3. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation

Approach to Teaching and Learning:

50. Observation of adult learning principles.
51. Both institution-based and work-based learning to facilitate the integration of theory and practice.
52. Face-to-face education and learning.
53. Problem-based learning.
54. Online/distance education and learning.
55. Blended/hybrid education and learning.
56. Use of social media.

Approach to Assessment:

42. Weighting of practical and theory assessment: 60% theory and 40% practical.
43. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
44. Oral assessment to be conducted by a panel of two or more assessors.
45. Portfolio of evidence.
46. Assessment of work conducted by both individual learners and teams of learners.

Resources:

1 Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualification and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).
All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

30. Facilities, Tools, Equipment and Materials Facilities, Tools, Equipment and Materials

- Computer
- Communication equipment
- Data storage devices
- Television
- DVD Recorder/player Generic which are relevant to the type of business

31. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

32. Reference Materials (recommended textbooks, recommended readings)

Alderman,P.,J.,(2011) Entrepreneurial Finance,Pearson Education LTD, London
Appleby R (1994) Modern Business Administration
Barringer,B.,R., &Ireland,D.,R.,(2006) Entrepreneurship:Successfully Launching New Ventures, Pearson Education
Bridge, S., O'Neill , K. & Martin, F., (2009) Understanding Entrerprise: Entrepreneurship &Small Business, Third Edition, Palgrave Macmillan, London
Burns, P. & Dewhurst, J., (eds) 91990)Small Business and Entrepreneurship, Macmillan Education LTD,Hampshire
City and Guilds, (2012) Hospitality supervision & Leadership,Heinemann,Essex,
Deakins, D., & Freel, M., (2012) Entrepreneurship and Small Firms,McGraw-Hill,Berkshire
Hisrich, R. D. & Peters, M. P. (2016) Entrepreneurship, Tatq McGraw Hill New Delphi Entre
Holt, D.T., (2017)Entrepreneurship, Prentice Hall, London
Jarskoy, H. & Stevenson, D., (2014) International Labour Organisation Start Your Business. ILO, Harare
Justin Smith (2000) Business Management Trainer's Guide
Kotler Philip & Armstrong G (2001) Principles of Marketing
Kuratiko, D., F., (2008) Introduction to Entrepreneurship, Cengage Learning , Hampshire
Lee, C.,L., &Melicher,W.,(2012) Entrepreneurial Finance,4th Edition,Cengage Learning, South Western
Marcourse, I.(2016) Business Studies @nd Ed Hodder Arnold, London
McGuckin Frances (1988) Business for Beginners (A simple step by step Guide to Start Your New Business)
Mullins L (1999) Management and Organisational Behaviour 5th edition
Need Harm, D, & Dransfield, R.(2000) Advanced Business and Dexel, Oxford
Rae, D., (2007) Entrepreneurship,From opportunity to action,Palgrave Macmillan, New York
Rwegema , V., U., Entrepreneurship:theory in practice, 2nd edition,Oxford University Press, Cape Town
Stokes, D., Wilson, N. & Mador, M.,(2010) Entrepreneurshp,Cengage Learning EMEA, Hampshire
Stoner, J., A. F., Freeman, R., E. & Gilbert, D, R., J. R. (2017) Management 6th Edition, Prentice Hall International Englenwood Cliffs, New Jersey.
Van Der Wagen & Davies, C.(1998) Supervision and Leadership, Hospitality PressPty LtdElsternwick Victoria
Zimmerer T.W, Scarborough M Norman – Essentials of Entrepreneurship and Small

Module Code:	**401/22/M01**
Module Title:	**NATIONAL STUDIES**
ZNQF Level:	4
Credits:	8
Duration:	80 hours
Relationship with Qualification Standards:	**Based on Unit Standard National Studies For Patriotic Citizen**

Pre-requisite modules:	N/A
Purpose of Module:	This module describes the skills, knowledge and attitudes required by a patriotic citizen to develop values that make them proud to be Zimbabweans. This includes maintaining a Zimbabwean culture, preserving Zimbabwean History, assembling components of colonial effects, analysing post-independence socio-economic and political developments, assembling components of legal and parliamentary affairs, carrying out a feasibility study on peace, conflict and resolution as well as participating in civic responsibilities. This is important in producing an informed and responsible citizen prepared to defend and develop the country. Access to this module is open to all target groups, which include the unemployed youth, men and women willing to develop their country.
List of Learning Outcomes:	LO1: Maintain a Zimbabwean culture LO2: Preserve Zimbabwean History LO3: Assemble components of colonial effects LO4: Analyse post-independence socio-economic and political developments LO5: Carry out a feasibility study on peace, conflict and resolution LO6: Participate in civic responsibilities LO7 Assemble components of legal and parliamentary affairs
Learning Outcome 01	**Maintain a Zimbabwean culture**
Assessment Criteria:	**1.1.** Preserve cultural heritage **1.2.** Conserve cultural artefacts **1.3.** Demonstrate knowledge of Zimbabwean culture **1.4.** Capture records of maintaining natural resources of Zimbabwe **1.5.** Preserve indigenous knowledge systems
Content:	**1.1.Preserve cultural heritage** 1.1.1. Definition of cultural heritage 1.1.2. Types of cultural heritage 1.1.3. Importance of cultural heritage 1.1.4.Indigenous methods of preserving and conserving cultural heritage 1.1.5.Modern ways of preserving and conserving cultural heritage 1.1.6.Role of national and international organisations in protecting cultural heritage **1.2. Conserve cultural artefacts** 1.2.1. Identification of cultural artefacts 1.2.2. Threats to cultural artefacts 1.2.3. Importance of cultural artefacts 1.2.4. Ways of protecting cultural artefacts

	1.3. Demonstrate knowledge of Zimbabwean culture 1.3.1. Components of Zimbabwean culture 1.3.2. Significance of components of the Zimbabwean Culture 1.3.3. Threats to various components of the Zimbabwean Culture 1.3.4. Ways of upholding the Zimbabwean Culture **1.4. Capture records of maintaining natural resources of Zimbabwe** **1.4.1.** Types of natural resources 1.4.2. Importance of natural resources 1.4.3. Indigenous and modern methods of protecting natural Resources 1.4.4. National and international statutes that protect national Resources **1.5. Preserve indigenous knowledge systems** 1.5.1. Definition of indigenous knowledge systems 1.5.2. Components of indigenous knowledge systems 1.5.3. Meanings and significance of indigenous knowledge systems 1.5.4. Insights gained from indigenous knowledge systems
Assessment Tasks:	8. Written assessment on the skills and knowledge required maintain a Zimbabwean Culture as highlighted above. 9. Practical based assignment on ways of preserving cultural heritage sites within their communities.
Conditions/Context of assessment	11. Written assessment can be conducted in a classroom environment. 12. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 02	**Preserve Zimbabwean History**
Assessment Criteria	**2.1** Identify pre-colonial states 2.2 Analyse precolonial political structure 2.3 Record achievements of precolonial history 2.4 Record colonial history 2.5 Record role of Christian missionaries 2.6 Record occupation of Zimbabwe 2.7 Trace causes of first /second Chimurenga
Content	**2.1 Identify pre-colonial states** 2.1.1 Defining term pre-colonial 2.1.2. Identifying precolonial states 2.1.3 Pre- colonial socio-economic organisation 2.1.4. Causes of decline of pre-colonial states 2.1.5. Influence of pre-colonial civilisation on contemporary society

	2.2 Analyse precolonial political structure 2.2.1 System of governance of pre-colonial states 2.2.2 Features of the pre-colonial system 2.2.3. Influence of precolonial governance on contemporary society **2.3 Record achievements of precolonial history** **2.3.1** Impact of precolonial achievements and political development **2.4 Record colonial history** 2.4.1 Partition and colonisation of Africa 2.4.2 Berlin conference 2.4.3 Causes/ reasons for the colonisation/occupation of Zimbabwe 2.4.4 Colonisation steps/processes in Zimbabwe **2.5. Record role of Christian missionaries** **2.5.1** Socio-economic and political impact of Christian missionaries in Zimbabwe **2.6. Record occupation of Zimbabwe** **2.6.1** Colonial Administration from 1894 to 1923 **2.6.2** Socio-economic and political impact of colonisation in Zimbabwe **2.7 Trace causes of first /Second Chimurenga** 2.7.1 Causes and results of the Anglo-Ndebele war 1.7.2 Causes and results of the 1st Chimurenga/Umvukela 2.7.3. African reaction to socio-economic and political colonial administration 2.7.4. Causes and results of the 2nd Chimurenga 2.7.5. Socio-economic and political impact of the 1st and 2nd Chimurenga 2.7.6. Prosecution of the war of liberation 2.7.6 Social and political impact of heroes/heroines
Assessment Tasks:	1. Written or oral assessment on the skills and knowledge required to assess the understanding of Zimbabwean History. 2. Practical activities based on observations within and outside the institution that demonstrate understanding of Zimbabwean history.
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. 2. The practical based assignment/activities will be conducted based on participation/observations in their communities

Learning Outcome 03	**Assemble components of colonial effects**
Assessment Criteria	3.1 Demarcate administrative boundaries 3.2. Exploit natural resources (minerals, wildlife, land, water Vegetation, etc.) 3.3. Change traditional religion 3.4. Introduce foreign food crops and livestock 3.5. Change forms of trade 3.6. Change education systems 3.7. Introduce new legal systems 3.8. Introduce Capitalistic relations 3.9. Violate Human rights 3.10. Analyse results of colonisation
Content	**3.1 Demarcate administrative boundaries** 3.1.1. Factors that led to demarcation of boundaries 3.1.2. Distribution of land and uses 3.1.3. Consequences of establishing administrative boundaries **3.2. Exploit natural resources (minerals, wildlife, land, water Vegetation etc.)** 3.2.1. Geographical distribution of available resources 3.2.2. Measures enacted to exploit the resources 3.2.3. Consequences of exploiting the resources (Social, political, economic) **3.3. Change traditional religion** 3.3.1. The nature of African traditional religion prior to colonisation 3.3.2. The role of religion in the African societies 3.3.3. The introduction of foreign religion 3.3.4. The effect of foreign religion on African societies 3.3.5. The place of African Traditional religion in contemporary society **3.4. Introduce foreign food crops and livestock** 3.4.1. Nature and significance of African food crops and livestock 3.4.2. Types of foreign crops introduced 3.4.3. Consequences of the foreign crops and livestock on African Societies 3.4.4. The sustainability of traditional versus foreign crops and livestock in contemporary Zimbabwean society **3.5. Change forms of trade** 3.5.1. Nature and benefits of trade prior to colonisation 3.5.2. Nature of trade during colonisation 3.5.3. Effects of trade during colonial era on African societies. 3.5.4. Influence of trade patterns to contemporary society

	3.6. Change education systems 3.6.1. Nature and purpose of Traditional African Education system 3.6.2. Nature and purpose of Colonial education 3.6.3. Consequences of Colonial education on African Societies 3.6.4. Influence of colonial education to contemporary society **3.7. Introduce new legal systems** 3.7.1. Nature of African legal system prior to colonisation. 3.7.2. Nature of colonial legislation (social, political and economic) 3.7.3. Purpose of colonial legal system 3.7.5. Consequences of colonial legal system to colonial and contemporary African societies **3.8. Introduce Capitalistic relations** 3.8.1. Nature of African relations before colonisation 3.8.2. Introduction of capitalist relations 3.8.3. Effects of capitalist relations during the colonial era and the contemporary society **3.9. Violate Human rights** 3.9.1. Definition of human rights 3.9.2. Nature of human rights violations in the colonial era 3.9.3. Response to human rights violations during the colonial era **3.10. Analyse results of colonisation** 3.10.1. Social effects of colonisation on African Societies 3.10.2. Economic effects of colonisation on African Societies 3.10.3. Political effects of colonisation on African societies 3.10.4. Benefits and non-benefits of colonisation
Assessment Tasks	1. Written assessment on the skills and knowledge required to assess the consequences of colonisation on the African Societies. 2. Practical based assignment on observable socio-politico and economic effects of colonisation within their communities.
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment. 2. The practical based assignment assessment will be conducted based on observations in their communities
Learning outcome O4	**Analyse post-independence socio-economic and political developments**
Assessment Criteria	**4.1 Analyse socio-economic, political developments** **4.2 Formulate Policies** **4.3 Adopt measures to address colonial injustices**

Content	**4.1 Examine socio-economic and political developments** 4.1.1 Social-economic and political post-independence developments 4.1.2 Critique of post-independent development **4.2 Formulate Policies** 4.2.1 Legislation that addressed colonial injustices 4.2.2 Impact of post-independent legislation 4.2.3 Comparison of colonial and post-independence legislation **4.3 Adopt measures to address colonial injustices** 4.3.1 Socio-economic and political measures to address colonial injustices 4.3.2 Impact of measures to address colonial injustices 4.3.3 Colonial vestiges 4.3.4 Strategies to address colonial vestiges
Assessment Tasks	1. Written assessment on the skills and knowledge required to assess the achievements and challenges of post-independent in Zimbabwe. 2. Practical based assignment on observable socio-economic and political developments in their communities.
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment. 2. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 05	**Carry out a feasibility study on peace, conflict and resolution**
Assessment Criteria	**5.1. Demonstrate Conflict and resolution styles** **5.2. Demonstrate 3Cs between Zimbabwe and the global community** **5.3. Analyse Strategies for sustaining peace** **5.4. Analyse the influence of multi-national companies in developing countries** **5.5. Examine the benefits of International capital to developing countries**
Content	**5.1. Demonstrate Conflict and resolution styles** 5.1.1 Defining conflict and conflict resolution 5.1.2 Identifying and explaining conflict resolution styles 5.1.3 Impact of conflict resolution to socio-economic development 5.1.5 Traditional African conflict resolution methods. **5.2. Demonstrate 3Cs between Zimbabwe and the global community** 5.2.1 Defining terms Conflict, competition and co-operation 5.2.2 Impact of 3Cs to economic development 5.2.3 Approaches/Theories to International Relations

	5.2.4 Global power balance 5.2.5 Zimbabwean foreign policy 5.2.6 Zimbabwean regional and international interventions **5.3. Analyse Strategies for sustainable peace** 5.3.1 Defining peace and sustainable peace 5.3.2 Importance of peace to socio-economic and political Development 5.3.3. Impact of sanctions on development 5.3.4 Strategies for sustainable peace 5.3.5 Role of NGOs in the development of sustainable peace 5.3.6 Role of media in promoting and maintaining peace **5.4. Analyse the influence of multi-national companies in developing countries** 5.4.1 Role of multi-national companies in developing countries 5.4.2 International capital and imperialism 5.4.3 The IMF/WB Institutions 5.4.4 Impact of Non-Governmental Organisations in developing countries **5.5 Examine the benefits of International capital to developing countries** 5.5.1 Characteristics of finance capital 5.5.2 International economic relations 5.5.3 Features of Globalisation 5.5.4 Benefits and non-benefits of globalisation
Assessment Tasks	1. Written assessment on the skills and knowledge required to assess the importance of understanding the importance of peace, conflict and resolution on socio-economic developments in Zimbabwe. 2. Practical based assignment on observable socio-economic and political developments in their communities.
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment. 2. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 06	**Participate in civic responsibilities**
Assessment Criteria	**6.1 Undertake Civic responsibilities** **6.2 Observe participation in Disaster Management** **6.3 Adopt Citizen duties**
Content	**6.1 Undertake Civic responsibilities** 6.1.1. Definition of civic responsibilities 6.1.2. Civic responsibility activities 6.1.3. Justification for civic responsibilities

	6.2. Observe participation in Disaster Management 6.2.1. Definition of disaster management 6.2.2. Justification for participation in disaster management 6.2.3. Sustainable disaster management practices **6.3 Adopt Citizen duties** 6.3.1. Definition of terms: citizen and citizen duties 6.3.2. Identification and explanation of citizen duties(Socio-economic & political) 6.3.3. Citizen rights 6.3.4. Importance of citizen duties
Assessment Tasks	1. Written or oral assessment on the skills and knowledge required to assess the understanding of citizen duties and responsibilities. 2. Practical activities within and outside the institution that demonstrate civic duties and responsibilities by community participation
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. 2. The practical based assignment/activities will be conducted based on participation/observations in their communities
Learning outcome 07:	**Assemble components of legal and parliamentary affairs**
Assessment Criteria	**7.1 Identify and explain origins of law** **7.2 Observe constitutional provisions** **7.3 Identify and explain arms of the state** **7.4 Explain Law making process**
Content	7.**1 Identify and explain the origins of law** 7.1.1 Definition of legal terms 7.1.2 Purpose of the law to the community 7.1.3 Classification of the law 7.1.4 Sources of law in Zimbabwe **7.2 Observe constitutional provisions** 7.2.1 Justification of a Zimbabwean constitution 7.2.2 Constitutional Rights as enshrined in the Zimbabwean constitution 7.2.3 Benefits of constitutional rights to the community 7.2.3 Enforcement of rights 7.2.4 Role played by stakeholders in upholding constitutional rights (NGO, Civil Societies and victim friendly units) 7.2.5. Impediments to exercising human rights 7.2.6. Role of constitution in the community **7.3 Observe arms of the state** 7.3.1 Identification of the three arms of state

	7.3.2 Duties and functions of the three arms of the state 7.3.3 Importance of separation of powers to Zimbabwe 7.4 **Explain Law making process** 7.4.1 Steps in the Law making 7.4.2 Role of community in law making process
Assessment Tasks	1. Written or oral assessment on the skills and knowledge required to assess the understanding of legal and parliamentary affairs. 2. Practical activities within and outside the institution that demonstrate the importance of participating in legal and parliamentary activities.
Conditions/Context of assessment	1. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. **2.** The practical based assignment/activities will be conducted based on participation/observations in their communities.

Approach to Teaching and Learning:

57. Observation of adult learning principles; both institution-based and work-based learning to facilitate the integration of theory and practice.
58. Face-to-face education and learning.
59. Problem-based learning.
60. Online/distance education and learning.
61. Blended/hybrid education and learning.
62. Use of social media.

Approach to Assessment:

47. Weighting of institution-based and examination -based assessment: 60% institution-based assessment and 40% examination.
48. Portfolio of evidence.

Resources:

33. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone a Bachelor's Degree in History or equivalent.

34. Facilities, Tools, Equipment and Materials

- Computer
- Communication equipment
- Data storage devices
- Television
- DVD Recorder/player
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35. Learning Resources

- Artefacts
- Resource persons
- Museums and heritage sites
- Videos and audio materials

36. Reference Materials (recommended textbooks, recommended readings)

American Heritage Dictionary of the English Language, Fifth Edition (2011), Houghton Mifflin.
Astrow, A., 1983. Zimbabwe: A Revolution That Lost Its. *Way*, pp.1980-1986.
Banana, C. ed., 1989. *Turmoil and tenacity: Zimbabwe 1890-1990*. College Press.

Batchelor, P., Kingma, K. and Lamb, G. eds., 2004. *Demilitarisation and Peace-building in Southern Africa: Concepts and processes* (Vol. 1). Gower Publishing, Ltd.

Birmingham, D. and Martin, P. eds., 1983. *History of Central Africa* (Vol. 2). Addison-Wesley Longman Limited.
Centre for Peace Initiatives in Africa, 2005. *Zimbabwe: The Next 25 Years*. Benaby Printing and Publishing.

Change African Indigenous Knowledge and Disciplines
Chirimuuta, C., Gudhlanga, E. and Bhukuvhani, C., 2012. Indigenous knowledge systems: a panacea in education for development?
Chitiyo, T.K., 2000. Land violence and compensation: reconceptualising Zimbabwe's land and war veterans' debate. *Track Two: Constructive Approaches to Community and Political Conflict*, *9*(1).

Chitsike, F., 2003, December. A critical analysis of the land reform programme in Zimbabwe. In *2nd FIG Regional Conference* (pp. 2-5).

Collins English Dictionary – Complete and Unabridged, 12th Edition (2014) HarperCollins.

De Villiers, B., 2003. Land reform: issues and challenges: a comparative overview of experiences in Zimbabwe. *Namibia, South Africa and Australia, Johannesburg: Konrad Adenauer Publications*.
Emeagwali and Dei, G, J.S (Eds) (2014), Anti-Colonial Educational Perspectives for Transformative
Government of Zimbabwe, 2013. The Constitution of the Republic of Zimbabwe Amendment (No.20).
Hammar, A., Jensen, S. and Raftopoulos, B. eds., 2003. *Zimbabwe's unfinished business: Rethinking land, state and nation in the context of crisis*. Weaver Press.
Hayes, D., 1980. *Human Rights*, Sussex, Wayland Publishers.

Kriger, N., 1995. The politics of creating national heroes: The search for political legitimacy and national identity. *Soldiers in Zimbabwe's liberation war*, *1*, pp.139-162.

Lalonde, A., 1991. African indigenous knowledge and its relevance to environment and development activities. *Canadian International Development Agency*.
Madhuku, L. 2004. Law, Politics and the Land Reform Process. In Masiyiwa, S. 2004. Post-Independence Land Reform in Zimbabwe: Controversies and Impact on the Economy.

Mkabela, Q., 2005. Using the Afrocentric method in researching indigenous African culture. *The qualitative report*, *10*(1), pp.178-190.
Mlambo, A.S., 2014. *A history of Zimbabwe*. Cambridge University Press.
Moyo, S., 2004. *Overall impacts of the fast track land reform programme*. African Institute for Agrarian Studies.
Moyo, S., 2006. The evolution of Zimbabwe's land acquisition. University of Zimbabwe (UZ) Publications/Michigan State University (MSU).
Ogunbanjo, M.B., Human Rights in Africa in the new Global Order: A Dilemma?

