GENERAL INFORMATION

Programme Nomenclature: National Vocational Certificate in MOTOR VEHICLE MECHANICS

1.0 GOAL:

This programme is designed to produce skilled craftsmen with good knowledge of the working principles of motor vehicle and the techniques and safety practices involve in its maintenance.

2.0 OBJECTIVES:

On completion of the programme, a graduate of NVC in motor vehicle mechanics should be able to:-

2.1 Identify various tools/equipment used in the repair of motor vehicle.
2.2 Identify the various units and component parts that make up a motor vehicle.
2.3 Dismantle and assemble parts with expertise
2.4 Carry out diagnostics by aural, visual and functional methods.
2.5 To carry out with expertise, repairs or replacement of faulty components.
2.6 To identify and procurement of genuine spare parts.
2.7 Carry out routine vehicle checks and basic scheduled servicing as recommended by the manufacturer.
2.8 To carry out performance test as applicable

3.0 ENTRY QUALIFICATIONS

a. Basic Education requirement (Post JSS) – i.e. candidate with requisite credits in Junior Secondary Certificate (JSC)
b. Post –Secondary students who are unable to gain access to higher education or IEIs, who may have less than the required five (5) credits.
c. Mature candidate with experience

4.0 NATIONAL CERTIFICATION

Trainees who successfully complete all the courses/modules specified in the curriculum table and pass the national examinations in the trade will be awarded the following certification:

PROGRAMME	CERTIFICATE
Motor vehicle mechanics	National Vocational Certificate
Assessments	Fail, Pass, Credit or Distinction

This programme is expected to be in the form of session-based training courses of not less than to (9) nine calendar months per session. The entire programme is made flexible into three Session Modules viz. NVC Part I, NVC Part II and NVCIII (Final).

5.0 ACCREDITATION

The Certificate programme shall be accredited by the National Board for Technical Education before the candidates can be awarded the National Vocational Certificates (NVC).Details about the process of accrediting a programme for the award of the NVC can be obtained from:

The Executive Secretary, National Board for Technical Education, Plot "B", Bida Road, P.M.B. 2239, Kaduna, Nigeria

6.0 GUIDANCE NOTES FOR TEACHERS

a. This curriculum is drawn in unit courses on modular basis.
b. In designing the units, the principle of the modular system has been adopted, thus making each of the professional modules, when completed, enough to provide the student with operative skills, which can be used for employment purposes or otherwise.
c. Institutions may, as required, add courses to the minimum guide curriculum
d. Teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each course, there should be a balance of theory to practical in the ratio of 20:80

7.0 THE CURRICULUM STRUCTURE

The curriculum of all NVC programmes consists of three (3) main components, viz:

a. General education
b. Trade theory, Trade practice and related studies which account for minimum of 60% of the total contact hours for the programme
c. Supervised Industrial Attachment which accounts for 20% of the total contact hours for the programme shall be undertaken either at the middle or at the end of the session for each academic year.

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8.0 DURATION

The three year programme comprises three (3) parts, each for one year (5) hours per day or 25 hours per week and 14 weeks per term)
Note: 2 weeks is for evaluation and registration

9.0 CURRICULUM TABLE FOR NVC IN MOTOR VEHICLE MECHANICS

PART 1

9.1 First Term NVC Motor vehicle mechanics Part I

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Unit***
1	CSK*	Communications Skill I	2	0	2	
2	VMT*	Numbers and Numeral	2	0	2	
3	CMVS1	Mechanical Science	2	1	3	
4	TD*	Technical Drawing	0	3	3	
5	CMV 10	Tools Appreciation and Safety	2	6	8	
6	CMV 11	Service Station Procedure I	2	5	7	
	TOTAL				**25**	

*** See NVC general studies curriculum**

9.2 Second Term NVC Motor vehicle mechanics Part I

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Credit***
1	EDP*	Entrepreneurship I	2	0	2	
2	GMW	General Metal Work I	1	4	5	
3	CMV 12	Cooling and Lubrication Systems	1	4	5	
4	CMV 13	Introduction to Petrol Engine and Fuel Systems	1	2	3	
5	CMV 14	Introduction to Diesel Engine and Fuel Systems	1	2	3	
6	CMV 15	Service Station procedure II	2	5	7	
	TOTAL				**25**	

Third Term NVC Motor vehicle mechanics part 1

CMV 16: INDUSTRIAL TRAINING – 3 MONTHS

PART 11 `

9.3 First Term NVC Motor vehicle mechanics part 11

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Credit***
1	ICT*	Introduction to Computer	1	2	3	
2	CMVS II	Electrical Science	2	1	3	
3	CMV 17	Transmission and Clutches I	2	5	7	
4	CMV 18	Engine Faults Diagnosis I	1	3	4	
5	CMV 19	Breaking System	1	3	4	
6	CMV 20	Workshop Technology	1	3	4	
	TOTAL				**25**	