Raftopoulos, B. and Mlambo, A. eds., 2009. *Becoming Zimbabwe. A History from the Pre-colonial Period to 2008: A History from the Pre-colonial Period to 2008*. African Books Collective.

Ranger, T., 1985. Peasant Consciousness and Guerrilla Warfare in Zimbabwe: A Comparative Study. *Harare: McMillan*.

Ranger, T.O. ed., 1968. *Aspects of Central African History*. Northwestern University Press.
Richardson, C., 2004. *The collapse of Zimbabwe in the wake of the 2000-2003 land reforms*.
Schmidt, E.S., 1992. Peasants, traders and wives: Shona women in the history of Zimbabwe, 1870-1939.
Shaw, W.H., 2003. 'They Stole Our Land': debating the expropriation of white farms in Zimbabwe. *The Journal of Modern African Studies*, *41*(1), pp.75-89.
Shamuyarira, N.M., 1966. Crisis in Rhodesia.
Warren, D.M., 1989. Linking scientific and indigenous agricultural systems.
Zikhali, P., 2008. *Fast track land reform, tenure security, and investments in Zimbabwe* (No. dp-08-23-efd).

UNIT 1

Unit Code	401/22/M01
Unit Title:	**National Studies**

Level of Unit: **Generic**

Credits: **8**

Occupation: **Patriotic Citizen**

Date of Promulgation: **TBA**

Review Date: **TBA AIM OF THE UNIT STANDARD**

This unit helps people to develop values that make them proud to be Zimbabweans.

ELEMENT AND PERFORMANCE CRITERIA

Element 1.1	Maintain a Zimbabwean culture

Performance Criteria:

1.1.1 Cultural heritage preserved
1.1.2 Cultural artefacts conserved
1.1.3 Knowledge of Zimbabwe culture demonstrated
1.1.4 Records of maintaining natural resources of Zimbabwe captured
1.1.5 Indigenous knowledge systems preserved

Element 1.2	Preserve Zimbabwean History

Performance Criteria:

1.2.1 Pre-colonial states identified
1.2.2 Precolonial political structure analysed
1.2.3 Achievements of precolonial history recorded
1.2.4 Colonial history recorded
1.2.5 Role of Christian missionaries recorded
1.2.6 Occupation of Zimbabwe recorded
1.2.7 Causes of First /Second Chimurenga traced

Element 1.3	Assemble components of colonial effects

Performance Criteria:

1.3.1 New administrative boundaries demarcated
1.3.2 Natural resources exploited (minerals, wildlife, land, water, vegetation etc)
1.3.3 Traditional religion changed
1.3.4 Foreign food crops and livestock introduced
1.3.5 Education systems changed
1.3.6 Capitalistic relations introduced
1.3.7 New legal systems introduced
1.3.8. Forms of trade changed
1.3.9 Human rights violated
1.3.10 Results of colonisation analysed

Element 1.4	Analyse post-independence socio-economic and political developments

Performance Criteria:

1.4.1 Socio-economic and political developments examined
1.4.2 Policies formulated
1.4.3 Measures to address colonial injustices adopted

Element 1.5	Carry out a feasibility study on peace, conflict and resolution

Performance Criteria:

1.5.1 Conflict and resolution styles demonstrated
1.5.2 3Cs between Zimbabwe and the global community demonstrated

1.5.3 Strategies for sustaining peace analysed
15.4 Influence of multi-national companies in developing countries analysed
1.5.5 Benefits of International capital to developing countries examined.

Element 1.6	Participate in civic responsibilities

Performance Criteria:
1.6.1 Civic responsibilities undertaken
1.6.2 Participation in disaster management observed
1.6.3 Citizen duties adopted

Element 1.7	Assemble components of legal and parliamentary affairs

Performance Criteria:
1.7.1 Origins of law identified and explained
1.7.2 Constitutional provisions observed
1.7.3 Arms of the state identified and explained
1.7.4 Law making process explained

COMPETENCIES REQUIRED IN READINESS FOR ASSESSMENT:

- Record keeping skills
- Customer care skills
- Management skills (decision making, planning, organising)
- Technological awareness
- Problem-solving skills
- Interpersonal skills
- Legal awareness
- Mobilisation skills
- Upholding norms, values and social aspects of Zimbabwean culture.
- Patriotism
- Environmental awareness skills
- Legal awareness
- Critical thinking skills
- Research skills
- Problem-solving skills
- Maintaining Zimbabwean culture
- Social responsible
- Abreast with global current events

Tool handling skills

GENERIC SKILLS:
Patriotic
Practical skills
Tolerance skills
Technological knowledge
Communication

Positive regard
Planning
Organisation
Controlling
Good attitude
Good morals
Acceptance of others
Servant hood
Committed cadre to National Agenda
Quest for more knowledge
Social skills

Human relation skills
Interpersonal skills
Critical thinking skills
Analytical skills

RANGE STATEMENT:

TOOLS AND EQUIPMENT:
Generic which are relevant to the type of business.

MATERIALS:
Generic which are relevant to the type of business.

Duration: **8**0 hours

ASSESSMENT AND CERTIFICATION:
In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Accredited assessors will conduct assessment. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT

HIGHER EDUCATION EXAMINATION COUNCIL (HEXCO)

OCCUPATIONAL STANDARD

FOR

DIESEL PLANT FITTING

(2022)

SECTOR: **MECHANICAL ENGINEERING**

QUALIFICATION FOR **A DIESEL PLANT FITTING**

QUALIFICATION CODE: **_____TBA_____**

LEVEL: **NATIONAL CERTIFICATE**

DATE OF PROMULGATION: **____**

Foreword

This document constitutes the first draft of a standard for the occupation of a Diesel Plant Fitting which was developed using Occupational Competence Profiles (OCPs) as a basis.

This is in preparation for the registration of the Standards on the Zimbabwe Qualifications Framework (ZQF). The ZQF is expected to be administered by the Zimbabwe Examinations and Qualifications Authority (ZIMEQA) once the ZIMQA Bill currently before parliament becomes law.

In line with the SADC Protocol on Education and Training, each SADC member state was tasked to come up with its own Qualifications Framework that shall subsequently be linked to the Regional Qualifications Framework (RQF). The development and registration of standards on a qualifications framework is meant to facilitate the upward and horizontal movement of individuals in their occupations, across occupations or in their areas of study – within the country or the SADC region.

As a draft, certain sections have not yet been addressed. These sections are denoted by a [TBA] and will be attended to as information is finalised.

For ease of reference, a definition of terms commonly used in this document is included in the document.

This particular standard, for the occupation of a Diesel Plant Fitting, was developed with the active participation of expert workers from the industry.

Definition of Terms

Assessment	A process of collecting evidence of a learner's work to measure and make judgements about the achievement or non-achievement of the specified National Qualifications Framework standards or qualifications.
Certification	Awarding of approved documentary evidence of a qualification.
Common essential skills	Universal skills which apply to more than one occupation.
Competences required in readiness for assessment	Critical relevant knowledge, skills and attitudes a learner requires in order to achieve specified outcomes before assessment.
Credit	The value assigned to a unit completed or a value assigned to a unit standard which reflects the relative time and effort required to complete the outcomes.
Date of promulgation	Date when standard and qualification have been approved registered and gazetted.
Element	The smallest component of a unit with a meaningful outcome.
Level	Position of achievement on the ZQF indicating depth, breadth and complexity of competency.
Level descriptor	A specific indicator of competence level on the ZQF.
Occupation	A group of related economically beneficial work activities performed by a person.
Performance criteria	A statement of competence or achievement against which the attainment of outcomes is measured.
Qualification	Formal award of recognition of the achievement of the required competency and/or capability level of the Zimbabwe Qualifications Framework as may be determined by the relevant bodies registered for such purpose by the Authority.
Range statement	The context within which a competence is performed and assessed.
Review Date	Date of revision of qualification as and when necessary but not later than three years from date of issue.

Sector	A section of the economy in which operators produce or provide similar products or services.
Standard	Registered statement of desired education and training outcomes and their assessment criteria.
Unit	The smallest combination of work activities capable of being a full-time economically beneficial occupation.
Unit Standard	Registered statement(s) of desired education and training outcomes, their associated assessment criteria together with administrative information as specified.
ZQF	National qualifications framework approved by the minister for registration of national standards and qualifications.

UNIT TITLES

NO.	UNIT	CREDITS
1	Safe Working Environment Maintenance	30
2	Plant Maintenance	40
3	Engine Maintenance	30
4	Power Train maintenance	30
5	Hydraulic Systems Maintenance	20
6	Undercarriage Maintenance	10
7	Ground Engaging Tools Maintenance	20
8	Braking System Maintenance	20
9		

SUMMARY OF STANDARD

UNIT NO.	UNIT TITLE	CREDITS	ELEMENTS
1	Safe Working Environment Maintenance	30	1.1 Practice and Adhere to Safety, Health and Environment 1.2 Use Appropriate PPE/PPC 1.3 Carry out risk assessment 1.4 Participate in safety Awareness Meetings
2	Plant Maintenance	40	2.1 Prepare Maintenance Schedule 2.2 Conduct Visual inspection 2.3 Service/Repair plant 2.4 Test run plant
3	Engine Maintenance	30	3.1 Prepare service Schedule 3.2 Carryout trouble shooting 3.3 Service/ Repair engine 3.4 Test run the engine
4	Power Train maintenance	30	4.1 Prepare service schedule 4.2 Carry out trouble shooting 4.3 Service/Repair Components 4.4 Test run for functionality
5	Hydraulic Systems Maintenance	20	5.1 Prepare service schedule 5.2 Carry out trouble shooting 5.3 Service the units 5.4 Test run the system
6	Undercarriage Maintenance	10	6.1 Prepare service schedule 6.2 Inspect the components 6.3 Service/Repair Components
7	Ground Engaging Tools Maintenance	20	7.1 Prepare service schedule 7.2 Inspect the components 7.3 Service/Repair Components
8	Braking System Maintenance	20	8.1 Prepare service schedule 8.2 Carry out trouble shooting 8.3 Service/Repair Components 8.4 Test run for functionality

UNIT NO.	UNIT TITLE	CREDITS	ELEMENTS
9	Electrical and electronic system maintenance	20	9.1 Inspect electrical and electronic components and circuits 9.2 Dismantle starter motor 9.3 Inspect components 9.4 Reassemble components 9.5 Dismantle alternator 9.6 Inspect alternator components 9.7 Reassemble alternator 9.8 Perform electrical/electronic tests 9.9 Repair electrical circuits and components

UNIT 1

Unit Title:	SAFE WORKING ENVIRONMENT MAINTENANCE

Level of Unit: **NATIONAL CERTIFICATE**

Credits: **30**

Occupation: **DIESEL PLANT FITTER**

Date of Promulgation: **TBA**

Review Date: **TBA**

AIM

This unit will enable an individual to assemble plant components to specified standards

ELEMENT AND PERFORMANCE CRITERIA

Element 1.1	Practice and Adhere to Safety, Health and Environment

Performance Criteria:

1.1.1 Employees are introduced to safety, Health and Environment policies
1.1.2 Safety colour codes are established
1.1.3 Gangways are labelled
1.1.4 Storage areas are identified
1.1.5 Fire-fighting procedures are demonstrated
1.1.6 Tools and lifting equipment usage demonstrated
1.1.7 Handling of Hazardous substances manual produced

Element 1.2	Use Appropriate PPE and PPC

Performance Criteria:
1.2.1 Personnel Protective equipment is used
1.2.2 Personnel Protective clothing is worn
1.2.3 Use of PPE and PPC is monitored
1.2.4 Organisational Standards and Regulations are enforced

Element 1.3	Carry out Risk Assessment

Performance Criteria:

1.3.1 Housekeeping issues addressed.
1.3.2 Correct work procedure is followed.
1.3.3 Equipment register is enforced
1.3.4 Equipment storage procedure is observed/followed
1.3.5 Lock out mechanism is in stored
1.3.6 Hazardous areas are barricaded
1.3.7 Hot jobs, working on heights are permitted
1.3.8 Incidents reports are generated

Element 1.4	Participate in Safety Awareness Meetings

Performance Criteria:

1.4.1 Safety meetings attended to
1.4.2 Meeting pointer are implemented
1.4.3 Safety signs and symbols are identified
1.4.4 Fire-fighting drills are carried out
1.4.5 Fire-fighting equipment identified.
1.4.6 Smoking zones are designated
1.4 7 Incidents reports are generated

Competencies Required in Readiness for Assessment:

Ability to interpret Statutes, Regulations
Knowledge of Safety, Health and Environmental regulations
Knowledge of Fire-fighting equipment, fire drills and fire prevention
Knowledge of report writing Skills

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Lux meter
Noise level meter
Hydrometer
pH meters
Gas analyser
Thermometer
Camera
Tape measure
Breathlyser

Materials

Stationery
PPE

Duration: 300 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 2

Unit Title:	PLANT MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 20

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to successfully carry out maintenance of components/equipment as per schedule and to specified standards

ELEMENT AND PERFORMANCE CRITERIA

Element 2.1	Prepare Maintenance Schedule

Performance Criteria:

2.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
2.1.2 Specific tasks for each service interval and time frame are defined
2.1.3 Service kits and tools for each service interval are identified/listed/sourced
2.1.4 Relevant equipment and human resources are identified
2.1.5 Service record book/checklist are analysed

Element 2.2	Conduct Visual Inspection

Performance Criteria:

2.2.1 Whole plant/machine is inspected
2.2.2 Notable defects are identified
2.2.3 Plant/machine is cleaned
2.2.4 Plant/machine components are opened
2.2.5 Mileage/time is noted
2.2.6 Noted defects are listed/compiled

Element 2.3	Service/Repair Plant

Performance Criteria:

2.3.1 SHEQ is observed
2.3.2 Visual inspection report consulted
2.3.3 Operation manual and appropriate tools and equipment are gathered
2.3.4 Serviceable components are changed according to manufacturer's manuals
2.3.5 Defective components are repaired/replaced

Element 2.4	Test run Plant/machine

Performance Criteria:

2.4.1 Necessary checks are conducted/analysed
2.4.2 Appropriate instruments are connected
2.4.3 Plant/machine is started according the specifications
2.4.4 Operating specifications are compared against manufacturer's specifications
2.4.5 Necessary adjustments are carried out
2.4.6 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:

Ability to interpret engineering drawings
Appreciation of Engineering Mathematics
Appreciation of Engineering Science
Knowledge of and ability to use measuring instruments
Good knowledge of standard mechanical engineering practices
Knowledge of workshop machinery and tools
Knowledge of materials
Trouble shooting
Knowledge of Safety, Health and Environment regulations

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Oil ring remover
Micrometer
Oil drainer
punches,
chisels
Overhead crane and lifts
Parts catalogue
Hydraulic press/ puller
Fire extinguisher
Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre
Stocks and dies, hacksaws,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

Materials

Duration: 400 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 3

Unit Title:	ENGINE MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 30

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to troubleshoot and repair faults on diesel plant machines and components.

ELEMENT AND PERFORMANCE CRITERIA

Element 3.1	Prepare Service Schedule

Performance Criteria:

3.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
3.1.2 Specific tasks for each service interval and time frame are defined
3.1.3 Service kits and tools for each service interval are identified/listed/sourced
3.1.4 Relevant equipment and human resources are identified
3.1.5 Service record book/checklist are analysed

Element 3.2	Carry out Troubleshooting

Performance Criteria:

3.2.1 Necessary instruments are connected to determine nature of failure
3.2.2 Printed results are analysed
3.2.3 Nature of problem is determined
3.2.4 Course of action is outlined/described

Element 3.3	Service/Repair Engine

Performance Criteria:

3.3.1 Necessary resource are gathered (tools, equipment, manuals, HR and materials)
3.3.2 Appropriate servicing/repairing procedure is followed
3.3.3 Necessary checks are carried out
3.3.4 Prestart procedure (eg priming bearings) are conducted
3.3.5 Necessary running instruments are connected

Element 3.4	Test run Plant/machine

Performance Criteria:

3.4.1 Necessary checks are conducted/analysed
3.4.2 Appropriate instruments are connected
3.4.3 Plant/machine is started according the specifications
3.4.4 Operating specifications are compared against manufacturer's specifications
3.4.5 Necessary adjustments are carried out
3.4.6 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:

Ability to interpret engineering drawings
Appreciation of Engineering Mathematics
Appreciation of Engineering Science
Knowledge of and ability to use measuring instruments
Good knowledge of standard mechanical engineering practices
Knowledge of workshop machinery and tools
Knowledge of materials
Trouble shooting
Knowledge of Safety, Health and Environment regulations

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Oil ring remover
Micrometer
Oil drainer
punches,
Stocks and dies, hacksaws, chisels
Overhead crane and lifts
Parts catalogue
Hydraulic press/ puller
Fire extinguisher
Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

Materials

Duration: 300 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 4

Unit Title:	POWER TRAIN MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 30

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to become a successful diesel plant fitter.

ELEMENT AND PERFORMANCE CRITERIA

Element 4.1	Prepare Service Schedule

Performance Criteria:

4.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
4.1.2 Specific tasks for each service interval and time frame are defined
4.1.3 Service kits and tools for each service interval are identified/listed/sourced
4.1.4 Relevant equipment and human resources are identified
4.1.5 Service record book/checklist are analysed

Element 4.2	Carry out Troubleshooting

Performance Criteria:

4.2.1 Necessary instruments are connected to determine nature of failure
4.2.2 Printed results are analysed
4.2.3 Nature of problem is determined
4.2.4 Course of action is outlined/described
4.2.5 Magnetic screen is removed to inspect debris
4.2.6 Scientific wear analysis is conducted on the oil

Element 4.3	Service/Repair Components

Performance Criteria:

4.3.1 Necessary resource are gathered (tools, equipment, manuals, HR and materials)
4.3.2 Appropriate servicing/repairing procedure is followed
4.3.3 Necessary checks are carried out
4.3.4 Prestart procedure (eg priming bearings) are conducted
4.3.5 Necessary running instruments are connected

Element 4.4	Test for Functionality

Performance Criteria:

3.4.7 Necessary checks are conducted/analysed
3.4.8 Appropriate instruments are connected
3.4.9 Plant/machine is started according the specifications
3.4.10 Operating specifications are compared against manufacturer's specifications
3.4.11 Necessary adjustments are carried out
3.4.12 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:

Ability to interpret engineering drawings
Appreciation of Engineering Mathematics
Appreciation of Engineering Science
Knowledge of and ability to use measuring instruments
Good knowledge of standard mechanical engineering practices
Knowledge of workshop machinery and tools
Knowledge of materials
Trouble shooting
Knowledge of Safety, Health and Environment regulations
Good knowledge of network management
Knowledge of machine operation
Knowledge of monitoring and evaluation
Research methods
Ability to train and develop team members

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements

Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Repair manual
work-bench
measuring instruments
Valve adjustment set

Oil ring remover
Micrometer
Oil drainer
punches,
Stocks and dies, hacksaws, chisels
Overhead crane and lifts
Parts catalogue
Allen keys
Trays
Scrappers, files, centre
Ring squeezer/expander
Injector tester
Standard tool box

Hydraulic press/ puller
Fire extinguisher
Dial indicator gauge
Steam cleaner

Materials

Duration: **300 Hours**

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 5

Unit Title:	HYDRAULIC SYSTEM MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 20

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to effectively maintain a safe working environment.

ELEMENT AND PERFORMANCE CRITERIA

Element 5.1	Prepare Service Schedule

Performance Criteria:

5.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
5.1.2 Specific tasks for each service interval and time frame are defined
5.1.3 Service kits and tools for each service interval are identified/listed/sourced
5.1.4 Relevant equipment and human resources are identified
5.1.5 Service record book/checklist are analysed

Element 5.2	Carry out Troubleshooting

Performance Criteria:

5.2.1 Necessary instruments are connected to determine nature of failure
5.2.2 Printed results are analysed
5.2.3 Nature of problem is determined
5.2.4 Course of action is outlined/described
5.2.5 Magnetic screen is removed to inspect debris
5.2.6 Scientific wear analysis is conducted on the oil

Element 5.3	Service/Repair Units

Performance Criteria:

5.1.1 Implement cycles are checked
5.1.2 Safety precautions are observed due to high pressure and raised implements
5.1.3 Necessary resource are gathered (tools, equipment, manuals, HR and materials)
5.1.4 Appropriate servicing/repairing procedure is followed
5.1.5 Necessary checks are carried out
5.1.6 Prestart procedure (eg priming bearings) are conducted
5.1.7 Necessary running instruments are connected

Element 5.4	Test run the System

Performance Criteria:

5.4.1 Necessary checks are conducted/analysed
5.4.2 Appropriate instruments are connected
5.4.3 Plant/machine is started according the specifications
5.4.4 Operating specifications are compared against manufacturer's specifications
5.4.5 Necessary adjustments are carried out
5.4.6 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:
Ability to interpret engineering drawings
Appreciation of Engineering Mathematics
Appreciation of Engineering Science
Knowledge of and ability to use measuring instruments
Good knowledge of standard mechanical engineering practices
Knowledge of workshop machinery and tools
Knowledge of materials
Trouble shooting
Knowledge of Safety, Health and Environment regulations
Knowledge of report writing
Knowledge of memo and letter writing
Knowledge of minute writing
Knowledge of Record management
Knowledge of coordinating meetings
Knowledge of Public relations

GENERIC SKILLS

Communication

Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Repair manual
work-bench
measuring instruments
Valve adjustment set

Oil ring remover
Micrometer
Oil drainer
punches,
Stocks and dies, hacksaws, chisels
Overhead crane and lifts
Parts catalogue
Allen keys
Trays
Scrappers, files, centre
Ring squeezer/expander
Injector tester
Standard tool box

Hydraulic press/ puller
Fire extinguisher
Dial indicator gauge
Steam cleaner

Materials

Duration: 200 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 6

Unit Title:	UNDERCARRIGE MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 10

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to effectively maintain a safe working environment.