9.4 Second Term NVC Motor vehicle mechanics part II

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Credit***
1	CSK*	Communications Skill II	2	0	2	
2	ICT *	Computer Appreciation	1	2	3	
3	CMV 21	Workshop Administration	2	0	2	
4	CMV 22	Petrol Engine Maintenance	2	5	7	
5	CMV 23	Transmission and Clutches II	2	4	6	
6	CMV 24	Steering Systems	1	3	4	
	TOTAL				**24**	

Third Term NVC Motor vehicle mechanics part II

CMV 25: INDUSTRIAL TRAINING – 3 MONTHS

PART III

9.5 First Term NVC Motor vehicle mechanics part III

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Credit***
1	EDP*	Entrepreneurship II	2	0	2	
2	CMV 26	Diesel Engine Electronics	1	3	4	
3	CMV 27	Diesel Engine Maintenance	1	4	5	
4	CMV 28	Petrol Engine Electronics	1	4	5	
5	CMV 29	Engine Faults Diagnosis II	1	3	4	
6	CMV 30	Auto Electricity	1	4	5	
	TOTAL				**25**	

*** See NVC general studies curriculum (assessment on these courses shall be based on specifications stated therein)**

9.6 Second Term NVC Motor vehicle mechanics part III

			Hrs/Week			
S/N	***Course code***	***Course Title***	***Theory***	***Practical***	***Total***	***Credit***
1	EDP*	Entrepreneurship III	2	0	2	
2	GMW	General Metal Work II	2	4	6	
3	CMV 32	Car air conditioning	1	3	4	
4	CMV 33	Engine Repair and Overhaul	1	4	5	
5	CMV 34	Computerized Engine Diagnosis	1	3	4	
6	CMV 35	Wheels Alignment, Balancing, Chassis and Suspension System	1	3	4	
	TOTAL				**25**	

*** See NVC general studies curriculum**

Third Term NVC Motor vehicle mechanics part III

CMV 36: INDUSTRIAL TRAINING – 3 MONTHS

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Mechanical Science
CODE: CMVS I
CONTACT HOUR: 3 Hours/week
Theoretical: 2 Hours/week
Practical: 1 Hour/weeks

GENERAL OBJECTIVES

1. Understand the concepts and effects of forces.
2. Understand the effects of friction and the laws governing it.
3. Understand linear and angular motions of bodies.
4. Understand curvilinear motion of bodies.
5. Understand Momentum of bodies.
6. Understand the concepts of Work, Energy, and Power.
7. Understand general principle of operation of simple machines.
8. Know Simple Harmonic Motion (SHM).

	General Objective 1.0: Understand the concept and effect of forces and their moments.			General Objective1.0: Understand the concept and effect of forces and their movements.		
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
1 – 2	1.1 Define forces 1.2 Explain how to construct parallelogram of force 1.3 Calculate the resultant of a system of two forces 1.4 State the principle of triangle of force 1.5 Resolve forces into components 1.6 Resolve a force into force and couple 1.7 State the conditions for the equilibrium of co-planar forces 1.8 Define moment of a force 1.9 State the principles of moments 1.10 Solve problems related to 2.1 to 2.9 above	• Explain in details the concept and effects of forces and their moments. • Guide the students to solve problems relating to forces and its moments. • Assess students' assignments.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	1.1 Construct parallelogram of forces 1.2 Draw triangle of forces 1.3 Draw polygon of forces 1.4 Verify Lami's theorem using a force board 1.5 Verify the parallelogram law of forces	Demonstrate activities 1.1 to 1.5 for the students to learn and ask them to carry out all the activities	Drawing materials/instruments.
	General Objective: 2.0 Understand the effect of Friction and the law governing it.			**General Objective 2.0: Understand the effect of Friction.**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**
	2.1 Define friction	• Explain in	Recommended	2.1 Determine the co-efficient	Demonstrate activity	Specimens of mosses

3 -4	2.2 State advantages and disadvantages of friction 2.3 Define coefficient of friction 2.4 Define limiting angle of friction 2.5 Define angle of Repose 2.6 Solve problems related to 3.1 to 3.5	details the principles and effects of friction and the law governing it. • Guide the students to solve problems relating to friction.	textbook, Chalkboard, duster, Chalk, Lecture notes, etc	of friction by means of an inclined plane.	3.1 for the students to learn and ask them to carry out the activity.	and inclined plain set-up. Protractor, etc.