ELEMENT AND PERFORMANCE CRITERIA

Element 6.1	Prepare Service Schedule

Performance Criteria:

6.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
6.1.2 Specific tasks for each service interval and time frame are defined
6.1.3 Service kits and tools for each service interval are identified/listed/sourced
6.1.4 Relevant equipment and human resources are identified
6.1.5 Service record book/checklist are analysed

Element 6.2	Inspect the Components

Performance Criteria:

6.2.1 Visual inspection is carried out
6.2.2 Specialised is applied and referred to specs and recommendations
6.2.3 Necessary course of action is determined

Element 6.3	Service/Repair Units

Performance Criteria:

6.3.1 Necessary resources are mobilised
6.3.2 Appropriate servicing/repairing procedure is followed
6.3.3 Test run is conducted
6.3.4 Necessary adjustments carried out

Element 6.4	Test run the System

Performance Criteria:

6.4.1 Necessary checks are conducted/analysed
6.4.2 Appropriate instruments are connected
6.4.3 Plant/machine is started according the specifications
6.4.4 Operating specifications are compared against manufacturer's specifications
6.4.5 Necessary adjustments are carried out
6.4.6 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:

Knowledge of report writing
Knowledge of memo and letter writing
Knowledge of minute writing
Knowledge of Record management
Knowledge of coordinating meetings
Knowledge of Public relations
Ability to interpret engineering drawings
Appreciation of Engineering Mathematics
Appreciation of Engineering Science
Knowledge of and ability to use measuring instruments
Good knowledge of standard mechanical engineering practices
Knowledge of workshop machinery and tools
Knowledge of materials
Trouble shooting
Knowledge of Safety, Health and Environment regulations

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers

Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Oil ring remover
Micrometer
Oil drainer
punches,
Stocks and dies, hacksaws, chisels
Overhead crane and lifts
Parts catalogue
Hydraulic press/ puller
Fire extinguisher
Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

Materials

Duration: **100 Hours**

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 7

Unit Title:	GROUND ENGAGING TOOLS MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 20

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to effectively maintain a safe working environment.

ELEMENT AND PERFORMANCE CRITERIA

Element 7.1	Prepare Service Schedule

Performance Criteria:

7.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
7.1.2 Specific tasks for each service interval and time frame are defined
7.1.3 Service kits and tools for each service interval are identified/listed/sourced
7.1.4 Relevant equipment and human resources are identified
7.1.5 Service record book/checklist are analysed

Element 7.2	Inspect the Components

Performance Criteria:

7.2.1 Necessary instruments are connected to determine nature of failure
7.2.2 Printed results are analysed
7.2.3 Nature of problem is determined
7.2.4 Course of action is outlined/described
7.2.5 Magnetic screen is removed to inspect debris
7.2.6 Scientific wear analysis is conducted on the oil

Element 7.3	Service/Repair Units

Performance Criteria:

7.3.1 Implement cycles are checked
7.3.2 Safety precautions are observed due to high pressure and raised implements
7.3.3 Worn out components are replaced

Competencies Required in Readiness for Assessment:

Hydraulics
Material science
Basic electrics
Care, use and storage of tools and equipment
Knowledge of Safety, Health and Environment regulations

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox

Dynamometer
Jacks and axle stands
Heavy duty spanners, sockets, screw-drivers and hammers
Torque wrench
Oil ring remover
Micrometer
Oil drainer
Stocks and dies, hacksaws, chisels
Overhead crane and lifts
Parts catalogue
Hydraulic press/ puller
Fire extinguisher
Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

Materials

Duration: 200 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

UNIT 8

Unit Title:	BRAKING SYSTEM MAINTENANCE

Level of Unit: NATIONAL CERTIFICATE

Credits: 20

Occupation: DIESEL PLANT FITTER

Date of Promulgation: TBA

Review Date: TBA

AIM

This unit will enable an individual to effectively maintain a safe working environment.

ELEMENT AND PERFORMANCE CRITERIA

Element 5.1	Prepare Service Schedule

Performance Criteria:

5.1.1 A servicing program based on the machine time/mileage and with service intervals is prepared
5.1.5 Specific tasks for each service interval and time frame are defined
5.1.6 Service kits and tools for each service interval are identified/listed/sourced
5.1.7 Relevant equipment and human resources are identified
5.1.5 Service record book/checklist are analysed

Element 5.2	Conduct Visual Inspection

Performance Criteria:

5.2.1 Necessary instruments are connected to determine nature of failure
5.2.2 Tooling is applied and refer to specs and recommendations
5.2.3 Necessary course of action is determined

Element 5.3	Service/Repair Components

Performance Criteria:

5.1.1 Implement cycles are checked
5.1.2 Safety precautions are observed due to high pressure and raised implements
5.1.3 Necessary resource are gathered (tools, equipment, manuals, HR and materials)
5.1.4 Appropriate servicing/repairing procedure is followed
5.1.5 Necessary checks are carried out
5.1.6 Prestart procedure (eg priming bearings) are conducted
5.1.7 Necessary running instruments are connected

Element 5.4	Test run the System

Performance Criteria:

5.4.7 Necessary checks are conducted/analysed
5.4.8 Appropriate instruments are connected
5.4.9 Plant/machine is started according the specifications
5.4.10 Operating specifications are compared against manufacturer's specifications
5.4.11 Necessary adjustments are carried out
5.4.12 Plant/machine service/repair report is produced

Competencies Required in Readiness for Assessment:

Material science
Types of braking systems, operation; service and repair
Hydraulics
Types of brake fluids and oils -Use knowledge of Hydraulic and -Mechanical hand and foot brakes
Functions of the braking systems:
Mechanical.
Hydraulic.
Pneumatic.
Operation of master cylinders:

GENERIC SKILLS

Communication
Drawing
Reading and writing
Computers
Estimations
Measurements
Organizing
Planning
Analytical
Numeracy

RANGE STATEMENT:

Tools and equipment

Artisan's toolbox
Dynamometer
Repair manual
work-bench
Heavy duty spanners, sockets, screw-drivers and hammers
measuring instruments
Torque wrench
Allen keys
Micrometer
Trays
Injector tester
Parts catalogue
Standard tool box
Dial indicator gauge
Fire extinguisher
Steam cleaner

Materials

Duration: 200 Hours

ASSESSMENT AND CERTIFICATION:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

Unit 9

Unit Title:9	ELECTRICAL AND ELECTRONIC SYSTEMS
Unit Code	

ZQF Level: **National Certificate**

Credits:

Occupation: **Diesel Plant Fitting**

Date of Promulgation:

Review Date:

Aim
On completion of this unit the individual will be able to carry out checks and tests on electrical and mechanical vehicle systems

ELEMENTS AND PERFORMANCE CRITERIA

Element 9.1	Inspect electrical and electronic systems

Performance Criteria:

9.1.1 Suitable tools and equipment are selected
9.1.2 Safety precautions are followed
9.1.3 Starting and charging system is checked for functionality
9.1.4 Functionality of warning lights and gauges established
9.1.5 Wires and connections are checked for tightness and damages
9.1.6 Operation of all lights and accessories checked
9.1.7 Battery checks done

Element 9.2	Dismantle starter motor

Performance Criteria:
9.2.1 External starter motor connections disconnected
9.2.2 Starter solenoid removed
9.2.3 Brush box housing removed
9.2.4 Brush holder removed
9.2.5 Field coil housing removed
9.2.6 Yoke is disconnected
9.2.7 Armature is removed

9.2.8 Overrunning clutch is removed

Element 9.3	Inspect components

Performance Criteria:

9.3.1 Components are cleaned using appropriate solvent
9.3.2 Brushes are checked and inspected for wear
9.3.3 Armature inspected wear and insulation (ground)
9.3.4 Growler test is carried out on the commutator
9.3.5 Overrunning is inspected for slippage (one way clutch)
9.3.6 Bearings and bushes inspected for wear
9.3.7 Overrunning clutch housing is inspected for wear and cracks
9.3.8 Pinion is inspected for teeth chipping
9.3.9 Commutator inspected for insulation
9.3.10 Solenoid is tested for pull in and hold in

Element 9.4	Re-assemble starter motor

Performance Criteria:

9.4.1 Overrunning clutch is assembled into the housing
9.4.2 Yoke is replaced
9.4.3 Commutator is connected to the yoke and the clutch
9.4.4 Armature is correctly installed
9.4.5 Field coil housing fitted correctly
9.4.6 Brush box is replaced onto the commutator
9.4.7 Positive brushes connected and fitted to the brush cage and insulated
9.4.8 Brush box is fitted onto the field coil housing
9.4.9 Solenoid and the external wire are connected back correctly
9.4.10 Starter motor is tested for motoring, cranking and hold-in

Element 9.5	Dismantle alternator

Performance Criteria:

9.5.1 Remove the rear end cover
9.5.2 Remove the regulator
9.5.3 Remove front pulley using special service tool
9.5.4 Remove the front end cover

Element 9.6	Inspect components

Performance Criteria:

9.6.1 Clean the components using appropriate solvent
9.6.2 I.C regulator diodes are checked for insulation
9.6.3 Brushes and bearings are checked for wear
9.6.4 Slip rings are checked for open C.C.T and wear and ovality
9.6.5 Rotor segments are checked for insulation
9.6.6 Stator is checked for grounding and continuity
9.6.7 Pulley is checked for chips and cracks

Element 9.7	Re-Assembling of Alternator

Performance Criteria:

9.7.1 Pulley is fitted back to the front-end cover and rotor
9.7.2 Stator is fitted and correct bearing is replaced
9.7.3 Bearing is greased using appropriate lubricants
9.7.4 IC regulator is replaced onto the rotor
9.7.5 Rear end cover is replaced
9.7.6 Alternator is tested for charging

Element 9.8	Perform electrical tests

Performance Criteria:

9.8.1 Suitable tools and equipment selected
9.8.2 Safety precautions followed
9.8.3 Bearing is greased using appropriate lubricants
9.8.4 I.C regulator is replaced onto the rotor
9.8.5 Rear end cover is replaced
9.8.6 Alternator is tested for charging

Element 9.9	Perform electrical tests on circuits and components

Performance Criteria:

9.9.1 Suitable tools and equipment selected
9.9.2 Safety precautions followed
9.9.3 Circuits checked for continuity
9.9.4 Voltage drop/output is tested

9.9.5 Current draw tested and results compared with specifications
9.9.6 Resistance is measured against specifications
9.9.7 Battery tests done to ascertain condition
9.9.8 Operation of air conditioning system is checked

Element 9.10	Repair electrical circuits and components

Performance Criteria:

9.10.1 Suitable tools and equipment selected
9.10.2 Safety precautions followed
9.10.3 Faulty components identified
9.10.4 Faulty components removed as per repair manual
9.10.5 Components repaired/replaced and fitted back
9.10.6 Faulty circuits rectified and tested for functionality
9.10.7 Battery tests done to ascertain condition
9.10.8 Terminals and connections cleaned and lubricated

Competencies Required in readiness for Assessment
Electrical fault finding
Electrics and electronics problem solving
Automobile electrical principles
Automobile electronic principles
Workshop safety

Common Essential Skills:
Computer literacy
Communication
Supervision
Vehicle driving

Range Statement:
Tools and equipment
Diagnostic machine
Vernier callipers
Standard tool box
Digital Multimeter
Battery load tester and charger
Workbench with bench vice
Personal protective equipment
Puller
Copper jaws
Soldering iron
Growler
Hydrometer

Test meter
Beam setter

Materials
Cleaning agents
Mutton cloth
Protective clothing
Water paper
Fuses
Degreaser
Insulation tape
Soldering wire
Grease

Duration 200 hours

Assessment and Certification:

In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Assessment will be conducted by accredited assessors. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

Module Code:	**402/22/M01**
Module Title:	**ENTREPRENEURSHIP SKILLS DEVELOPMENT**
ZNQF Level:	**4**
Credits:	**8**
Duration:	**80 HOURS**
Relationship with Qualification Standards:	Based on Unit Standard **TBA ENTREPRENEURSHIP SKILLS DEVELOPMENT OF UNIT STANDARD FOR AN ENTREPRENEUR**
Pre-requisite modules:	NON
Purpose of Module:	This module describes the skills, knowledge and attitudes required by an entrepreneur to acquire leadership, business and time management, creative thinking and problem-solving in a job role and industries. This module will ensure that the entrepreneur will formulate a business plan, register a company and operate a business. The advantages of entrepreneurship skills development are that growth and development are constant, beneficial network is developed and work life autonomy is possible. Access to this module is open to all youth, man and woman who want to own a business.
List of Learning Outcomes:	**LO1: Formulate a business** **LO2: Register a company** **LO3: Operate a business**
Learning Outcome 01	**Formulate a business**
Assessment Criteria:	1.1 Formulate a business idea 1.2Produce business plan 1.3 Research on business market 1.4 Compile a financial plan 1.5 Position a product/service 1.6 Envelope survival strategies 1.7 Establish a business environment 1.8 Mobilise financial resources
Content:	**1.1.Formulate a business idea** 1.1.1Define an entrepreneur 1.1.2 Discuss the various concepts of entrepreneurship 1.1.3 Analyse the various forms of business ownership **1.2. Produce business plan**

	1.2.1 Define a business plan 1.2.2Produce an executive summary of your business 1.2.3Describe the business 1.2.4 Provide the organisational structure of the business 1.2.5Describe product/services 1.2.6 Provide market analysis 1.2.7 Give marketing strategies 1.2.8 Provide a financial plan **1.3 Research on business market** 1.3.1 Define business market 1.3.2 Study market trends 1.3.3 Analyse market segmentation 1.3.4 Analyse competitors in the market **1.4 Compile a financial plan** 1.4.1Plan for staffing and employees 1.42 Forecast on profit and loss 1.4.3 Analysis of cashflow 1.4.5 Prepare a balance sheet **1.5 Position products/services** 1.5.1 Define positioning of products and services 1.5.2 Describe the types of product and services positioning 1.5.3 Discuss the importance of product/service positioning **1.6 Envelope survival strategies** 1.6.1 Define survival strategies 1.6.2Describe the types of survival strategies 1.6.3Discuss the importance of survival in business **1.7 Establish a business environment** 1.7.1Conduct SWOT analysis 1.7.2Discuss price and position products/ services 1.7.3Conduct viable promotions **1.8 Mobilise Financial resources** 1.8.1Provide a detailed account of how to bring revenue and funding to get started 1.8.2Balancing financial statement
Assessment Tasks:	10. Written and/or oral assessment on the skills and knowledge required to formulate a business as outlined in the assessment criteria and content above. 11. Practical assessment on the formulation of a business plan

Conditions/Context of assessment	13. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 14. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 15. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation.
Learning Outcome 02	**Register a company**
Assessment Criteria	2.1Prepare company documents 2.2 Process business registration 2.3Secure a place of business operation 2.4Compile rules and regulations
Content	**2.1Prepare company documents** 2.1.1 Identify business documents 2.1.2 Explain the purpose of books of accounts (cashbooks, ledger,etc) 2.1.3 Explain the importance of business documents **2.2 Process business registration** 2.2.1Define company registration 2.2.2Identify the types of companies that can be registered 2.2.3 Describe the requirements needed to register different companies 2.2.4 Discuss the procedures for company registration 2.2.5 Describe the documents that are received after company registration **2.3 Secure a place of business operation** 2.3.1 Identify factors that influence an entrepreneur in securing a place of business operation 2.3.2 Discuss the macro and micro environmental factors affecting entrepreneurship 2.3.3 Define SMEs(Small and Medium Enterprises) 2.3.4 Discuss the roles of SMEs 2.**4Compile rules and regulations** 2.4.1 Define rules and regulations in business 2.4.2 Compile guiding rules and regulations in business 2.4.3 Explain the importance of rules and regulations in business

Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to registering a company as outlined in the assessment criteria and content above. 2. Practical assessment on the registering of a business plan
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation
Learning Outcome 03	**Operate a business**
Assessment Criteria	3.1Manage a business according to organisation policy 3.2Allocate resources according to line of business 3.3 Cost products in line with procedures 3.4 Price products according to company procedures 3.5 Update and maintain records 3.6 Control stock in line with organisation requirements 3.7 Formulate market plans 3.8 Manage risks in line with organisation requirements 3.9 Adopt growth strategies 3.10 Observe business and give social responsibility 3.11 Practise customer care 3.12 Motivate employees in line with organisational requirements
Content	**3.1Manage a business according to organisation policy** 3.1.1Define business management 3.1.2 Explain the roles of management in a business 3.1. Discuss the importance of computers as a business management tool 3**.2 Allocate resources according to line of business** 3,2.1 Define resource allocation 3.2.2 Explain the importance of properly allocating resources (human, capital, material) **3.3 Cost products in line with procedures** 3.3.1 Define various costing terms 3.3.2 Explain the importance of costing to a business 3.3.3 Describe the costing processes of a business 3.3.4 Calculate using the basic cost - pricing and profit methods in relation to products/ services **3.4 Price products in line with business policy**

	3.4.1 Define various pricing terms 3.4.2 Explain the importance of pricing to a business 3.4.3 Analyse the pricing processes of a business 3.4.4 Calculate prices of products 3.4.5 Describe pricing strategies **3.5 Update and maintain records** 3.5.1Define record keeping in business 3.5.2 Identify source business documents 3.5.3 Explain the importance of record keeping 3.5.4 Describe the purposes of books of accounts **3.6 Control stock in line with organisation requirements** 3.6.1Define stock control in business 3.6.2Describe the importance of stock control 3.6.3 Outline effective stock control procedures **3.7 Formulate market plans** 3.7.1Define marketing 3.7.2 Devise a marketing plan for a business 3.7.3 Explain the Ps of marketing 3.7.4 Discuss the marketing mix strategies **3.8 Manage risks in line with organisation requirements** 3.8.1 Define risk management 3.8.2 Discuss the importance of risk covers in entrepreneurship 3.8.3Explain the principles of risk management to a business 3.8.4 Analyse the steps involved in risk management process 3.8.4Identify the various risk management strategies in business **3.9 Adopt growth strategies** 3.9.1 Define business growth strategies 3.9.2 Explain the four business growth strategies **3.10 Observe business ethics and give social responsibility** 3.10.1 Define business ethics and social responsibility 3.10.2 Explain the importance of business ethics to entrepreneurs 3.10.3 Outline social responsibility principles 3.10.4 Explain the importance of social responsibility to the entreptreneur 3.10.5 Illustrate acts of social responsibility by an entrepreneur in a community **3.11 Practise customer care**

	3.11.1 Define customer care 3.11.2 Discuss ten tips of customer care 3.11.3 Explain benefits of customer care **3.12 Motivate employees in line with organisational requirements** 3.12.1 Define motivation 3.12.2 Outline theories of staff motivation in business 3.12.3 Discuss the importance of motivation
Assessment Tasks	1. Written and/or oral assessment on the skills and knowledge required to operate a business as outlined in the assessment criteria and content above. 2. Practical assessment on operating a business
Conditions/Context of assessment	1. Written and/or oral assessment can be conducted in a classroom environment. Oral assessment can also be conducted by the assessor during the performance of the practical assessment by the trainees. 2. The practical assessment will be conducted in the workplace or simulated work environment in the training institution. 3. The context of assessment should include the facilities, tools, equipment and materials as per entrepreneur's occupation

Approach to Teaching and Learning:

8 Observation of adult learning principles.

9 Both institution-based and work-based learning to facilitate the integration of theory and practice.

10 Face-to-face education and learning.

11 Problem-based learning.

12 Online/distance education and learning.

13 Blended/hybrid education and learning.

14 Use of social media.

Approach to Assessment:

9. Weighting of practical and theory assessment: 60% theory and 40% practical.
10. Weighting of institution-based and work-based assessment: 50% institution-based assessment and 50%.
11. Oral assessment to be conducted by a panel of two or more assessors.
12. Portfolio of evidence.
13. Assessment of work conducted by both individual learners and teams of learners.

Resources:

1 Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualification and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

All trainers, assessors and moderators should have undergone ZNQF accredited training programmes and should have qualifications and experience recognised by the Zimbabwe National Qualifications Authority (ZNQA).