Week	**General Objective 3.0: Understand Linear and Angular motions of bodies.**			**General Objective 3.0: Understand Linear and Angular motions of bodies.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
5- 6	3.1 Define displacement, speed, distance, velocity and acceleration. 3.2 State units of displacement, speed, distance, velocity and acceleration. 3.3 Derive the relationship between displacement, velocity and acceleration. 4.4 Draw velocity time graph.	• Explain in details the concepts of linear motion of bodies. • Guide the students to draw velocity - time graph and solve problems relating to displacement, velocity and acceleration.	Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, Graph sheets, etc.			

	3.5 Add velocities vectorially. 3.6 Define relative velocity. 3.7 Solve simple problems related to 1.1 to 1.6 above. 3.8 Define angular motion of a body in a circle. 3.9 Derive the relationship between angular velocity and acceleration. 3.10 Draw angular velocity-time graph.	• Assess students' assignments.				

Week	General Objective4.0: Understand curvilinear motion of bodies.			General Objective 4.0: Understand Curvilinear motion of bodies.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
7	4.1 Develop the relationship between angular and linear motions. 4.2 Define circular motion. 4.3 Explain centrifugal acceleration and centrifugal force. 4.4 Develop expressions	• Explain in details the concept of curvilinear motion of bodies. • Guide students to develop expressions for centripetal and centrifugal forces and solve problems on them.	Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, etc.	4.1 Show that centrifugal force varies with mass, speed of rotation, and the distance of the mass from the centre of rotation using centrifugal force apparatus. 4.2 Verify the equation of motion using Fletcher's trolley.	• Illustrate 4.1 to 4.2 and ask the students to perform experiments. • Assess the students' reports.	Practical guide, Centrifugal apparatus. Fletcher's trolley Weights

	for centripetal and centrifugal forces. 4.5 Give examples of centrifugal effects e.g. Planetary motion, Conical pendulum, etc.					
Week	**General Objective 5.0: Understand Momentum of Bodies.**			**General Objective 5.0: Understand Momentum of Bodies**.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
8-9	5.1 Define Mass and Weight of a body. 5.2 State Newton's Laws of motion. 5.3 Define Impulse and Momentum. 5.4 State the Law of Conservation of Momentum. 5.5 Define Angular Momentum. 5.6 Define Radius of Gyration. 5.7 Explain Moment of inertia. 5.8 Solve problems related to 5.1 to 5.7.	• Describe in details the concepts and principles of momentum. • Guide the students to solve problems relating to momentum. • Assess students' assignments.	Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, etc.	5.1 Determine moment of inertia. 5.2 Verify the law of conservation of moment on Fletcher's trolley.	• Illustrate activities 5.1 to 5.2 and ask the students to perform experiments. • Assess the students' reports.	Recommended apparatus. Fletcher's trolley.
Week	**General Objective 6.0: Understand the concept of Work, Energy and Power**			**General Objective 6.0: Understand Forces and Torque of a system.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers**	**Resources**

					Activities	
10-11	6.1 Define Work, Energy and Power. 6.2 State the units of work, energy and power. 6.3 Develop expressions for Work, Energy and Power. 6.4 Define Torque and work done by Torque. 6.5 Explain Tractive Force and driving Torque of a system. 6.6 Differentiate between Kinetic Energy and Potential Energy. 6.7 Explain Kinetic Energy of rotating bodies. 6.8 Explain Mechanical Efficiency in power transmission. 6.9 Explain power transmission by flat belts, spur gearing and worm gearing.	• Explain in details with the concepts of work, energy, torque and power. • Guide the students to solve problems on work, energy, power and torque. • Assess the students' graded assignments.	Chalk, Chalkboard duster, Recommended textbooks, Lecture notes, etc. Chalk, Blackboard.	6.1 Determine tractive force and driving torque of a system. 6.2 Determine kinetic energy of rotation.	• Demonstrate to the students the activities in 6.1 to 6.2 and ask the students to perform the experiments. • Assess the students' reports.	
Week	**General Objective 7.0: Understand General principle of operation of simple machines.**			**General Objective 7.0: Understand the practical principle of operation of simple machines**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
12-13	7.1 Define simple machine. 7.2 Give examples e.g. Lever, Pulley, Screw Jack, etc.	• Explain in details the features, types and principle of operation	Chalk, Chalkboard, Duster, Recommended textbooks,	7.1 Determine the velocity ratio, mechanical advantage and mechanical efficiency of a screw jack.	• Demonstrate the activities in 7.1 and 7.2, and	Practical guide, screw jack and pulley system.

	7.3 Explain the operations of 5.2 above. 7.4 Define (i) Mechanical Advantage (ii) Velocity Ratio (iii) Mechanical Efficiency 7.5 Develop the relationship for Mechanical Advantage, Velocity Ratio and Efficiency of a wheel, pulley and screw jack 7.6 Solve simple problems related to 5.1 to 5.5 above.	of simple machines. • Guide the students to derive the expression for the Mechanical Advantage, Velocity Ratio and Efficiency of wheel, pulley and screw jack and solve problems on them.	Lecture notes, etc.	7.2 Determine the velocity ratio and efficiency of simple pulley system.	ask the students to perform the experiments.	