16. Facilities, Tools, Equipment and Materials Facilities, Tools, Equipment and Materials

- Computer
- Communication equipment
- Data storage devices
- Television
- DVD Recorder/player Generic which are relevant to the type of business

17. Learning Resources

Relevant training manual (learners' guide) and facilitators' guide

18. Reference Materials (recommended textbooks, recommended readings)

Alderman,P.,J.,(2011) Entrepreneurial Finance,Pearson Education LTD, London
Appleby R (1994) Modern Business Administration
Barringer,B.,R., &Ireland,D.,R.,(2006) Entrepreneurship:Successfully Launching New Ventures, Pearson Education
Bridge, S., O'Neill , K. & Martin, F., (2009) Understanding Entrerprise: Entrepreneurship &Small Business, Third Edition, Palgrave Macmillan, London
Burns, P. & Dewhurst, J., (eds) 91990)Small Business and Entrepreneurship, Macmillan Education LTD,Hampshire
City and Guilds, (2012) Hospitality supervision & Leadership,Heinemann,Essex,
Deakins, D., & Freel, M., (2012) Entrepreneurship and Small Firms,McGraw-Hill,Berkshire
Hisrich, R. D. & Peters, M. P. (2016) Entrepreneurship, Tatq McGraw Hill New Delphi Entre
Holt, D.T., (2017)Entrepreneurship, Prentice Hall, London
Jarskoy, H. & Stevenson, D., (2014) International Labour Organisation Start Your Business. ILO, Harare
Justin Smith (2000) Business Management Trainer's Guide
Kotler Philip & Armstrong G (2001) Principles of Marketing
Kuratiko, D., F., (2008) Introduction to Entrepreneurship, Cengage Learning , Hampshire
Lee, C.,L., &Melicher,W.,(2012) Entrepreneurial Finance,4th Edition,Cengage Learning, South Western
Marcourse, I.(2016) Business Studies @nd Ed Hodder Arnold, London
McGuckin Frances (1988) Business for Beginners (A simple step by step Guide to Start Your New Business)
Mullins L (1999) Management and Organisational Behaviour 5th edition
Need Harm, D, & Dransfield, R.(2000) Advanced Business and Dexel, Oxford
Rae, D., (2007) Entrepreneurship,From opportunity to action,Palgrave Macmillan, New York
Rwegema , V., U., Entrepreneurship:theory in practice, 2nd edition,Oxford University Press, Cape Town
Stokes, D., Wilson, N. & Mador, M.,(2010) Entrepreneurshp,Cengage Learning EMEA, Hampshire
Stoner, J., A. F., Freeman, R., E. & Gilbert, D, R., J. R. (2017) Management 6th Edition, Prentice Hall International Englenwood Cliffs, New Jersey.
Van Der Wagen & Davies, C.(1998) Supervision and Leadership, Hospitality PressPty LtdElsternwick Victoria
Zimmerer T.W, Scarborough M Norman – Essentials of Entrepreneurship and Small

UNIT 1

Unit Code	**402/22/M01**
Unit Title:	**Entrepreneurship skills development**

Level of Unit: **Generic**

Credits: **8**

Occupation: **ENTREPRENEUR**

Date of Promulgation: **TBA**

Review Date: **TBA**

AIM OF THE UNIT STANDARD

This unit enables an individual to acquire skills and knowledge in leadership, business and time management, creative thinking and problem-solving in a job role and industries.

ELEMENT AND PERFORMANCE CRITERIA

Element 1.1	**Formulate a Business**

Performance Criteria:

1.1.6 Business idea formulated according to requirements
1.1.7 Business plan produced
1.1.8 Business market researched in line with policy
1.1.9 Financial plan compiled
1.1.10 Product or service positioned in line with specifications
1.1.11 Survival strategies enveloped
1.1.12 Business environment established according to requirements
1.1.13 Financial resources Mobilised

Element 1.2	**Register a company**

Performance Criteria:

1.2.1 Company documents prepared in line with procedures
1.2.2 Business registration processed according to policies
1.2.3 Place of business operation secured
1.2.4 Rules and regulations compiled according to business requirements

Element 1.3	Operate a business

Performance Criteria:

1.3.1 Business managed according to organisation policies
1.3.2 Resources allocated according to line of business
1.3.3 Products costed in line with procedures
1.3.4 Products priced according to company procedures
1.3.5 Records updated and maintained
1.3.6 Stock controlled in line with organisation requirements
1.3.7 Marketing plan formulated
1.3.8 Risks managed in line with organisation requirements
1.3.9 Growth strategies adopted
1.3.10 Business ethics observed and social responsibility given
1.3.11 Customer care practised
1.3.12 Employees motivated in line with organisational requirements

COMPETENCIES REQUIRED IN READINESS FOR ASSESSMENT:

Accounting skills
Record keeping
Customer care skills
Management skills (decision making, planning, organising)
Technological awareness
Marketing skills
Business conduct
Legal awareness
Mobilisation skills
Self-Supervision
Patriotism
Environmental awareness (PESTEL)

GENERIC SKILLS:
Practical skills
Calculations
Skills
Creativity
Sense of initiative
Ability to
Marshall
Resources
Technological knowledge
Communication
Planning
Organization
Controlling
Human relation skills
Interpersonal skills
Analytical skills

RANGE STATEMENT:

Tools and Equipment
Generic which are relevant to the type of business
Materials
Generic which are relevant to the type of business

Duration: **8**0 hours

ASSESSMENT AND CERTIFICATION:
In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Accredited assessors will conduct assessment. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence of their achievements.

Module Code:	**401/22/M01**
Module Title:	**NATIONAL STUDIES**
ZNQF Level:	Generic
Credits:	8
Duration:	80 hours
Relationship with Qualification Standards:	**Based on Unit Standard TBA NATIONAL STUDIES UNIT STANDARD FOR PATRIOTIC CITIZEN**
Pre-requisite modules:	NON
Purpose of Module:	This module describes the skills, knowledge and attitudes required by a patriotic citizen to develop values that make them proud to be Zimbabweans. This includes maintaining a Zimbabwean culture, preserving Zimbabwean History, assembling components of colonial effects, analysing post-independence socio-economic and political developments, assembling components of legal and parliamentary affairs, carrying out a feasibility study on peace, conflict and resolution as well as participating in civic responsibilities. This is important in producing an informed and responsible citizen prepared to defend and develop the country. Access to this module is open to all target groups, which include the unemployed youth, men and women willing to develop their country.
List of Learning Outcomes:	**LO1: Maintain a Zimbabwean culture** **LO2: Preserve Zimbabwean History** **LO3: Assemble components of colonial effects** **LO4: Analyse post-independence socio-economic and political developments** **LO5: Carry out a feasibility study on peace, conflict and resolution** **LO6: Participate in civic responsibilities** **LO7 Assemble components of legal and parliamentary affairs**
Learning Outcome 01	**Maintain a Zimbabwean culture**
Assessment Criteria:	**1.6. Preserve cultural heritage** **1.7. Conserve cultural artefacts** **1.8. Demonstrate knowledge of Zimbabwean culture** **1.9. Capture records of maintaining natural resources of Zimbabwe** **1.10. Preserve indigenous knowledge systems**

Content:	**1.2.Preserve cultural heritage** 1.2.1. Definition of cultural heritage 1.1.2. Types of cultural heritage 1.1.3. Importance of cultural heritage 1.5.4.Indigenous methods of preserving and conserving cultural heritage 1.5.5.Modern ways of preserving and conserving cultural heritage 1.5.6.Role of national and international organisations in protecting cultural heritage **1.6. Conserve cultural artefacts** 1.2.1. Identification of cultural artefacts 1.2.2. Threats to cultural artefacts 1.2.3. Importance of cultural artefacts 1.2.4. Ways of protecting cultural artefacts **1.7. Demonstrate knowledge of Zimbabwean culture** 1.3.1. Components of Zimbabwean culture 1.3.2. Significance of components of the Zimbabwean Culture 1.3.3. Threats to various components of the Zimbabwean Culture 1.3.4. Ways of upholding the Zimbabwean Culture **1.8. Capture records of maintaining natural resources of Zimbabwe** **1.4.1.** Types of natural resources 1.4.2. Importance of natural resources 1.4.3. Indigenous and modern methods of protecting natural Resources 1.4.4. National and international statutes that protect national Resources **1.9. Preserve indigenous knowledge systems** 1.5.1. Definition of indigenous knowledge systems 1.5.2. Components of indigenous knowledge systems 1.5.3. Meanings and significance of indigenous knowledge systems 1.5.4. Insights gained from indigenous knowledge systems
Assessment Tasks:	12. Written assessment on the skills and knowledge required maintain a Zimbabwean Culture as highlighted above. 13. Practical based assignment on ways of preserving cultural heritage sites within their communities.

Conditions/Context of assessment	19. Written assessment can be conducted in a classroom environment. 20. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 02	**Preserve Zimbabwean History**
Assessment Criteria	**2.1 Identify pre-colonial states** **2.2 Analyse precolonial political structure** **2.3 Record achievements of precolonial history** **2.4 Record colonial history** **2.5 Record role of Christian missionaries** **2.6 Record occupation of Zimbabwe** **2.7 Trace causes of first /second Chimurenga**
Content	**2.1 Identify pre-colonial states** 2.1.1 Defining term pre-colonial 2.1.2. Identifying precolonial states 2.1.3 Pre- colonial socio-economic organisation 2.1.4. Causes of decline of pre-colonial states 2.1.5. Influence of pre-colonial civilisation on contemporary society **2.2 Analyse precolonial political structure** 2.2.1 System of governance of pre-colonial states 2.2.2 Features of the pre-colonial system 2.2.3. Influence of precolonial governance on contemporary society **2.3 Record achievements of precolonial history** **2.3.1** Impact of precolonial achievements and political development **2.4 Record colonial history** 2.4.1 Partition and colonisation of Africa 2.4.2 Berlin conference 2.4.3 Causes/ reasons for the colonisation/occupation of Zimbabwe 2.4.4 Colonisation steps/processes in Zimbabwe **2.5. Record role of Christian missionaries** 2.5.1 Socio-economic and political impact of Christian missionaries in Zimbabwe **2.6. Record occupation of Zimbabwe** **2.6.1** Colonial Administration from 1894 to 1923 1.2.6.2 Socio-economic and political impact of colonisation in Zimbabwe **2.7 Trace causes of first /Second Chimurenga**

	2.7.1 Causes and results of the Anglo-Ndebele war 1.7.2 Causes and results of the 1st Chimurenga/Umvukela 2.7.3. African reaction-to socio-economic and political colonial administration 2.7.4. Causes and results of the 2nd Chimurenga 2.7.5. Socio-economic and political impact of the 1st and 2nd Chimurenga 2.7.6. Prosecution of the war of liberation 2.7.6 Social and political impact of heroes/heroines
Assessment Tasks:	3. Written or oral assessment on the skills and knowledge required to assess the understanding of Zimbabwean History. 4. Practical activities based on observations within and outside the institution that demonstrate understanding of Zimbabwean history.
Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. 4. The practical based assignment/activities will be conducted based on participation/observations in their communities
Learning Outcome 03	**Assemble components of colonial effects**
Assessment Criteria	3.1 Demarcate administrative boundaries 3.2. Exploit natural resources (minerals, wildlife, land, water Vegetation, etc.) 3.3. Change traditional religion 3.4. Introduce foreign food crops and livestock 3.5. Change forms of trade 3.6. Change education systems 3.7. Introduce new legal systems 3.8. Introduce Capitalistic relations 3.9. Violate Human rights 3.10. Analyse results of colonisation
Content	**3.1 Demarcate administrative boundaries** 3.1.1. Factors that led to demarcation of boundaries 3.1.2. Distribution of land and uses 3.1.3. Consequences of establishing administrative boundaries **3.2. Exploit natural resources (minerals, wildlife, land, water Vegetation etc.)** 3.2.1. Geographical distribution of available resources 3.2.2. Measures enacted to exploit the resources 3.2.3. Consequences of exploiting the resources (Social, political,

	economic) **3.3. Change traditional religion** 3.3.1. The nature of African traditional religion prior to colonisation 3.3.2. The role of religion in the African societies 3.3.3. The introduction of foreign religion 3.3.4. The effect of foreign religion on African societies 3.3.5. The place of African Traditional religion in contemporary society **3.4. Introduce foreign food crops and livestock** 3.4.1. Nature and significance of African food crops and livestock 3.4.2. Types of foreign crops introduced 3.4.3. Consequences of the foreign crops and livestock on African Societies 3.4.4. The sustainability of traditional versus foreign crops and livestock in contemporary Zimbabwean society **3.5. Change forms of trade** 3.5.1. Nature and benefits of trade prior to colonisation 3.5.2. Nature of trade during colonisation 3.5.3. Effects of trade during colonial era on African societies. 3.5.4. Influence of trade patterns to contemporary society **3.6. Change education systems** 3.6.1. Nature and purpose of Traditional African Education system 3.6.2. Nature and purpose of Colonial education 3.6.3. Consequences of Colonial education on African Societies 3.6.4. Influence of colonial education to contemporary society **3.7. Introduce new legal systems** 3.7.1. Nature of African legal system prior to colonisation. 3.7.2. Nature of colonial legislation (social, political and economic) 3.7.3. Purpose of colonial legal system 3.7.5. Consequences of colonial legal system to colonial and contemporary African societies **3.8. Introduce Capitalistic relations** 3.8.1. Nature of African relations before colonisation 3.8.2. Introduction of capitalist relations 3.8.3. Effects of capitalist relations during the colonial era and the contemporary society **3.9. Violate Human rights**

	3.9.1. Definition of human rights 3.9.2. Nature of human rights violations in the colonial era 3.9.3. Response to human rights violations during the colonial era **3.10. Analyse results of colonisation** 3.10.1. Social effects of colonisation on African Societies 3.10.2. Economic effects of colonisation on African Societies 3.10.3. Political effects of colonisation on African societies 3.10.4. Benefits and non-benefits of colonisation
Assessment Tasks	3. Written assessment on the skills and knowledge required to assess the consequences of colonisation on the African Societies. 4. Practical based assignment on observable socio-politico and economic effects of colonisation within their communities.
Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment. 4. The practical based assignment assessment will be conducted based on observations in their communities
Learning outcome O4	**Analyse post-independence socio-economic and political developments**
Assessment Criteria	**4.1 Analyse socio-economic, political developments** **4.2Formulate Policies** **4.3 Adopt measures to address colonial injustices**
Content	**4.1 Examine socio-economic and political developments** 4.1.1 Social-economic and political post-independence developments 4.1.2 Critique of post-independent development **4.2 Formulate Policies** 4.2.1 Legislation that addressed colonial injustices 4.2.2 Impact of post-independent legislation 4.2.3 Comparison of colonial and post-independence legislation **4.3 Adopt measures to address colonial injustices** 4.3.1 Socio-economic and political measures to address colonial injustices 4.3.2 Impact of measures to address colonial injustices 4.3.3 Colonial vestiges 4.3.4 Strategies to address colonial vestiges
Assessment Tasks	3. Written assessment on the skills and knowledge required to assess the achievements and challenges of post-independent in Zimbabwe. 4. Practical based assignment on observable socio-economic and political developments in their communities.

Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment. 4. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 05	**Carry out a feasibility study on peace, conflict and resolution**
Assessment Criteria	**5.1. Demonstrate Conflict and resolution styles** **5.2. Demonstrate 3Cs between Zimbabwe and the global community** **5.3. Analyse Strategies for sustaining peace** **5.4. Analyse the influence of multi-national companies in developing countries** **5.5. Examine the benefits of International capital to developing countries**
Content	**5.1. Demonstrate Conflict and resolution styles** 5.1.1 Defining conflict and conflict resolution 5.1.2 Identifying and explaining conflict resolution styles 5.1.3 Impact of conflict resolution to socio-economic development 5.1.5 Traditional African conflict resolution methods. **5.2. Demonstrate 3Cs between Zimbabwe and the global community** 5.2.1 Defining terms Conflict, competition and co-operation 5.2.2 Impact of 3Cs to economic development 5.2.3 Approaches/Theories to International Relations 5.2.4 Global power balance 5.2.5 Zimbabwean foreign policy 5.2.6 Zimbabwean regional and international interventions **5.3. Analyse Strategies for sustainable peace** 5.3.1 Defining peace and sustainable peace 5.3.2 Importance of peace to socio-economic and political Development 5.3.3. Impact of sanctions on development 5.3.4 Strategies for sustainable peace 5.3.5 Role of NGOs in the development of sustainable peace 5.3.6 Role of media in promoting and maintaining peace **5.4. Analyse the influence of multi-national companies in developing countries** 5.4.1 Role of multi-national companies in developing countries 5.4.2 International capital and imperialism 5.4.3 The IMF/WB Institutions 5.4.4 Impact of Non-Governmental Organisations in developing countries

	5.5 Examine the benefits of International capital to developing countries 5.5.1 Characteristics of finance capital 5.5.2 International economic relations 5.5.3 Features of Globalisation 5.5.5 Benefits and non-benefits of globalisation
Assessment Tasks	3. Written assessment on the skills and knowledge required to assess the importance of understanding the importance of peace, conflict and resolution on socio-economic developments in Zimbabwe. 4. Practical based assignment on observable socio-economic and political developments in their communities.
Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment. 4. The practical based assignment assessment will be conducted based on observations in their communities
Learning Outcome 06	**Participate in civic responsibilities**
Assessment Criteria	**6.1 Undertake Civic responsibilities** **6.2 Observe participation in Disaster Management** **6.3 Adopt Citizen duties**
Content	**6.1 Undertake Civic responsibilities** 6.1.1. Definition of civic responsibilities 6.1.2. Civic responsibility activities 6.1.3. Justification for civic responsibilities **6.2. Observe participation in Disaster Management** 6.2.1. Definition of disaster management 6.2.2. Justification for participation in disaster management 6.2.3. Sustainable disaster management practices **6.3 Adopt Citizen duties** 6.3.1. Definition of terms: citizen and citizen duties 6.3.2. Identification and explanation of citizen duties(Socio-economic & political) 6.3.3. Citizen rights 6.3.4. Importance of citizen duties
Assessment Tasks	3. Written or oral assessment on the skills and knowledge required to assess the understanding of citizen duties and responsibilities. 4. Practical activities within and outside the institution that demonstrate civic duties and responsibilities by community participation

Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. 4. The practical based assignment/activities will be conducted based on participation/observations in their communities
Learning outcome 07:	**Assemble components of legal and parliamentary affairs**
Assessment Criteria	**7.1 Identify and explain origins of law** **7.2 Observe constitutional provisions** **7.3 Identify and explain arms of the state** **7.4 Explain Law making process**
Content	7.**1 Identify and explain the origins of law** 7.1.1 Definition of legal terms 7.1.2 Purpose of the law to the community 7.1.3 Classification of the law 7.1.4 Sources of law in Zimbabwe **7.2 Observe constitutional provisions** 7.2.1 Justification of a Zimbabwean constitution 7.2.2 Constitutional Rights as enshrined in the Zimbabwean constitution 7.2.3 Benefits of constitutional rights to the community 7.2.3 Enforcement of rights 7.2.4 Role played by stakeholders in upholding constitutional rights (NGO, Civil Societies and victim friendly units) 7.2.5. Impediments to exercising human rights 7.2.6. Role of constitution in the community **7.3 Observe arms of the state** 7.3.1 Identification of the three arms of state 7.3.2 Duties and functions of the three arms of the state 7.3.3 Importance of separation of powers to Zimbabwe 7.4 **Explain Law making process** 7.4.1 Steps in the Law making 7.4.2 Role of community in law making process
Assessment Tasks	3. Written or oral assessment on the skills and knowledge required to assess the understanding of legal and parliamentary affairs. 4. Practical activities within and outside the institution that demonstrate the importance of participating in legal and parliamentary activities.
Conditions/Context of assessment	3. Written assessment can be conducted in a classroom environment or practical activities conducted within or outside the institution. 4. The practical based assignment/activities will be conducted based on participation/observations in their communities.

Approach to Teaching and Learning:

15 Observation of adult learning principles; both institution-based and work-based learning to facilitate the integration of theory and practice.
16 Face-to-face education and learning.
17 Problem-based learning.
18 Online/distance education and learning.
19 Blended/hybrid education and learning.
20 Use of social media.

Approach to Assessment:

14. Weighting of institution-based and examination -based assessment: 60% institution-based assessment and 40% examination.
15. Portfolio of evidence.

Resources:

21. Qualifications and experience of Trainers, Assessors and Moderators

All trainers, assessors and moderators should have undergone a Bachelor's Degree in History or equivalent.

22. Facilities, Tools, Equipment and Materials

- Computer
- Communication equipment
- Data storage devices
- Television
- DVD Recorder/player
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23. Learning Resources

- Artefacts
- Resource persons
- Museums and heritage sites
- Videos and audio materials

24. Reference Materials (recommended textbooks, recommended readings)

American Heritage Dictionary of the English Language, Fifth Edition (2011), Houghton Mifflin.
Astrow, A., 1983. Zimbabwe: A Revolution That Lost Its. *Way*, pp.1980-1986.
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Mlambo, A.S., 2014. *A history of Zimbabwe*. Cambridge University Press.
Moyo, S., 2004. *Overall impacts of the fast track land reform programme*. African Institute for Agrarian Studies.
Moyo, S., 2006. The evolution of Zimbabwe's land acquisition. University of Zimbabwe (UZ) Publications/Michigan State University (MSU).
Ogunbanjo, M.B., Human Rights in Africa in the new Global Order: A Dilemma?

Raftopoulos, B. and Mlambo, A. eds., 2009. *Becoming Zimbabwe. A History from the Pre-colonial Period to 2008: A History from the Pre-colonial Period to 2008*. African Books Collective.

Ranger, T., 1985. Peasant Consciousness and Guerrilla Warfare in Zimbabwe: A Comparative Study. *Harare: McMillan*.

Ranger, T.O. ed., 1968. *Aspects of Central African History*. Northwestern University Press.
Richardson, C., 2004. *The collapse of Zimbabwe in the wake of the 2000-2003 land reforms*.
Schmidt, E.S., 1992. Peasants, traders and wives: Shona women in the history of Zimbabwe, 1870-1939.
Shaw, W.H., 2003. 'They Stole Our Land': debating the expropriation of white farms in Zimbabwe. *The Journal of Modern African Studies*, *41*(1), pp.75-89.
Shamuyarira, N.M., 1966. Crisis in Rhodesia.
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Zikhali, P., 2008. *Fast track land reform, tenure security, and investments in Zimbabwe* (No. dp-08-23-efd).

UNIT 1

Unit Code	401/22/M01
Unit Title:	**National Studies**

Level of Unit: **Generic**

Credits: **8**

Occupation: **Patriotic Citizen**

Date of Promulgation: **TBA**

Review Date: **TBA**

AIM OF THE UNIT STANDARD

This unit helps people to develop values that make them proud to be Zimbabweans.

ELEMENT AND PERFORMANCE CRITERIA

Element 1.1	**Maintain a Zimbabwean culture**

Performance Criteria:
1.1.14 Cultural heritage preserved
1.1.15 Cultural artefacts conserved
1.1.16 Knowledge of Zimbabwe culture demonstrated
1.1.17 Records of maintaining natural resources of Zimbabwe captured
1.1.18 Indigenous knowledge systems preserved

Element 1.2	Preserve Zimbabwean History

Performance Criteria:

1.2.1 Pre-colonial states identified
1.2.2 Precolonial political structure analysed
1.2.3 Achievements of precolonial history recorded
1.2.4 Colonial history recorded
1.2.5 Role of Christian missionaries recorded
1.2.6 Occupation of Zimbabwe recorded
1.2.7 Causes of First /Second Chimurenga traced

Element 1.3	Assemble components of colonial effects

Performance Criteria:

1.3.1 New administrative boundaries demarcated
1.3.2 Natural resources exploited (minerals, wildlife, land, water, vegetation etc)
1.3.3 Traditional religion changed
1.3.4 Foreign food crops and livestock introduced
1.3.5 Education systems changed
1.3.6 Capitalistic relations introduced
1.3.7 New legal systems introduced
1.3.8. Forms of trade changed
1.3.9 Human rights violated
1.3.10 Results of colonisation analysed

Element 1.4	Analyse post-independence socio-economic and political developments

Performance Criteria:

1.4.1 Socio-economic and political developments examined
1.4.2 Policies formulated
1.4.3 Measures to address colonial injustices adopted

Element 1.5	Carry out a feasibility study on peace, conflict and resolution

Performance Criteria:

1.5.1 Conflict and resolution styles demonstrated
1.5.2 3Cs between Zimbabwe and the global community demonstrated
1.5.3 Strategies for sustaining peace analysed
15.4 Influence of multi-national companies in developing countries analysed
1.5.5 Benefits of International capital to developing countries examined.

Element 1.6	Participate in civic responsibilities

Performance Criteria:

1.6.1 Civic responsibilities undertaken
1.6.2 Participation in disaster management observed
1.6.3 Citizen duties adopted

Element 1.7	Assemble components of legal and parliamentary affairs

Performance Criteria:

1.7.1 Origins of law identified and explained
1.7.2 Constitutional provisions observed
1.7.3 Arms of the state identified and explained
1.7.4 Law making process explained

COMPETENCIES REQUIRED IN READINESS FOR ASSESSMENT:

Record keeping skills
Customer care skills
Management skills (decision making, planning, organising)
Technological awareness
Problem-solving skills
Interpersonal skills
Legal awareness
Mobilisation skills
Upholding norms, values and social aspects of Zimbabwean culture.
Patriotism
Environmental awareness skills
Legal awareness
Critical thinking skills
Research skills
Problem-solving skills
Maintaining Zimbabwean culture
Social responsible
Abreast with global current events

Tool handling skills

GENERIC SKILLS:

Patriotic
Practical skills
Tolerance skills
Technological knowledge
Communication
Positive regard
Planning
Organisation
Controlling
Human relation skills
Interpersonal skills
Critical thinking skills
Analytical skills

Good attitude
Good morals
Acceptance of others
Servant hood
Committed cadre to National Agenda
Quest for more knowledge
Social skills

RANGE STATEMENT:

TOOLS AND EQUIPMENT:
Generic which are relevant to the type of business.**MATERIALS:**
Generic which are relevant to the type of business.

Duration: **8**0 hours

ASSESSMENT AND CERTIFICATION:
In order to gain credits for this unit standard, a candidate must be assessed and demonstrate competency in all the elements and performance criteria of this unit standard.

Accredited assessors will conduct assessment. The results of the assessment will be submitted to ZIMEQA. A candidate can apply to ZIMEQA for documentary evidence

ZIMBABWE	MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE		CODE

INDUSTRY	TRADE/ OCCUPATION	CLASS/ LEVEL
AUTOMOTIVE	DIESEL PLANT FITTING	NC

DUTY A: SAFTEY, HEALTH, ENVIROMENT, AND QUALITY MAINTAINANCE 5

Pre-requisites: **Approval Date:** **Review Date:**

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
A1: Observe personal safety and health	✓ Carry out risk assessment ✓ Put on appropriate personal protective gear. ✓ Interpret safety warning signs ✓ Use safety regulation rules ✓ Use correct tool for the right job ✓ Handle tools and equipment appropriately ✓ Maintain accident report register	➢ Risk assessment report produced ➢ Warning signs observed ➢ Personal protective gear worn. ➢ Correct tool used for job and properly handled ➢ Accident register maintained.	▪ Factories Act and Regulations ▪ SHEQ standards ▪ First Aid ▪ Fire Fighting ▪ Computer Literacy	○ Communication ○ Coordination ○ Firefighting Equipment handling
A2: Demonstrate first Aid procedure	✓ Ensure personal safety. ✓ Call for nearby assistance. ✓ Remove victim from danger following laid down procedure. ✓ Introduce yourself to the victim.	➢ Personal safety ensured. ➢ Victim removed from danger ➢ Assistance from nearby obtained. ➢ Appropriate first aid rendered.		

	✓ State your intention to the victim ✓ Assess victim condition ✓ Communicate with victim (where necessary) ✓ Render appropriate first aid action as required ✓ Call for medical assistance ✓ Document incident			
A3: Maintain safe working conditions	✓ Put on appropriate PPE. ✓ Barricade the working area. ✓ Practice safe working environment ✓ Place tools and equipment in appropriate positions. ✓ Tidy up the places as per procedure ✓ Segregate the waste ✓ Dispose waste following laid down procedure ✓ Store tools and equipment as per standard.	➢ Appropriate PPE worn ➢ Barricades installed ➢ Safety precautions observed. ➢ Tools and equipment well placed. ➢ Appropriate tools used for right job. ➢ Tolls and equipment checklist availed ➢ Waste management disposal procedures observed.		
A4: Perform Housekeeping	✓ Clean working area ✓ Clear gang ways of obstacles ✓ Separate waste materials to c lass ✓ Sweep floors regularly ✓ Clean tools and equipment after use ✓ Store tools and equipment according to rules and regulations	➢ Clean working area ➢ Gang ways free of obstacles ➢ Classified waste materials ➢ Clean floors ➢ Clean stored tools and equipment		

A5: Comply with environmental management systems	✓ Identify potential environmental aspects ✓ Adhere to relevant statutory instruments ✓ Dispose waste in line with local authority regulations ✓ Prevent unnecessary spillages to the environment ✓ Implement Reduce recycle and reuse practices	➢ List/ register of potential environmental aspects ➢ Spillage free environment ➢ Lower waste material ➢ Clean environment ➢ Colour coded bins		
A6: Participate in SHEQ awareness campaign	✓ Mobilise SHEQ awareness campaigning material ✓ Attend SHEQ briefing meeting ✓ Identify potential hazards ✓ Induct new personnel on SHEQ issues ✓ Adhere to SHEQ rules and regulations ✓ Enforce SHEQ rules and regulations	➢ SHEQ campaign materials availed ➢ Attendance register/Minutes ➢ Hazards Register ➢ Loss incidences ➢ Proper Personal Protection Equipment (PPE)		
A7: Maintain organizational standards	✓ Identify relevant quality standards ✓ Perform quality checks ✓ Adhere to standard operating procedures ✓ Maintain product quality	➢ List/register of relevant quality standards produced ➢ Quality checks conducted in accordance to set procedures ➢ Operational checklist ➢ Quality products		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- First aid kit.
- Safety signs and symbols.

- Awareness campaigns material.

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Personal protective gear
- Use of proper insulated tools
- Use of calibrated instruments incompliance to ISO standards
- Free gang ways at the worksite
- Floors free of slippery conditions
- Safety insignia post at all relevant areas.

SPECIFIC WORKER TRAITS REQUIRED COMPLETING THIS DUTY:

- Team work
- Sober minded
- Communication
- Honest
- Punctual
- Target orientated.

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY B: OVERHAUL POWER-TRAIN SYSTEM **15**

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
B1: Replace clutch assembly	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Drain transmission/gear box oil ✓ Tag and lock out **Removal** ✓ Disconnect propeller shaft from gearbox output shaft flange ✓ Remove starter motor ✓ Remove slave cylinder/ clutch linkages ✓ Remove bell housing bolts /nuts ✓ Disconnect speedometer cable ✓ Disconnect electrical connections ✓ Remove gearbox housing bolts ✓ Withdraw gearbox	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ All electrical connectors are disconnected and re-connected according to manual specifications ➢ One side of live axle is jacked up ➢ Gearbox is drained in containers	▪ Clutch function ▪ Principles of operation ▪ Identification of components ▪ Types of clutches ▪ Friction clutches ▪ Centrifugally assisted clutches	○ Communication ○ Drawing ○ Reading and writing ○ Computers ○ Estimations ○ Measuring ○ Organizing ○ Planning ○ Analytical

	✓ Remove thrust bearing, fork pressure and clutch plates and flywheel ✓ **Reassembling** ✓ Replace defective components ✓ Fit new pressure plate and clutch plate ✓ Fit new thrust bearing and clutch fork ✓ Fit gearbox ✓ Fit gearbox mounting bolts ✓ Tighten gearbox mounting bolts ✓ Fit cross member ✓ Fit propeller shaft ✓ Connect gearbox and clutch linkages ✓ Connect propeller shaft ✓ Grease universal joints ✓ Connect all accessories ✓ Fit starter motor ✓ Fit slave cylinder ✓ Lower vehicle ✓ Fill up gearbox with oil ✓ Remove tag and lock ✓ Connect gear lever/shift ✓ Connect battery/switch on master key ✓ Bleed and adjust clutch ✓ Start vehicle ✓ Check operation ✓ Test	➢ Push-rod adjusted to specifications ➢ Work done within stipulated time ➢ Dismantling of components done according to set procedures ➢ Flywheel is de-glazed and checked ➢ Visual inspection of pressure and clutch plates, flywheel, thrust and pilot bearings, gearbox mounting and clutch fork ➢ Bolts tightened to manufacturer's specifications using torque ➢ Wrench ➢ Gearbox supported and not left to hang	▪ Fault diagnosis and analysis and rectification ▪ Testing techniques of components ▪ Knowledge on Technical drawing ▪ Tools and equipment	○ Numeracy

B2: Remove torque converter/divider	✓ Select suitable tools and equipment ✓ Clean work area ✓ Disconnect battery ✓ Choke wheels and Jack machine and support on stands ✓ Drain oil ✓ Remove covers/ belly plates and disconnect pipes ✓ Put lifting tackle into position ✓ Remove charge pumps, hydraulic pump propeller shaft, planet gear train and inspection plate ✓ Decouple drive plate from flywheel ✓ Loosen and remove torque converter/divider	➢ Correct use of tools and equipment ➢ Correct handling of tools and equipment ➢ Use of trays ➢ Locating drive/ flexi-plate converter bolts done ➢ Battery earth removed first ➢ Correct positioning of lifting equipment		
B3: Overhaul torque converter/ divider	✓ Clean torque converter ✓ Clean work area ✓ Separate impeller and carrier from housing ✓ Remove impeller, stator unidirectional clutch and turbine ✓ Remove bearings from housing ✓ Clean components ✓ Visually inspect impeller, turbine stator, and housing, input and output shaft ✓ Replace defective components ✓ Dismantle converter inlet and outlet valves and clean	➢ Seating pattern and bearing clearance in housing observed with special attention on wobbling of shaft ➢ Correct assembling order followed and turbine splines checked against shaft splines ➢ One-way shaft fitted correctly		

	✓ Re-assemble torque converter ✓ Clean torque converter ✓ Fit torque converter housing bearings ✓ Fit turbine, one-way clutch stator, impeller into housing ✓ Check clearances ✓ Block all ports and clean cylinder ✓ Remove end caps ✓ Remove spring retaining clips ✓ Withdraw spool from valve block ✓ Remove seals from block ✓ Remove pressure relieve valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals and fit spool into valve block ✓ Fit springs, circlips, end caps and o pressure relief valve ✓ Test inlet/outlet valve ✓ Fit seal ring from converter to divider ✓ Fit planetary gear train ✓ Fit housing cover	➢ Impeller to stator clearance checked using plastic gauge in conjunction with micrometer as opposed to checking turning resistance ➢ Turbine to stator clearance, properly checked as above ➢ Turbine impeller, vanes and fins counted against specifications ➢ End float checked for stator adjusting as necessary ➢ Unit in assembled mode checked for smooth turning ➢ All seals replaced ➢ Planetary gears backlash checked ➢ Output shaft pre-loaded ➢ Needle bearings –planetary pin clearance hand checked ➢ Turning resistance checked		

		➢ Output shaft flange seal area checked for grooving and seal changed ➢ Output shaft pre-load checked ➢ Turning resistance checked ➢ Fit seals correctly		
B4: Remove automatic/ semi-automatic transmission	✓ Select suitable tools and equipment ✓ Clean work area ✓ Disconnect battery ✓ Disconnect propeller shaft ✓ Remove mounting bolts to rear axle / final drive ✓ Disconnect linkages and hydraulic pipes from pumps, body and filters ✓ Plug /cap open pipes/ports ✓ Put lifting equipment in position ✓ Lift out unit	➢ Correct use of tools and equipment ➢ Safety precautions adhered to ➢ Correct plugs/caps used to plug ports ➢ Correct positioning of lifting equipment observed		
B5: Overhaul transmission	✓ Select suitable tools ✓ Clean transmission ✓ Remove output flange ✓ Take off transmission housing bolts and remove transmission valve group ✓ Remove clutch pack and dismantle clutch pack ✓ Remove all seals and bearings	➢ Correct use of tools and equipment ➢ Safety precautions adhered to ➢ Correct disassembling procedure followed		

	✓ Take out separator plates and friction discs ✓ Remove piston from housing ✓ Remove all shafts ✓ Clean and visually inspect components for wear and damage ✓ **Assemble transmission** ✓ Replace piston seals and fit piston into clutch housing ✓ Replace all seals and bearings ✓ Fit friction and separator plates into clutch housing ✓ Fit pressure plates and retaining circlips ✓ Fit all shafts back ✓ Test clutch plate engagement using air pressure ✓ test transmission unit and adjust	➢ Inspect separator plates and friction discs for wear ➢ Ring gaps checked for metal rings ➢ Housing checked for wear ➢ Friction and separator plate thicknesses measured against specifications ➢ Clutches end play measured ➢ Shaft wear checked (seal ring areas) ➢ Seals and bearings fitted correctly		
B6: Replace clutch booster/air pack	✓ Select suitable tools ✓ Choke wheels ✓ Disconnect air pipes and hydraulic pipes ✓ Remove clutch air pack mounting bolts/booster ✓ Withdraw clutch air pack /booster ✓ Fit new clutch air pack/booster ✓ Fit cross member ✓ Fit propeller shaft ✓ Connect air pipes and hydraulic pipes	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Work done chronologically ➢ Work done within stipulated time		

	✓ Start vehicle ✓ Check operation ✓ Road test	➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications using torque		
B7: Repair clutch master cylinder/slave cylinder	✓ Select suitable tools ✓ Cover fenders ✓ Choke wheels ✓ Disconnect fluid pipes ✓ Remove clutch master cylinder mounting bolts ✓ Disconnect pushrod from clutch pedal ✓ Withdraw clutch master cylinder ✓ Remove reservoir ✓ Remove pushrod from clutch master cylinder ✓ Remove clutch slaver cylinder ✓ Disconnect pushrod from fork ✓ Remove piston seals and springs ✓ Clean and inspect components ✓ Replace defective components ✓ Fit new components ✓ Connect pushrod to clutch pedal ✓ Mount clutch master cylinder/slave cylinder	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Work done chronologically ➢ Work done within stipulated time ➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications using torque Wrench		

	✓ Connect fluid pipes ✓ Fill up reservoir ✓ Bleed and adjust clutch system ✓ Start vehicle ✓ Check operation ✓ Road test			
B8: Replace clutch cable	✓ Select suitable tools ✓ Cover fenders ✓ Choke wheels ✓ Disconnect battery ✓ Disconnect cable from clutch fork ✓ Disconnect cable from bell housing bracket ✓ Disconnect cable from clutch pedal ✓ Remove rubber glommet ✓ Withdraw cable ✓ Connect new clutch cable to clutch pedal ✓ Connect new clutch cable to fork. ✓ Tighten new clutch cable mounting brackets ✓ Check operation ✓ Adjust new cable ✓ Road test	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Work done chronologically ➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications using torque Wrench		
B9: Replace propeller shaft /universal joints/Centre bearing	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Clean work area ✓ Choke wheels	➢ Correct use of tools and equipment ➢ Battery earth terminal disconnected ➢ Work done chronologically		

	✓ Tag and lock out ✓ Raise one side of live axle ✓ Drain gearbox oil ✓ Indent match marks on flanges ✓ Disconnect propeller shaft from pinion and gearbox output shaft flange ✓ Remove centre bearing mounting bolts and bearing ✓ Withdraw propeller shaft assembly ✓ Remove retaining circlips ✓ Remove universal joints (UJs) ✓ Remove spiders ✓ Inspect all components ✓ Replace all worn and defective components ✓ Replace universal joints and retaining circlips ✓ Fit greasing nipples and grease shaft ✓ Slide propeller shaft assembly into gearbox and align to pinion flange ✓ Mount propeller shaft mounting bolts and nuts to final drive flange ✓ Secure centre bearing ✓ Fill gearbox oil ✓ Lower vehicle ✓ Connect batteries ✓ Remove tag and lock equipment ✓ Test run machine	➢ Work done within stipulated time ➢ Use of recommended cleaning solvents ➢ Correct alignment of propeller shaft ➢ Match marks on flanges aligned on assembling ➢ Correct replacement parts fitted ➢ Bolts tightened to manufacturer's specifications using torque Wrench ➢ Propeller shaft splines checked for wear ➢ Recommended grease used to grease shaft		

B10: Overhaul differential unit	✓ Select suitable tools and equipment ✓ Clean work area ✓ Choke wheels ✓ Disconnect battery /switch off master key ✓ Disconnect shaft from propeller flange ✓ Remove axle shaft splined to sun gears ✓ Remove differential assembly from banjo housing ✓ Punch mark bearing caps on differential cage ✓ Remove bearing caps ✓ Secure shims to corresponding caps ✓ Remove differential cage, planet gears ✓ Remove pinion flange nut and flange, sun gears and washer ✓ Remove pinion from housing ✓ Clean and inspect all components ✓ Replace all defective components ✓ Fit bearing on pinion shaft ✓ Install outer bearing race ✓ Install pinion into case /housing ✓ Pre-load pinion bearing ✓ Lock pinion nut ✓ Install sun gears and planet gears	➢ Correct use of tools and equipment ➢ Battery earth terminal disconnected ➢ Safety precautions adhered to ➢ Proper wheel chokes used ➢ Seal installed facing correct side ➢ Tooth contact pattern measured and adjusted to specifications ➢ Backlash is checked and adjusted ➢ Pinion gear depth is measured and adjusted ➢ Bearing pre-load is measured and adjusted according to manufacturer's specifications ➢ Centre bearing replaced ➢ Shim with chamfer facing gear side is fitted	▪ Tools and equipment use and handling ▪ Work hazards related to this duty ▪ Identification of components and their material science ▪ Operation and purpose of differential unit ▪ Fault diagnosis i.e defects, causes and rectification ▪ Measurements to be carried out on differential unit and procedures ▪ Adjustments procedure ▪ Dismantling and assembling procedures	

	✓ Install bearings on differential cage into housing ✓ Fit caps to mating surface and pre-load ✓ Check backlash and tooth contact pattern ✓ Fit differential assembly to banjo housing ✓ Fit axle shafts and road wheels ✓ Connect propeller shaft to pinion flange ✓ Fill differential with oil ✓ Connect batteries/switch on master key ✓ Remove wheel chokes ✓ Test machine	➢ Bearings fitted correctly onto pinion using hot oil bath or shaft shrunk using liquid nitrogen ➢ Oil coolant levels checked ➢ Engineers blue used to check tooth contact pattern ➢ Gears visually inspected for wear and chipping	▪ Inspection of components	
B11: Overhaul/ replace electric solenoids	✓ Select appropriate tools and equipment ✓ Disconnect solenoid connections ✓ Remove solenoid ✓ Test solenoid for functionality ✓ Replace solenoid seals ✓ Inspect return spring, wiring and plunger/solenoid ✓ Clean the valve body and connection	➢ A list of appropriate selected tools and equipment ➢ Disconnected solenoids ➢ New functional solenoids ➢ Cleaned valve body		
B12: Overhaul valve body	✓ Select appropriate tools and equipment ✓ Disconnect battery/ switch off master key	➢ A list of appropriate selected tools and equipment ➢ Disconnected battery		

	✓ Remove Valve body ✓ Clean valve body ✓ Strip valve body ✓ Check spools and valves ✓ Replace seals ✓ Inspect housing for damage ✓ Clean all components ✓ Assemble valve body ✓ Fit/Mount valve body ✓ Reconnect all necessary components ✓ Test run valve body and make necessary adjustments	➢ Clean valve body ➢ Functional valve body		
B13: Service or replace filtration system	✓ Select appropriate tools and equipment ✓ Disconnect battery/ switch off master key ✓ Choke wheels ✓ Tag and lockout ✓ Remove filters ✓ Drain oil ✓ Sent sample oil for analysis ✓ Remove and clean the screen ✓ Remove sump (where necessary) ✓ Cut and inspect the filter in half and inspect ✓ Inspect oil cooler ✓ Replace and reassemble necessary components ✓ Recharge transmission oil	➢ A list of appropriate selected tools and equipment ➢ Disconnected battery ➢ Drained oil ➢ New service components		➢

B14: Verify Transmission pressures	✓ Select appropriate tools and equipment ✓ Clean the whole machine ✓ Connect gauges before running the machine ✓ Start and note the measurements/ readings (Cold) ✓ Run machine to operating temperature ✓ Take note the measurements/ readings (Hot/ Maximum operating temperature) ✓ Analyze measurements / readings according to specifications	➢ A list of appropriate selected tools and equipment ➢ A completed checklist		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge

- Fire extinguisher Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE

CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: **DIESEL PLANT FITTING**	CLASS/LEVEL: NC

DUTY C: OVERHAUL ENGINE 15

Pre-requisites:	**Approval Date:**	**Review Date:**

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
C1: Remove engine	✓ Select suitable tools ✓ Choke wheels ✓ Disconnect battery ✓ Remove covers ✓ Drain engine oil ✓ Drain coolant ✓ Remove radiator hoses ✓ Remove radiator ✓ Disconnect all electrical connections ✓ Remove starter motor ✓ Remove hydraulic pipes ✓ Remove pneumatic pipes ✓ Disconnect all accessories ✓ Put lifting tackle in position ✓ Connect hoist ✓ Remove engine mounting bolts	-Correct use of tools and equipment ➢ -Battery earth terminal disconnected ➢ -All electrical connectors are safely disconnected ➢ -Work done within stipulated time ➢ -Engine oil and water drained in containers ➢ -All pipes to be blocked ➢ -Lifting position identified as stated in service manual	▪ -Tools and equipment handling and use ▪ -Repair standards ▪ Use of repair manuals ▪ -Occupational health and safety precautions ▪ -Simple dis-assembly of engines ▪ -Specification, types and principles of engines	○ Communication ○ Drawing ○ Reading and writing ○ Computers ○ Estimations ○ Measurements ○ Organizing ○ Planning ○ Analytical

	✓ Detach engine from other components ✓ Lift engine out ✓ Place engine on work-bench or stands	➢ -Engine removed within manufacturer's time specifications	▪ -Removal and installation of engines ▪ -Types of engines and their operation-4 stroke, 2 stroke etc ▪ -Engine components and their functions ▪ -Tools and equipment and correct usage ▪ -Engine faults, causes and rectification ▪ -Cooling system and components ▪ -Fuel and lubrication systems and components ▪ -Air induction systems for naturally aspirated and turbo charged engines ▪ -Turbo chargers and air cleaners	○ Numeracy
C2: Dismantle engine	✓ Select suitable tools ✓ Clean engine ✓ Remove clutch assembly/torque converter, flywheel and housing ✓ Remove hydraulic pumps and compressor and water pump ✓ Remove the following: - tappet cover - cylinder head - oil and fuel filters - high pressure pipes and injector pump - rocker shaft assembly and push-rods - timing cover - timing gear train - sump - oil strainer and pump - crankshaft balance weights ✓ Clean and dry all components ✓ Visually inspect all components	➢ -Correct use of tools and equipment ➢ -Correct cleaning solvents used ➢ -Provide for workplace cleanliness and orderliness ➢ -Ports blocked before engine is cleaned ➢ -Engine disassembled following manufacturer's specifications ➢ -Visual inspection carried out on all components ➢ -Correct loosening sequence followed in dismantling following components: rocker shaft, cylinder head and crankshaft ➢ -Big end bearing caps marked in relation to camshaft		

		➢ -Piston marked in relation to connecting rod ➢ -Main bearing cap marks indented to position on cylinder block ➢ -Crankshaft positioning observed	▪ -Engine related non-electric circuits like oil coolers and after coolers and related components ▪ -Measuring, adjustment, component and parts replacement ▪ -Testing of cooling systems, governors, fuel systems, lubrication systems ▪ -Air induction, turbo chargers, air cleaners, coolers and hydraulic systems ▪ -Dynamometer testing of engines	
C3: Inspect engine components	✓ Select suitable tools ✓ Clean engine ✓ Provide for workplace orderliness and cleanliness ✓ Visually inspect components ✓ Measure crankshaft journals ✓ Inspect connecting rod ✓ Measure cylinder block ✓ Inspect and measure piston, ✓ camshaft, cam followers, push rods and rocker shaft assembly	➢ -Correct use of tools and equipment ➢ -Correct cleaning solvents used ➢ -Clean and orderly workplace ➢ Crankshaft measured for – taper, ovality, run out and size ➢ Visual inspection of all components for physical wear and distortion as follows: ➢ Piston, Cam lobes, Cam followers, ➢ Push rods, Rocker shaft, arm bushes and heel, timing gears and bushes Crankshaft balancer,		

	✓ Inspect gear train, crankshaft balance, oil pump, water pump ✓ Replace seals ✓ Measure cylinder block ✓ Check core plugs ✓ Check piston, connecting rods, crankshaft, camshaft and oil pump	➢ -Oil pump housing, rotor, vane. ➢ -Water jackets and oil galleries ➢ for blockage, cracks and corrosion ➢ -Cylinder block measured for straightness ➢ -Damaged or loose core plugs replaced ➢ -Piston skirt measured for ovality and wear in relation to cylinder bore ➢ -Piston ring groove clearance measured against manufacturer's specification ➢ -Gudgeon pin piston clearance measured ➢ -Clearance between housing and rotor /gear measured against manufacturer's specification		

		➢ -Clearance between rotor and vane measured against manufacturer's specification ➢ -Clearance between driving and driven gear measured against manufacturer's specification ➢ -Oil pump bushes to shaft clearances measured against specifications ➢ -Condition of relief valve checked		
C4: Overhaul cylinder head	✓ Select suitable tools ✓ Provide for workplace cleanliness and orderliness ✓ Clean cylinder head ✓ Remove thermostat housing ✓ Remove injectors ✓ Mark valves ✓ Remove valve springs and valves ✓ Measure cylinder head thickness ✓ Check cylinder head warpage ✓ Test for cracks cylinder head ✓ Remove valve guides and valve seat ✓ Repair/replace defective valve guides and valves	➢ Correct use of tools and equipment ➢ Recommended cleaning solvents used ➢ Provide for workplace cleanliness and orderliness ➢ Valves marked at the centre of valve head in numerical sequence ➢ Valve guide stem clearance measured		

	✓ Cut valve seats ✓ Cut valve angle ✓ Lap valves, clean and assemble ✓ Carry out valve leakage test	➢ Valve collets checked for wear and replaced where necessary ➢ Valve springs measured for tension according to manufacturer's specification ➢ Valves checked for straightness, stem wear and land thickness ➢ Cylinder head thickness and warpage measured according to manual ➢ Valve angles cut according to manual ➢ Valve springs fitted correctly		
C5: Assemble engine	✓ Select suitable tools ✓ Clean and dry engine block ✓ Provide for workplace cleanliness and orderliness ✓ Fit new main bearings on block and caps and thrust washer ✓ Lay crankshaft into block ✓ Fit main bearing caps and connecting rod to piston ✓ Fit piston rings	➢ Timing marks noted on injector pump, crankshaft balancer and gear train ➢ Oil pump gasket /seal changed ➢ New sump gasket fitted ➢ Correct side noted		

	✓ Fit big end bearings, piston and connecting rod assembly to crankshaft ✓ Fit cam bushes, camshaft, cam followers and gear train ✓ Fit lift pump, injector pump, injectors and high-pressure pipes, back plate crankshaft balancer, oil pump, strainer, sump ✓ Carry out valve timing ✓ Fit idler gears, timing cover seal, timing cover and injector pump high pressure pipes ✓ Place cylinder head gasket ✓ Fit cylinder head, push rods and rocker shaft assembly ✓ Adjust valve clearances ✓ Fit tappet cover, crankshaft pulley, thermostat housing, water pump ✓ Fit oil and fuel filters ✓ Fill engine with oil ✓ Mount engine on dynamometer ✓ Fit starter motor and alternator ✓ Connect water hoses ✓ Connect all electrical connectors ✓ Start engine ✓ Check oil pressure ✓ Check oil leaks and water leaks ✓ Load engine	➢ Water jackets, oil galleries to align with gasket ➢ Tightening sequence followed as per service manual ➢ Bolt threads lubricated as per manual instruction ➢ Bolts tightened to manufacturer's specification following ➢ correct sequence ➢ Rocker arms adjusting screws loosened to Suitable tools and equipment used ➢ Cylinder liners pressed out ➢ Liner bore diameter and protrusion checked against manual specifications ➢ Safety precautions observed ➢ Position of oil galleries and lugs observed		

	✓ Check load appreciation ✓ Run in engine ✓ Re-torque engine ✓ Remove engine from dynamometer	➢ Crankshaft end-float measured i.e correct size thrust washer fitted ➢ Correct size main bearings fitted ➢ Thrust size noted when fitting pistons to connecting rod ➢ Bearing nip/crush checked ➢ Oil clearances checked ➢ Piston rings position noted ➢ Piston ring clearances and working gaps measured against specifications ➢ Piston rings staggered ➢ Bearing crush /nip checked ➢ Oil clearances measured on big end bearings ➢ Position of cam bushes holes in relation to oil galleries noted ➢ prevent bending of push rods		

		➢ Valve clearance adjusting sequence observed and adjusted according to manual specifications ➢ New rocker cover gasket fitted and tightening sequence observed ➢ Thermostat housing and cylinder head surfaces are cleaned ➢ New thermostat housing gasket fitted ➢ New water pump gasket fitted ➢ Fuel filter filled with fuel ➢ Oil and fuel filter seals lubricated ➢ Bolts tightened to specified torque. ➢ Injectors checked for correct spray pattern ➢ Injector pump timed		

C6: Overhaul water pump	✓ Select suitable tools ✓ Clean work area ✓ Remove drive pulley, flange, bearing securing circlip and impeller cover ✓ Press out spindle shaft, spindle and bearings from impeller side ✓ Clean and inspect housing, spindle and bearings ✓ Replace seal ✓ Replace bearing and retaining circlip ✓ Fit impeller and cover ✓ Fit flange and drive pulley ✓ Test water pump for functionality	➢ Suitable tools and equipment selected ➢ Working area clean and free of dust ➢ Recommended cleaning solvent used ➢ All bolts tightened to specified torque ➢ Seal fitted without damage and facing correct side ➢ Running surfaces of impeller and mechanical seal in contact ➢ Impeller clearances measured against specifications		
C7: Overhaul turbo charger	✓ Select tools and equipment ✓ Remove turbine and impeller ✓ Remove shaft retaining circlip ✓ Press out shaft from cartridge ✓ Remove seals and bearings ✓ Clean and inspect components ✓ Fit bearings ✓ Press in shaft ✓ Fit seals and shaft retaining circlip ✓ Fit impeller and turbine	➢ Suitable tools and equipment selected ➢ All bolts tightened to specified torque ➢ Safety precautions observed ➢ Shaft checked for straightness		

	✓ Fit impeller and turbine housing ✓ Test for smooth running	➢ Housings checked for wear and damage ➢ Impeller and turbine clearance measured against specifications		
C8: Overhaul injector pump	✓ Select suitable tools ✓ Provide workplace cleanliness and orderliness ✓ Remove delivery valves and mark ✓ Removing pumping elements, remove rack, pump camshaft and governor assembly ✓ Clean and inspect components ✓ Replace defective components ✓ Fit pump camshaft and rack ✓ Place pumping elements ✓ Fit delivery valve and governor assembly ✓ Test injector pump	➢ Correct use of tools and equipment ➢ Recommended cleaning solvents used ➢ Provide for workplace cleanliness and orderliness ➢ Safety precautions adhered to ➢ A mighty marker is used in marking delivery valves and pumping elements ➢ Delivery valve spring tension checked against specifications ➢ Pumping elements and delivery valves fitted to original position ➢ Pump calibration and phasing done		
C9: Overhaul injector	✓ Select suitable tools	➢ Correct use of tools		

	✓ Provide workplace cleanliness and orderliness ✓ Remove injector nozzle body, injector nozzle, injector spring, disc and needle valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit needle valve into nozzle ✓ Fit disc, injector spring, adjuster and injector nozzle body ✓ Test and adjust injector	➢ Safety precautions adhered to ➢ Clean workplace free of dust ➢ Proper sitting of needle valve noted ➢ Injector spring tension checked against specifications ➢ Spray pattern, breaking pressure, dribbling and leak off tests done to specifications		
C10: Fit engine	✓ Select suitable tools ✓ Clean working area ✓ Fit lifting equipment ✓ Mount all accessories to engine ✓ Fit engine mountings ✓ Lower engine onto mountings ✓ Fit radiator, hoses, alternator and starter motor, electrical connections, hydraulic and transmission pipes ✓ Fill radiator with coolant ✓ Fill oil and Check oil levels ✓ Connect battery ✓ Bleed fuel system ✓ Switch on master switch ✓ Start and run engine	➢ Correct use and handling of tools and equipment ➢ Lifting equipment fitted to correct positions when fitting engine ➢ All bolts tightened to specified torque ➢ Engine mountings replaced ➢ recommended oils and coolants used		

	✓ Fit covers			
C11: Overhaul oil pump	✓ Select appropriate tools and equipment ✓ Strip oil pump ✓ Clean parts ✓ Check oil pump housing for damages ✓ Check gears ✓ Check relief valve (Plunger/Spring) ✓ Check bearings and shaft ✓ Reassemble oil pump ✓ Verify relevant clearance ✓ Check gear end float	➢ List of appropriate tools and equipment ➢ Clean stripped oil pump parts ➢ Clean assembled oil pump ➢		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Fire extinguisher

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures
- Engine to be tightly secured before lifting

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY D: HYDRAULIC SYSTEM 5

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
D1: Overhaul fixed displacement hydraulic pump	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Mark mating surfaces ✓ Remove bolts clamping front and back plates to housing ✓ Remove thrust plates ✓ Remove seals, bushes/ bearings and gears from housing ✓ Clean, dry and inspect components ✓ Fit seals ✓ Replace defective components ✓ Fit bushes/ bearings ✓ Fit gears to back plate ✓ Fit thrust plate	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Bushes measured for wear against specifications ➢ Clearance between housing and gear measured against manufacturer's specification ➢ Clearance between driving and driven gear measured against manufacturer's specification	▪ hydraulic systems applications ▪ Ratings ▪ Operation of hydraulic systems and specifications ▪ Measurement and adjustment ▪ Removal and installation of hydraulic components	o Communication o Drawing o Reading and writing o Computers o Estimations o Measurements o Organizing o Planning o Analytical

	✓ Fit gear housing and other thrust plate ✓ Fit front plate ✓ Test hydraulic pump	➢ Hydraulic pump bushes to shaft clearances measured against specifications		○ Numeracy ○ driving
D2: Overhaul variable displacement hydraulic pump	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean motor ✓ Mark mating surfaces ✓ Remove cap screws ✓ Separate housings ✓ Remove seals, bearings from housings ✓ Remove piston cartridge assembly from housing and shaft ✓ Remove swash plate from housing ✓ Clean, dry and inspect components ✓ Replace defective components ✓ Fit bearings and seals into housing ✓ Fit swash plate into housing ✓ Fit piston cartridge assembly onto shaft then into housing ✓ Fit back housings	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Piston cartridge assembly clearances measured against specifications		

	✓ Test hydraulic pump			
D3: Overhaul hydraulic motor	✓ Select suitable tools ✓ Observe safety precautions ✓ Block all ports and clean motor ✓ Clean workplace ✓ Mark mating surfaces ✓ Remove cap screws ✓ Remove/separate front and back covers from housing ✓ Remove shaft and rotor assembly from housing ✓ Remove bearings and seals from housings ✓ Clean, dry and inspect components ✓ Replace defective components ✓ Fit bearings and seals into housing ✓ Fit shaft and rotor assembly into housing ✓ Fit front and back covers to housing ✓ Test hydraulic motor	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Vane /rotor clearance measured ➢ Rotor /housing clearance checked ➢ Vane spring tension measured		
D4: Overhaul hydraulic cylinder	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust		

	✓ Block all ports and clean cylinder ✓ Remove gland securing mechanism ✓ Withdraw rod and piston assembly from barrel ✓ Remove piston assembly from cylinder rod ✓ Remove gland nut from cylinder rod ✓ Remove seals from piston, eyes and gland nut ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals onto gland nut, eyes and piston assembly ✓ Fit gland nut and piston onto cylinder rod ✓ Fit piston and rod assembly into barrel ✓ Fit gland securing mechanism ✓ Test hydraulic cylinder	➢ Safety precautions adherence ➢ Use of correct plugs/caps on ports ➢ Lateral/longitudinal wear on barrel, piston, and rod noted ➢ Positioning of seals noted ➢ Piston and barrel clearance measured against manual specifications ➢ Bolts and nuts tightened to specifications		
D5: Overhaul hydraulic control valve	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean cylinder ✓ Remove end caps	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence		

	✓ Remove spring retaining clips ✓ Withdraw spool from valve block ✓ Remove seals from block ✓ Remove pressure relieve valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals spool into valve block ✓ Fit springs, circlips, end caps and pressure relief valve ✓ Test control valve	➢ Spool inspected for wear ➢ Valve block bore diameter measured ➢ Pressure relief valve seat and spring checked ➢ Pressure setting procedure followed as per specifications		
D6: Overhaul signaling systems	✓ Select appropriate tools and equipment ✓ Connect gauge from main signal distribution ✓ Start machine ✓ Activate implement ✓ Check pilot pressure and note reading ✓ Run machine to operating temperature ✓ Record pressure ✓ Analyse pressure readings	➢ List of appropriate tools and equipment ➢ Connected gauge ➢ Running machine ➢ Table of Pressure readings ➢		
D7: Inspect electronic control system	✓ Select appropriate tools and equipment ✓ Plug in diagnostic machine	➢ List of appropriate tools and equipment ➢ Plugged diagnostic machine		

	✓ Run the engine ✓ Note displayed fault codes ✓ Interpret /Analyse fault codes ✓ Repair detected faults	➢ Running engine ➢ Repaired electronic control system		
D8: Inspect Swing Motor	✓ Select appropriate tools and equipment ✓ Connect gauge ✓ Activate rotation ✓ Record pressure for both directions ✓ Analyse recorded pressure	➢ List of appropriate tools and equipment ➢ Connected gauge ➢ Pressure readings presented		
D9: Inspect reservoir	✓ Select appropriate tools and equipment ✓ Drain all the Oil ✓ Check drain valves where necessary ✓ Remove hydraulic filter ✓ Remove sieve / primary filter and clean ✓ Inspect reservoir condition ✓ Inspect reservoir for debris ✓ Clean and replace drain plug seal ✓ Send oil sample for analysis	➢ List of appropriate tools and equipment ➢ Empty oil reservoir ➢ Removed valves, hydraulic filter ➢ Cleaned reservoir ➢ Oil samples ➢ Running recharged machine		

	✓ Assess inspection glass condition ✓ Recharge the oil ✓ Run machine and check oil level			

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Fire extinguisher

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control

- Types of fires, fire extinguishers and operating procedures
- Hydraulic components must be assembled in a dust free area
- Components must be handled with care to avoid damage
- Avoid skin contact with oils under pressure

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY E: MAINTAIN UNDER-CARRIAGE SYSTEM 10

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
E1: Remove and install tracks	✓ Select suitable tools ✓ Observe safety precautions ✓ Clear workplace ✓ Identify position of master link/master pin ✓ Move master link/pin to accessible position ✓ De-adjust /release track tension ✓ Remove master link bolts/press out master pin ✓ Move machine to and fro to layout tracks ✓ Raise machine and pull out tracks ✓ Clean, dry and inspect tracks ✓ Replace/repair defective components	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Identification of master link/pin ➢ Identification of tension release valve ➢ Track tension released effectively ➢ Safety stands used to secure machine ➢ Tracks to face correct way ➢ Tracks tensioned to manufacturer's specifications	▪ Identification of components ▪ Function of each and every component ▪ Operation of tracks and track frames ▪ Different types of suspensions and operation ▪ Knowledge of the construction and operation of Track Type Tractors, Wheeled loaders, Scrappers,	o Communication o Drawing o Reading and writing o Computers o Estimations o Measurements o Driving o Numeracy

	✓ Layout / position tracks under machine with sprocket side raised on block or roller ✓ Lower the machine onto tracks ✓ Connect one track link into sprocket tooth ✓ Use machine drive to pick up and move track into position ✓ Fit master link /pin into place ✓ Grease track adjuster to tension tracks to manufacturer's specifications ✓ Test track operation	-	Graders and Dump trucks ▪ Construction and operation of an undercarriage ▪ Construction and operation of Track-type tractor final drive and types of sprockets. ▪ layout, construction and operation of hydraulic system ▪ Types of steering and operation ▪ Types of control valves, operation and application	
E2: Remove and install track frame	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Remove tracks ✓ Put lifting equipment in place to suspend track frame ✓ Remove track frame from machine ✓ Remove track idler from track frame ✓ Remove carrier rollers ✓ Remove load rollers ✓ Remove track adjuster ✓ Visually check for wear and damage ✓ Remove cir-clips ✓ Push out shaft ✓ Remove bearings ✓ Clean and inspect components	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence		

	✓ Replace defective components ✓ Fit bearings ✓ Fit shaft ✓ Fit cir-clips			
E3: Overhaul track adjuster	✓ Select suitable tools ✓ Observe safety precautions ✓ Block all ports and clean motor ✓ Clean workplace ✓ Remove gland securing mechanism ✓ Withdraw rod and piston assembly from barrel ✓ Remove piston assembly from cylinder rod ✓ Remove gland nut from cylinder rod ✓ Remove seals from piston, eyes and gland nut ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals onto gland nut, eyes and piston assembly ✓ Fit gland nut and piston onto cylinder rod ✓ Fit piston and rod assembly into barrel ✓ Fit gland securing mechanism ✓ Fit duo cover seals on sprocket ✓ Press socket onto dead shaft ✓ Fit track adjuster on track frame	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Use of correct plugs/caps ➢ Proper positioning of lifting equipment ➢ Measurements done to ascertain degree of wear ➢ Sprocket segments and splines checked for wear ➢ All seals replaced		

	✓ Fit load rollers ✓ Fit carrier rollers ✓ Fit track idler ✓ Install track frame onto machine ✓ Install tracks onto machine			
E4: Overhaul / Inspect hydraulic cylinder and Idler Wheel	✓ Select suitable tools and equipment ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean cylinder ✓ Remove gland securing mechanism ✓ Withdraw rod and piston assembly from barrel ✓ Remove piston assembly from cylinder rod ✓ Remove gland nut from cylinder rod ✓ Remove seals from piston, eyes and gland nut ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals onto gland nut, eyes and piston assembly ✓ Fit gland nut and piston onto cylinder rod ✓ Fit piston and rod assembly into barrel ✓ Fit gland securing mechanism ✓ Test hydraulic cylinder ✓ Inspect coil spring	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Use of correct plugs/caps on ports ➢ Lateral/longitudinal wear on barrel, piston, and rod noted ➢ Positioning of seals noted ➢ Piston and barrel clearance measured against manual specifications ➢ Bolts and nuts tightened to specifications		

	✓ Remove and check the idler bearings and shaft ✓ Measure guide thickness/land			
E5: Overhaul hydraulic control valve	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean cylinder ✓ Remove end caps ✓ Remove spring retaining clips ✓ Withdraw spool from valve block ✓ Remove seals from block ✓ Remove pressure relieve valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals on valve block ✓ Fit spool into valve block ✓ Fit springs and circlips ✓ Fit end caps ✓ Fit pressure relief valve ✓ Test control valve	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Spool inspected for wear ➢ Valve block bore diameter measured ➢ Pressure relief valve seat and spring checked ➢ Pressure setting procedure followed as per specifications		
E6: Overhaul steering control valve	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean cylinder ✓ Remove end caps ✓ Remove spring retaining clips	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence		

	✓ Withdraw spool from valve block ✓ Remove seals from block ✓ Remove pressure relieve valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals on valve block ✓ Fit spool into valve block ✓ Fit springs and circlips ✓ Fit end caps ✓ Fit pressure relief valve ✓ Test control valve	➢ Spool inspected for wear ➢ Valve block bore diameter measured ➢ Pressure relief valve seat and spring checked ➢ Pressure setting procedure followed as per specifications		
E7: Inspect rollers and hangers	✓ Select appropriate tools and equipment ✓ Jack the machine ✓ Run the machine ✓ Observe running machine for excessive play, leakage and noise ✓ Measure guide thickness/land ✓ Replace/ repair faulty roller/hangers ✓ Fit back all components ✓ Test run the machine	➢ List of appropriate tools and equipment ➢ Jacked machine ➢ Running machine ➢ Table of thickness of rollers, and hangers ➢ Repaired machine		

E8: Inspect sprokets	✓ Select appropriate tools and equipment ✓ Measure sprocket teeth ✓ Replace worn out sprocket and belts ✓ Test run the replaced sprocket	➢ List of appropriate tools and equipment ➢ Table of sprocket teeth measurements ➢ Replaced sprocket		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Fire extinguisher

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control

- Types of fires, fire extinguishers and operating procedures
- Recommended lifting equipment to be used

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY F: OVERHAUL BRAKING SYSTEMS 5

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
F1: Replace brake booster	✓ Select tools and equipment ✓ Choke wheels ✓ Disconnect battery ✓ Detach master cylinder ✓ Disconnect vacuum pipe and pedal connections ✓ Remove mounting bolts ✓ Mount new booster ✓ Connect pedal connections and vacuum pipe ✓ Mount master cylinder ✓ Connect battery ✓ Start engine ✓ Test booster operation	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Push-rod adjusted to specifications ➢ Work done chronologically ➢ Work done within stipulated time ➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications using torque	▪ Material science ▪ Types of braking systems, operation; service and repair ▪ Hydraulics ▪ Types of brake fluids and oils -Use knowledge of Hydraulic and -Mechanical hand and foot brakes ▪ Functions of the braking systems:	○ Communication ○ Drawing ○ Reading and writing ○ Computers ○ Estimations ○ Measurements ○ Organizing ○ Planning ○ Analytical

		➢ Wrench	▪ Mechanical. ▪ Hydraulic. ▪ Pneumatic. ▪ operation of master cylinders: ▪ hand-brake mechanism, brake faults: ▪ materials used as brake friction -material and the reasons for their selection. ▪ the principle operation of an air braking system. ▪ components of a basic air braking system. ▪ braking system ▪ components: ▪ Hand control valve.	o Numeracy
F2: Overhaul brake master cylinder	✓ Select appropriate tools and equipment ✓ Choke wheels ✓ Cover vehicle fenders ✓ Disconnect battery and electrical connections on master cylinder ✓ Disconnect pipes ✓ Remove master cylinder ✓ Empty brake fluid ✓ Dismantle master cylinder ✓ Inspect components ✓ Replace defective components ✓ Reassemble master cylinder ✓ Bench test master cylinder ✓ Fit master cylinder, pipes, and electrical connections ✓ Fill up master cylinder ✓ Bleed system ✓ Connect battery ✓ Remove fender covers and wheel chokes ✓ Road test vehicle	➢ Battery negative terminal disconnected ➢ Vehicle fenders covered ➢ Work-bench is cleaned and free of dust ➢ Correct use of tools done ➢ Master cylinder dismantled according to manufacturer's specifications ➢ Visual inspection carried to check for scoring and wear in bore ➢ Defective parts are identified ➢ Correct replacement parts fitted ➢ Master cylinder assembled according to manufacturer's specifications ➢ Safety precautions to be observed when disconnecting electrical connections		

		➢ Brake fluid handling precautions observed ➢ Appropriate type of fluid is used ➢ Pedal travel and clearance measured ➢ Hydraulic system to be rid of air after bleeding ➢ -Water used to clean brake components	▪ operation and layout of: ▪ Spring brake system. ▪ service procedure for air braking systems. ▪ The construction and operation of engine brakes. ▪ Operation of the Exhaust Braking System.	
F3: Replace Anti-lock Braking system (ABS)	✓ Select appropriate tools and equipment ✓ Choke wheels and cover vehicle fenders ✓ Disconnect battery, electrical connections and fluid pipes ✓ Remove mounting bolts and withdraw ABS unit ✓ Fit fluid pipes ✓ Fill reservoir ✓ Connect electrical connections ✓ Connect battery ✓ Start vehicle ✓ Test ABS operation	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Safety precautions to be observed when disconnecting/connecting electrical connections ➢ Correct ABS unit fitted ➢ Brake fluid handling precautions observed		

	✓ Remove fender covers and wheel chokes	➢ Reservoir filled with correct type of brake fluid ➢ ABS unit tested		
F4: Replace brake discs /pads	✓ Select tools and equipment ✓ Loosen wheel nuts ✓ Jack vehicle ✓ Fit stands ✓ Remove wheels and disconnect electrical connections ✓ Remove brake caliper, caliper bracket and ✓ wheel hub where integral ✓ Remove disc ✓ Fit new disc ✓ Clean and inspect wheel bearings ✓ Grease wheel bearings ✓ Fit bearings, hub ✓ Pre-load bearings ✓ Fit caliper bracket, new brake pads, brake caliper and electrical connections ✓ Check for operation ✓ Fit wheels and torque ✓ Jack vehicle and remove stands ✓ Road test vehicle	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected ➢ Safety precautions to be observed when disconnecting/connecting electrical connections ➢ Safety precautions observed on lifting vehicle ➢ Dismantling of caliper, hub and disc done according to manufacturer's specifications. ➢ Wheel bearings inspected to check for wear and scoring ➢ Bearing grease used ➢ Bearings pre-loaded to manufacturer's specifications		

		➢ Bolts tightened to manufacturer's specifications using a torque wrench ➢ Correct parts fitted ➢ New discs fitted ➢ Manufacturer's assembling procedure followed ➢ Wheels tightened to manufacturer's specifications using a torque wrench		
F5: Overhaul brake caliper	✓ Select tools and equipment ✓ Loosen wheel nuts ✓ Jack vehicle ✓ Place vehicle on stands ✓ Remove wheels, electrical connections, flexible hose/pipe, caliper and pads ✓ Dismantle caliper ✓ Clean components ✓ Inspect components ✓ Replace defective parts ✓ Assemble caliper ✓ Fit caliper, pads, brake pipe and electrical connections ✓ Fill reservoir	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Safety precautions to be observed when disconnecting/connecting electrical connections ➢ Cleaning of components is done using water ➢ Caliper bore is measured and compared with manufacturer's specifications		

	✓ Bleed brakes ✓ Check operation ✓ Fit wheels ✓ Jack and remove stands ✓ Road test vehicle	➢ Correct replacement seals are used ➢ Reassembling is done according to manufacturer's specification ➢ Road regulations adhered to during road test. ➢ Hydraulic system to be rid of air after bleeding		
F6: Replace brake shoe assembly and brake drum	✓ Select tools and equipment ✓ Loosen wheel nuts ✓ Jack vehicle ✓ Place vehicle on stands ✓ Remove wheels ✓ Release park brake ✓ Remove drum retainers, drum, shoe return springs and adjuster mechanism ✓ Disconnect park brake cable ✓ Connect park brake cable to new shoes ✓ Fit shoe retainers, adjuster mechanism and shoe return springs ✓ Adjust shoes ✓ Fit new drum and drum retainers	➢ Correct use of tools and equipment ➢ No fluid spilled on body paint ➢ Vehicle secured on chassis stands ➢ Correct type of brake fluid used ➢ Brakes bled until no air bubbles appear in fluid ➢ All pipes connected without stripping threads ➢ All bolts are tightened to specified torque		

	✓ Check operation ✓ Fit wheels ✓ Jack and remove stands ✓ Road test vehicle			
F7: Replace load sensing valve	✓ Select appropriate tools and equipment ✓ Jack and put vehicle on stands ✓ Disconnect and inspect brake fluid pipes ✓ Remove mounting bolts ✓ Fit new load sensing valve ✓ Connect brake pipes ✓ Fill reservoir with brake fluid ✓ Bleed brakes ✓ Check operation ✓ Road test vehicle	➢ Correct use of tools and equipment used ➢ No fluid spilled on body paint ➢ Vehicle secured on chassis stands ➢ Correct type of brake fluid used ➢ Brakes bled until no air bubbles appear in fluid ➢ All pipes connected without stripping threads ➢ Load sensing valve connected according to manufacturer's specifications ➢ All bolts are tightened to specified torque		
F8: Replace retarder	✓ Select appropriate tools and equipment ✓ Choke wheels ✓ Disconnect electrical connections ✓ Remove mounting brackets	➢ Use of correct tools ➢ Battery earth terminal disconnected ➢ Loosening sequence observed		

	✓ Remove retarder ✓ Fit new retarder and gaskets ✓ Fit brackets ✓ Connect electrical connections ✓ Start vehicle ✓ Check retarder operation			
F9: Overhaul wheel cylinder/park brake assembly	✓ Select appropriate tools and equipment ✓ Loosen wheel nuts ✓ Jack vehicle ✓ Place vehicle on stands ✓ Remove wheels ✓ Release park brake ✓ Remove drum retainers, drum, shoe return springs and adjuster mechanism ✓ Disconnect and inspect park brake assembly and park brake cable ✓ Disconnect brake pipes ✓ Dismantle wheel cylinder ✓ Clean and inspect components ✓ Replace defective components ✓ Assemble wheel cylinder ✓ Fit wheel cylinder ✓ Connect park brake cable to new shoes	➢ -Use of correct tools and equipment used ➢ -Battery earth terminal disconnected first ➢ -Danger warning on spring noted ➢ -Loosening sequence observed ➢ -Order of friction discs and separator plates noted ➢ -Thickness of friction discs and separator plates measured against specifications ➢ -Piston thickness measured ➢ -Brakes end play checked ➢ -Releasing of brakes ascertained ➢ -Drum checked for scoring		

	✓ Fit shoe retainers, shoe return springs and adjuster mechanism ✓ Adjust shoes ✓ Fit new drum and drum retainers ✓ Bleed brakes ✓ Check operation			
F10: Repair compressor	✓ Select tools and equipment ✓ Disconnect battery ✓ Disconnect water, oil and air pipes ✓ Remove compressor ✓ Clean compressor ✓ Disassemble compressor ✓ Clean components ✓ Inspect components ✓ Replace defective components ✓ Assemble compressor ✓ Mount compressor ✓ Connect water and oil pipes ✓ Connect battery and start engine ✓ Connect air pipes ✓ Test for operation	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected first ➢ Loosening sequence observed ➢ Brakes end play checked ➢ Operation of brakes ascertained ➢ Recommended cleaning solvents used ➢ Air and oil leaks checked		
F11: Overhaul spring applied hydraulic released brakes	✓ Select tools and equipment ✓ Disconnect battery ✓ Disconnect oil pipe ✓ Clean component after plugging oil port	➢ Use of correct tools and equipment		

(S.A.H.R)/hydraulic applied spring released	✓ Loosen securing bolts ✓ Take out brake assembly cover ✓ Take out separator and friction plates ✓ Take out piston ✓ Clean and inspect components ✓ Replace defective components ✓ Change piston seals ✓ Refit all components and fit back cover ✓ Test brakes	➢ Battery earth terminal disconnected first ➢ Danger warning on spring noted ➢ Loosening sequence observed ➢ Order of friction discs and separator plates noted ➢ Thickness of friction discs and separator plates measured against specifications ➢ Piston thickness measured ➢ Brakes end play checked ➢ Releasing of brakes ascertained		
F12: Replace brake foot valve	✓ Select appropriate tools and equipment ✓ Disconnect air pipes ✓ Disconnect electrical connections ✓ Remove mounting bolts ✓ Withdraw foot valve ✓ Connect air pipes ✓ Connect electrical connections ✓ Start engine	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected first ➢ Danger warning on spring noted ➢ Loosening sequence observed ➢ Brakes end play checked ➢ Releasing of brakes ascertained		

F13: Replace slack adjuster	✓ Select appropriate tools and equipment ✓ Block wheels ✓ Start engine ✓ Check pressure ✓ Switch off engine ✓ Disconnect slack adjuster from push-rod ✓ Remove slack adjuster retaining circlip ✓ Withdraw the slack adjuster ✓ Fit slack adjuster retaining circlip ✓ Connect slack adjuster to push rod ✓ Adjust brakes ✓ Test brakes	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected first ➢ Danger warning on spring noted ➢ Loosening sequence observed ➢ Brakes end play checked ➢ Releasing of brakes ascertained ➢ Brakes adjusted to specifications		
F14: Replace brake chamber	✓ Select appropriate tools and equipment ✓ Block wheels ✓ Start engine ✓ Check pressure ✓ Switch off engine ✓ Cage brake chamber	➢ Use of correct tools ➢ Battery earth terminal disconnected ➢ Loosening sequence followed ➢ Brakes end play checked		

	✓ Disconnect slack adjuster from push-rod ✓ Remove mounting bolts and nuts ✓ Withdraw brake chamber ✓ Mount new brake chamber ✓ Connect air pipes ✓ Start engine ✓ Check pressure ✓ Switch off engine ✓ Check operation ✓ Connect slack adjuster to push rod ✓ Adjust brakes ✓ Road test vehicle	➢ Releasing of brakes ascertained		
F15: Replace brake pneumatic governor	✓ Select appropriate tools and equipment ✓ Disconnect electrical connections ✓ Disconnect air pipes ✓ Remove mounting bolts ✓ Remove brake pneumatic governor ✓ Fit new pneumatic governor ✓ Connect air pipes ✓ Connect electrical connections ✓ Start engine ✓ Check pressure	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected ➢ Danger warning on spring noted ➢ Loosening sequence observed ➢ Releasing of brakes ascertained ➢ Air pipes checked for leaks		

	✓ Check operation			
F16: Replace quick release valve	✓ Select appropriate tools and equipment ✓ Disconnect air pipes ✓ Remove mounting bolts ✓ Remove quick release valve ✓ Fit new quick release valve ✓ Connect air pipes ✓ Start engine ✓ Check pressure ✓ Check operation	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected first ➢ Brakes end play checked ➢ Releasing of brakes ascertained		
F17: Replace 'S' cam shaft	✓ Select tools and equipment ✓ Choke wheels ✓ Loosen wheel nuts ✓ Jack vehicle and put on stands ✓ Remove wheels ✓ Remove wheel drum ✓ Remove shoe assembly ✓ Disconnect slack adjuster from push rod ✓ Remove slack adjuster retaining circlip ✓ Withdraw slack adjuster ✓ Withdraw 'S' camshaft ✓ Clean and inspect bushes and seals ✓ Replace defective components ✓ Grease bushes	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected first ➢ Danger warning on spring noted ➢ Loosening sequence observed ➢ Order of friction discs and separator plates noted ➢ Thickness of friction discs and separator plates measured against specifications ➢ Piston thickness measured		

	✓ Fit new 's' camshaft ✓ Fit shoe assembly ✓ Fit slack adjuster and retaining circlip ✓ Connect slack adjuster to push-rod ✓ Fit wheel drum ✓ Adjust brakes ✓ Test operation ✓ Fit wheels ✓ Jack vehicle and remove stands ✓ Remove wheel chokes ✓ Road test vehicle	➢ Brakes end play checked ➢ Releasing of brakes ascertained ➢ Defective components are replaced		
F18: Replace vacuum pump	✓ Select appropriate tools and equipment ✓ Choke wheels ✓ Disconnect battery ✓ Disconnect vacuum hoses ✓ Remove mounting bolts ✓ Withdraw vacuum pump ✓ Fit new vacuum pump ✓ Connect vacuum hoses ✓ Connect battery and start engine ✓ Check operation ✓ Road test vehicle	➢ Use of correct tools and equipment ➢ Battery earth terminal disconnected ➢ Releasing of brakes ascertained		
F19: Adjust brakes	✓ Select appropriate tools and equipment ✓ Loosen wheel nuts ✓ Jack vehicle and put on stands	➢ Use of correct tools and equipment		

	✓ Release handbrake ✓ Remove wheels ✓ Remove drum retaining screws and drums ✓ Clean components ✓ Inspect components ✓ Replace defective components ✓ Fit drums and drum retainers ✓ Fit wheels ✓ Jack vehicle and remove chassis stands ✓ Road test vehicle	➢ Battery earth terminal disconnected ➢ Adjusting sequence observed ➢ Brakes end play checked ➢ Releasing of brakes ascertained		
F20: Bleed brakes	✓ Select tools and equipment ✓ Choke wheels ✓ Start engine ✓ Fill reservoir ✓ Bleed master cylinder ✓ Fit transparent hose to bleeding nipple of furthest wheel from master cylinder ✓ Immerse one end of hose into a half filled transparent container. ✓ Depress pedal a few times and hold in depressed position ✓ Loosen bleeding nipple, allow brake fluid to drain and observe air bubbles.	➢ Use of correct tools and equipment ➢ Bleeding sequence observed ➢ Order of friction discs and separator plates noted ➢ Brakes end play checked ➢ Releasing of brakes ascertained ➢ Brakes bled until bubble free		

	✓ Re-tighten bleeding screw and repeat process until no air bubbles are observed ✓ Check and maintain fluid level ✓ Repeat process on other wheels ending with wheel nearest master cylinder ✓ Remove wheel chokes. ✓ Road test vehicle			
F21: Overhaul hydraulic oil braking system	✓ Select appropriate tools and equipment ✓ Connect gauge to the OBS regulator ✓ Start machine ✓ Record pressures ✓ Engage the brakes ✓ Take note pressures to specifications ✓ Jack machine ✓ Engage in gear ✓ Depress brakes ✓ Analyse pressures and rectify where necessary ✓ Take note wheels should stop ✓ Observe any noise ✓ Drain axle oil ✓ Remove axle ✓ Strip trumpet housings ✓ Check friction discs and plates	➢ List of appropriate tools and equipment ➢ Running machine ➢ Record of pressure ➢ Jacked machine ➢ Drained axle oil ➢ Replaced replaceable ➢ Functional braking system		

	✓ Check hydraulic piston and seal ✓ Clean and replace all faulty or worn out components ✓ Fit back all components ✓ Charge oil			

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Injector tester
- Standard tool box
- Dial indicator gauge
- Brake adjusters
- Steam cleaner

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays
Scrappers, files, centre punches,
Overhead crane and lifts
Parts catalogue
Hydraulic press/ puller
Fire extinguisher
circlip pliers

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business

- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures
- Avoid splashing brake fluid on paint or body of machine

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY G:PLANNED MAINTENANCE 10

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
G 1. Perform daily checks (Routine)	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Tag and lock out ✓ Check oil and coolant levels. ✓ Check batteries ✓ Check air cleaner indicator ✓ Check wheels or tracks ✓ Check for leaks ✓ Check V-belts ✓ Check all electrical and hooter ✓ Perform walk around inspection ✓ Grease machine	➢ Suitable tools and equipment selected ➢ Battery earth terminal disconnected first ➢ Battery checked for leaks ➢ Vee belts checked for cracks ➢ Recommended grease used ➢ Tyre pressures checked and inflated to specifications	▪ Different types of coolants ▪ Battery care and maintenance ▪ Material science ▪ Use, care and storage of tools and equipment ▪ Different types of oils, properties and use ▪ Basic auto electrics	o Communication o Drawing o Reading and writing o Computers o Estimations o Measurements o Drawing

G2: Perform 250-hour service (Minor)	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Tag and lock out ✓ Check coolant levels ✓ Change oil and oil filter ✓ Check batteries ✓ Check air cleaner indicator ✓ Blow air cleaner element ✓ Check wheels or tracks ✓ Check for leaks ✓ Check V-belts ✓ Check all electrical circuits and hooter ✓ Perform walk around inspection ✓ Grease machine ✓ Check power train	➢ Suitable tools and equipment selected ➢ Battery earth terminal disconnected ➢ Work done chronologically ➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications ➢ Recommended oils and coolants used	▪ types of tyres and repair techniques ▪ Types of engines and operation ▪ types of lubricants and application	○ Organizing ○ Planning ○ Analytical ○ Numeracy
G3: Perform 500-hour service	✓ Select tools and equipment ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Check coolant levels ✓ Change coolant filter ✓ Change oil and oil filter ✓ Change fuel filter ✓ Change transmission oil filter ✓ Check batteries ✓ Check air cleaner indicator	➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected first ➢ Work done chronologically ➢ Work done within stipulated time ➢ Bolts tightened to manufacturer's specifications using torque ➢ Wrench		

	✓ Change air cleaner element ✓ Check wheels or tracks ✓ Check for leaks ✓ Check V-belts ✓ Check all electrical circuits and hooter ✓ Perform walk around inspection ✓ Grease machine ✓ Check power train ✓ Adjust valve clearance	➢ Recommended oils and coolants used		
G4: Perform 1 000-hour service	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Change coolant, coolant filter and filter ✓ Change oil and oil filter ✓ Change fuel filter ✓ Change transmission oil and oil filter ✓ Check batteries ✓ Check air cleaner indicator ✓ Change air cleaner element ✓ Check wheels or tracks ✓ Check for leaks ✓ Change V-belts ✓ Check all electrical circuits and hooter ✓ Perform walk around inspection	➢ Recommended coolant used ➢ Recommended oils and filters used ➢ Coolant and oils filled to specified levels ➢ Suitable tools and equipment selected ➢ Fenders covered ➢ Battery earth terminal disconnected first ➢ Work done chronologically ➢ Work done within stipulated time		

	✓ Grease machine ✓ Check power train ✓ Adjust valve clearance ✓ Change hydraulic oil and oil filter ✓ Check and adjust drawbar trunion play ✓ Grease and pre-load wheel bearings ✓ Check brakes ✓ Check track tension ✓ Check steering clutches ✓ Change final drive oil	➢ Bolts tightened to manufacturer's specifications using torque Wrench ➢ Clearance adjusted ➢ Functional steering system ➢ Drive oil changed		
G5: Perform 5000-hour service (Major)	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Change coolant, coolant filter and filter ✓ Change oil and oil filter ✓ Change fuel filter ✓ Change transmission oil and oil filter ✓ Check batteries ✓ Check air cleaner indicator ✓ Change air cleaner element ✓ Check wheels or tracks ✓ Check for leaks ✓ Change V-belts ✓ Check all electrical circuits and hooter	➢ Suitable tools and equipment ➢ Disconnected battery ➢ Choked wheels ➢ Changed changeable ➢ Electrical connections checked ➢ Physical inspection conducted ➢ Greased machine ➢ Serviced machine		

	✓ Perform walk around inspection ✓ Grease machine ✓ Check power train ✓ Adjust valve clearance ✓ Change hydraulic oil and oil filter ✓ Check and adjust drawbar trunion play ✓ Grease and pre-load wheel bearings ✓ Check brakes ✓ Check track tension ✓ Check steering clutches ✓ Check all oil pressures (Main Hydraulic oil, Pilot Oil, engine oil, Steering oil, swing motor oil, Transmission oil and Drive motor oil) ✓ Check engine blow by- breathing ✓ Change final drive oil			

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Oil ring remover
- Micrometer

Repair manual
work-bench
measuring instruments
Valve adjustment set
Allen keys
Trays

- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Fire extinguisher

Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Dial indicator gauge
Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures
- Sump or differential plug tightened and oil filled

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY H REPAIR GROUND ENGAGING TOOLS 10

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
H1: Repair ripper	✓ Select suitable tools ✓ Clear work area ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Tag and lock out ✓ Change tips and pins ✓ Check frame bushes, pins, seals and lubricate if worn replace	➢ Correct tool and equipment handling and use ➢ Battery earth terminal disconnected first ➢ Safety precautions observed ➢ Recommended wheel chokes used ➢ New tips and pins fitted following manufacturer's manual ➢	▪ Hydraulics ▪ Material science ▪ Basic electrics ▪ Care, use and storage of tools and equipment	o Communication o Drawing o Reading and writing o Computers o Estimations o Measuring o Organizing o Planning o Numeracy
H2: Repair dozer/grader blades	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Tag and lock out ✓ Take off blade cutting edge ✓ Turn cutting face once	➢ Correct tool and equipment handling and use ➢ Battery earth terminal disconnected first ➢ Safety precautions observed ➢ Recommended wheel chokes used		

	✓ Replace bolts ✓ Check frame bushes, pins, seals and lubricate if worn replace	➢ New bolts used ➢ Tightening of bolts done according to specifications		
H3: Repair bucket	✓ Select suitable tools ✓ Disconnect battery/switch off master key ✓ Choke wheels ✓ Tag and lock out ✓ Change bucket bushes and pins ✓ Remove seals ✓ Grease nipples ✓ Remove bucket tips and wear plates ✓ Line bore ✓ Replace bolts ✓ Check frame bushes, pins, seals and lubricate if worn replace	➢ Correct tool and equipment handling and use ➢ Battery earth terminal disconnected first ➢ Safety precautions observed ➢ Recommended wheel chokes used ➢ New bolts used ➢ Tightening of bolts done according to specifications		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Scrappers, files, centre punches
- Overhead crane and lifts
- Standard tool box
- Dial indicator gauge
- Fire extinguisher
- Lifting equipment
- work-bench
- measuring instruments
- Allen keys
- Stocks and dies, hacksaws, chisels
- Parts catalogue
- Hydraulic press/ puller
- Repair manual
- Steam cleaner

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY I: OVERHAUL STEERING SYSTEM 5

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
I1: Overhaul steering clutch	✓ Select suitable tools ✓ Disconnect battery ✓ Choke wheels ✓ Clean machine ✓ Remove all impediments ✓ Disconnect all linkages ✓ Remove cover plate ✓ Remove steering clutch assembly ✓ Clean steering clutch assembly ✓ Inspect components ➢ **Re-assembling** ✓ Replace defective components ✓ Assemble steering clutch assembly ✓ Fit steering clutch assembly on machine ✓ Fit cover plates ✓ Fit all impediments	➢ Correct use of tools and equipment ➢ Battery earth terminal disconnected first ➢ Proper chokes used ➢ Use of recommended cleaning solvents ➢ Friction plates and separator plates inspected ➢ Due care taken on removing steering brake band ➢ Measurements done on separator plates and friction discs compared against specifications	• Material science • Hydraulics • Basic electrics • Knowledge of the layout, construction and operation of steering system. • Types of steering systems. • Wheel alignment and adjustment procedure. • Types of steering boxes • Hydraulic-operation of a	○ Communication ○ Drawing ○ Reading and writing ○ Computers ○ Estimations ○ Measurements ○ Organizing ○ Planning ○ Analytical ○ Numeracy

	✓ Test and adjust steering clutch system		basic hydraulically assisted steering	
I2: Repair steering cylinder	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Choke wheels ✓ Block all ports and clean cylinder ✓ Remove gland securing mechanism ✓ Withdraw rod and piston assembly from barrel ✓ Remove piston assembly from cylinder rod ✓ Remove gland nut from cylinder rod, seals from piston, eyes and gland nut ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals onto gland nut, eyes and piston assembly ✓ Fit gland nut and piston onto cylinder rod ✓ Fit piston and rod assembly into barrel ✓ Fit gland securing mechanism ✓ Test hydraulic cylinder ✓	➢ Suitable tools and equipment selected ➢ Work done chronologically ➢ Work done within stipulated time ➢ Worn components replaced ➢ Bolts tightened to manufacturer's specifications using torque wrench		

I3: Overhaul steering control valve	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Block all ports and clean cylinder ✓ Remove end caps and spring retaining clips ✓ Withdraw spool from valve block ✓ Remove seals from block ✓ Remove pressure relieve valve ✓ Clean and inspect components ✓ Replace defective components ✓ Fit seals and spool on valve block ✓ Fit springs, end caps, circlips, and pressure relief valve ✓ Test control valve	➢ Correct tool and equipment handling/use ➢ Work area free of dirt and dust ➢ Safety precautions adherence ➢ Spool inspected for wear ➢ Valve block bore diameter measured ➢ Pressure relief valve seat and spring checked ➢ Pressure setting procedure followed as per specifications		
I4: Overhaul hand metering unit	✓ Select suitable tools ✓ Observe safety precautions ✓ Clean workplace ✓ Disconnect battery ✓ Disconnect hand metering unit hydraulic lines ✓ Mark and plug open lines and ports ✓ Remove hand metering unit assembly ✓ Clean hand metering unit assembly ✓ Remove cap screws ✓ Remove/separate front and back covers from housing	➢ Suitable tools and equipment selected ➢ Work done chronologically ➢ Work done within stipulated time ➢ Worn components replaced ➢ Bolts tightened to manufacturer's specifications using torque wrench ➢ marking of lines observed		

	✓ Remove shaft, bearings, seals and rotor assembly from housing ✓ Clean, dry and inspect components ✓ Replace defective components ✓ Fit bearings, shaft, rotor and seals into housing ✓ Fit front and back covers to housing ✓ Fit piston and rod assembly into barrel ✓ Install unit ✓ Connect all lines ✓ Connect battery ✓ Test unit			

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Dynamometer
- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Allen
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Steam cleaner

Repair manual
work-bench
measuring instruments
Valve adjustment set
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Fire extinguisher

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures
- Dew care to be taken to avoid damaging cylinder rod and seals

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY J: OVERHAUL SUSPENSION **10**

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
J 1: Replace suspension bushes	✓ Choke wheels and put fender covers ✓ Jack and put vehicle on stands ✓ Remove wheels ✓ Disconnect hub assembly from upper and lower ball joints and secure ✓ Remove upper and lower control arm ✓ Clean and inspect components ✓ Remove bushes from control arms ✓ Fit new bushes on control arms and grease	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Bushes fitted according to manufacturers specifications or manual ➢ Defective components are identified ➢ Geometrical angles adjusted to manufacturers specifications ➢ Specified grease used	▪ Knowledge of oil properties ▪ Engine performance ▪ Basic electrics ▪ Workshop health and safety ▪ Component identification ▪ Drawings and sketch readings ▪ Storage and care of components	o Communication o Drawing o Reading and writing o Computers o Estimations o Measurements o Driving o Organizing o Planning o Analytical

	✓ Fit upper and lower control arms and connect ball joints ✓ Fit wheels and remove stands ✓ Align wheels	➢ Steering wheel centralized	▪ Lubrication system service and - maintenance procedures ▪ Operation of hydraulic systems, types, application ▪ Different types of suspensions ▪ Properties of metals	○ Numeracy
J 2: Replace leaf spring	✓ Select appropriate tools ✓ Choke wheels ✓ Remove park brake cable from spring ✓ Loosen 'u' bolts ✓ Jack vehicle and put on stands ✓ Remove 'u' bolts and shackle hanger ✓ Remove spring ✓ Inspect components ✓ Fit new spring, 'u' bolts', shackle hanger ✓ Connect park brake cable ✓ Jack vehicle and remove stands	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications		
J 3: Replace coil spring	✓ Select appropriate tools ✓ Choke wheels	➢ Safety procedures are adhered to		

	✓ Cover fenders ✓ Jack front of vehicle and support on safety stands ✓ Remove wheels ✓ Disconnect shock absorber from knuckle ✓ Remove brake fluid pipe mounting bracket from shock strut ✓ Remove shock pad and withdraw shock absorber assembly ✓ Clamp coil spring ✓ Remove shock pad retaining nut ✓ Remove coil spring and inspect ✓ Clamp new spring and fit shock absorber and pad retaining nut ✓ Unclamp spring ✓ Fit shock pad and connect shock absorber on knuckle ✓ Secure brake fluid pipe to shock absorber	➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Coil sprig aligned on pads ➢ Coil spring height measured		

	✓ Fit wheels ✓ Jack and remove stands ✓ Test vehicle			
J.4: Replace suspension air bag	✓ Select tools and equipment ✓ Choke wheels ✓ Jack vehicle and support on safety stands ✓ Remove air pipes ✓ Remove air bag mounting nuts and withdraw air bag ✓ Fit new airbag and air pipes ✓ Jack vehicle and remove stands ✓ Start vehicle and check pressure	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Airbag fitted according to manual ➢ System air pressure checked to manufacturers specifications ➢ Level height sensor operation checked		

J 5: Replace shock absorber	✓ Select appropriate tools ✓ Choke wheels ✓ Remove upper and lower locknuts, retainers and bushes ✓ Inspect components ✓ Fit new shock absorber ✓ Fit upper and lower, retainer's bushes and locknuts ✓ Test vehicle	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Shock absorber primed before fitting ➢ Match marks are observed		
J 6: Maintain axle	✓ Select appropriate tools ✓ Choke wheels ✓ Loosen 'u' bolts ✓ Jack vehicle and put on stands ✓ Remove wheels drums, brake cables ✓ Support axle beam, brake pipes and remove shock absorbers ✓ Remove 'u' bolts ✓ Lower axle ✓ Remove propeller shaft	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Brakes adjusted to manufacturers specifications ➢ Braking efficiency tested ➢ Park brake adjusted according to manufacturers specifications		

	✓ Fit new axle ✓ Support axle beam ✓ Fit 'u' bolts, shock absorbers, brake pipes, drums and wheels ✓ Fit propeller shaft ✓ Jack vehicle and remove stands ✓ Start engine, bleed and adjust brakes ✓ Rest brakes			
J 7: Replace torsion bar/ control arm/stabilizer bar	✓ Select appropriate tools ✓ Choke wheels ✓ Cover fenders ✓ Jack front of vehicle and put on stands ✓ Remove torsion bar anchor bolt, anchor swivel and torque plate mounting bolt ✓ Remove lower arm spindle, washer and nut from lower control arm ✓ Remove torsion bar	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Appropriate wheel chokes used ➢ Bolts tightened to manufactures specifications ➢ Assembling of components done according to manual ➢ Wheel alignment done according to manufacturers specifications ➢ Defective components are identified		

	✓ Remove stabilizer bar from control arm ✓ Remove control arm ✓ Clean and Inspect components ✓ Fit new control arm and camber plates ✓ Fit new stabilizer bar ✓ Connect ball joints ✓ Fit new torsion bar ✓ Jack vehicle and remove stands ✓ Align wheels ✓ Test vehicle	➢ Geometrical angles adjusted to manufacturers specifications ➢ Specified grease used ➢ Steering wheel centralized		
J 8: Adjust suspension height	✓ Select appropriate tools ✓ Choke wheels ✓ Inspect front and rear tyre pressure ✓ Measure the distance between the centre of each front wheel to the fender beam ✓ If the distance between the left and right wheel is not within the	➢ Safety procedures are adhered to ➢ Suitable tools and equipment are selected ➢ Bolts tightened to manufactures specifications ➢ Suspension height adjusted according to manufacturers specifications		

	manufacturers specifications adjust the height by turning the torsion bar spring anchor bolt	➢ Tyre pressures inflated or checked to manufacturer specifications		
J.9: Maintain Tandems	✓ Choke front wheels ✓ Jack machine and put on stands ✓ Drain oil from tandem ✓ Remove wheels on tandem ✓ Open inspection covers ✓ Inspect driving chains ✓ Inspect sprocket ✓ Inspect hub bearings ✓ Inspect tandem main bearings ✓ Inspect tandem main bush ✓ Replace worn components ✓ Reassemble and put back wheels and toque ✓ Charge oil to level	➢ Choked front wheels ➢ Machine on stand ➢ Drained oil ➢ Removed wheels ➢ Opened inspection covers ➢ Worn out components replaced ➢ Repaired machine		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- ➢ Dynamometer Repair manual

- Jacks and axle stands
- Heavy duty spanners, sockets, screw-drivers and hammers
- Torque wrench
- Allen
- Oil drainer
- Stocks and dies, hacksaws, chisels
- Overhead crane and lifts
- Parts catalogue
- Hydraulic press/ puller
- Steam cleaner

work-bench
measuring instruments
Valve adjustment set
Trays
Scrappers, files, centre punches,
Ring squeezer/expander
Injector tester
Standard tool box
Fire extinguisher

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Honesty Punctual Team worker Physically fit Sober minded
- Dedicated Competent Tolerant Focused

ZIMBABWE	**MINISTRY OF HIGHER AND TERTIARY EDUCATION, INNOVATION, SCIENCE AND TECHNOLOGY DEVELOPMENT SKILLS PROFICIENCY SCHEDULE**	CODE

INDUSTRY: AUTOMOTIVE	TRADE/OCCUPATION: DIESEL PLANT FITTING	CLASS/LEVEL: NC

DUTY K: ELECTRICAL SYSTEMS MAINTENANCE 10

Pre-requisites:	Approval Date:	Review Date:

TASK	STEPS	PROFICIENCY INDICATORS	RELATED KNOWLEDGE	WORKPLACE ESSENTIAL SKILLS
K1: Diagnose faults (Fully electronic Machine)	✓ Connect diagnostic machine ✓ Start the machine ✓ Read faults ✓ Interpret faults in line specifications ✓ Switch off the machine and attend to faults	➢ Diagnostic machine connected ➢ Record of faults ➢ Disconnected machine	▪ Charging circuit ▪ Safety and health precautions ▪ Nature of electricity ▪ Resistors ▪ Inductors ▪ Magnetism ▪ Diagnostic machines	o Reading o Interpretation of results o Communication o Drawing o Computers o Estimations o Measuring o Organizing
K2: Repair lighting systems	✓ Select suitable tools, equipment and safety clothing ✓ Choke wheels	➢ Correct use and handling of tools ➢ Fenders, seats, steering wheel, floors and gear knob covered		

	✓ Fit fender covers, seat covers, floor covers, gear lever cover and steering cover ✓ Check battery ✓ Carry out visual inspection ✓ Clean components ✓ Tighten all connections ✓ Test fuses and fusible links ✓ Test lighting components and circuits ✓ Check for short	➢ Recommended wheel chokes used ➢ Acid proof overall, goggles and gloves worn ➢ Visual inspection for ➢ Corrosion ➢ Sulphation ➢ Loose connections		○ Planning ○ Analytical ○ Numeracy
K3Repair Charging System	✓ Verify battery voltage ✓ Check cable continuity ✓ Check associated fuses ✓ Verify alternator output voltage ✓ Diagnose alternator and accessories	➢ Recorded output voltage ➢ Continuity test results recorded ➢ Alternator output voltage recorded ➢ Repaired alternator		
K.4 Repair instruments	✓ Select suitable tools, equipment and safety clothing ✓ Choke wheels ✓ Fit fender covers, seat covers, floor covers, gear lever cover and steering cover ✓ Check battery ✓ Test components	➢ Correct use and handling of tools ➢ Fenders, seats, steering wheel, floors and gear knob covered ➢ Recommended wheel chokes used ➢ Acid proof overall, goggles and gloves worn ➢ Visual inspection done		

K.5.Maintain Battery	✓ Select suitable tools, equipment and safety clothing ✓ Fit fender covers, seat covers, floor covers, gear lever cover and steering cover ✓ Choke wheels ✓ Connect diagnostic tester and record radio channels diagnostic trouble codes ✓ Inspect battery ✓ Check electrolyte level in each cell ✓ Check battery specific gravity ✓ Check battery voltage ✓ Check battery terminals ✓ Charge /replace battery ✓ Connect battery	➢ Correct tools and equipment used ➢ Fenders, seats, floor, steering covered ➢ Electrical wiring diagram used (EWD) ➢ Repair manual used ➢ Diagnostic machine used ➢ Noise results interpreted correctly ➢ Fusible links and fuses checked for continuity ➢ Defective fusible links and fuses replaced ➢ Drive belt checked for cracks wear and oiliness ➢ Drive belt tension checked as per manufacturer's specification ➢ Charge warning light checked as per manufacturer's specifications ➢ Charging circuit inspected with load i.e with headlights high beam and air conditioner on		

TOOLS AND EQUIPMENT NECESSARY TO COMPLETE THIS DUTY:

- Standard tool box
- brazing wire
- sand-paper
- welding rods
- Diagnostics machine
- Multi-meter
- Hydrometer
- Battery load tester

- Test light
- Regulator tester
- Insulation tape
- Soldering iron
- Welding machine

workshop manuals
Bench tester
Gas bottles
Drilling machine
fender, seat, floor, gear lever and steering wheel covers

HEALTH, SAFETY AND ENVIRONMENTAL ISSUES RELATED TO THIS DUTY:

- Acid proof overalls to be worn at all times
- Battery must never be short circuited so as to avoid damaging alternator
- Utilize Personal protective clothing (PPE)
- Workplace safety rules
- Environmental protection agency regulations and occupational safety and health administration
- Proper use of tools
- First aid
- Understand common safety hazards in automotive repair business
- Hazardous material and waste control
- Types of fires, fire extinguishers and operating procedures
- Fire fighting
- Waste Management Regulations
- Health Management

SPECIFIC WORKER TRAITS REQUIRED TO COMPLETE THIS DUTY:

- Responsible
- Hardworking
- Time conscious
- Clean
- Planned work habit
- Professional devotion
- Reliable