Week	**General Objective 8.0: Know simple harmonic motion.**			**General Objective 8.0: Know simple harmonic motion.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
14-15	8.1 Describe periodic motion 8.2 Describe period, frequency and amplitude in simple harmonic motion. 8.3 Develop expressions for 6.3 above. 8.4 Analyse the motion of a simple pendulum. 6.5 Solve problems related to the above.	• Explain in details the features and principles of Simple Harmonic Motion (SHM). • Guide the students to derive expression for period, frequency and amplitude of SHM and solve problems on them.	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.	8.1 Determine experimentally the period and frequency of oscillation of a simple harmonic motion.	• Demonstrate the activity in 8.1 and ask the students to carry out experiment.. • Assess the students' reports.	Simple Pendulum

		• Assess the students' assignments.				

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Tools Appreciation and Safety
CODE: CMV 10
CONTACT HOUR: 8 Hours/week
Theoretical: 2 Hour/week
Practical: 6 Hours/weeks

GENERAL OBJECTIVES

1. Understand the appropriate use of tools for relevant jobs
2. Understand the maintenance of tools and equipments
3. Understand safe tools/equipments systems

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS		
COURSE: Tools Application and Safety	**COURSE CODE: CMV 10**	**CONTACT HOURS: 8Hrs/week**
GOAL:		
COURSE SPECIFICATION: Theoretical Contents:	**Practical Contents:**	
General Objectives: 1.0: Understand appropriate use of tools for relevant jobs	**General Objectives: 1.0 Understand the appropriate use of tools**	

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	1.1 Explain - special tools - conventional tools 1.2 Explain the importance of tools and equipment 1.3 State the different classifications of tools, e.g. - measuring tools - hand tools - lifting tools - machine tools - digital diagnostic - fire fighting tools etc. 1.4 Explain the applications of the different classes.	• Describe special conventional tools • List the importance of tools and equipment. • Identify the classes of tools. • Explain the major difference between classes. • Ask students to state the application of the tools.	• Chart • Instructional material • Overhead projector • Manuals • Models • Tools	1.1 Identify special tools 1.2 Identify conventional tools 1.3 List the importance of tools and equipment 1.4 Apply the various classes of tools.	• Guide students to identify the different classes of tools. • Demonstrate how to use the tools • Guide students to apply the tools. • Show tools to students and allow them to apply it. • Ask students to explain how to use certain tools	• Chart • Instructional material • Overhead projector • Manuals • Models • Tools • equipment
	General Objective 2.0: Understand maintenance of tools and equipment			**2.0 Understand the tools/equipment maintenance procedures**		
	2.1 Explain the legal requirement in tools relating to application e.g. - Standard Organization of Nigeria - Manufacturer specifications - Soft ware update interval. 2.2 State the reasons why tools/equipments needs maintenance 2.3 Explain tools/equipment	• Explain to students using different tools manual the requirements. • Ask students to locate the legal requirements in the manual of a particular tool. • Ask students to state the reasons for maintenance. • State the various	• Marker • Chart • Manuals • White board • Overhead projector • Tools - Conventional - Special	2.1 Explain to students how to locate information in the manufacturer manual or internet 2.2 Carry out simple maintenance on a tool. 2.3 Explain how to update tools.	• Guide students to locate information on tools • Perform a simple maintenance task on some tools • Guide students to carry out simple adjustment and setting of tools. • Assess the students	• Marker • Chart • Manuals • White board • Overhead projector • Tools - Conventional - Special

	maintenance task e.g. - Lubrication - Cleaning - safety adjustment - proper storage	steps involved in the maintenance of conventional auto workshop tools.				
	General Objective 3.0: Understand tools and equipment storage.			**3.0 Understand tools and equipment storage**		
	3.1 Explain the reasons for safe tools/equipment storage. 3.2 Explain the types of tools/equipment storage system. 3.3 State the advantages and disadvantages of the common storage types. 3.4 Explain the term tools control and its necessity.	Ask students to • State the reason why tools/equipment should be properly stored. • State the types of storage system that is commonly applied. • List the advantages and disadvantages of the storage system. • Use notes to explain why tools control is important.	• Marker • Chart • Manuals • White board • Overhead projector • Model • Instructional material	3.1 List the reasons for safe storage of tools/equipment 3.2 State types of tools storage.	• Take the students to the workshop, store and show them the method of storage applied and tools control.	Ditto

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Service Station Procedure I
CODE: CMV 11
CONTACT HOUR: 7 Hours/week
Theoretical: 2 Hour/week
Practical: 5 Hours/week

GENERAL OBJECTIVES

1. Understand the layout, functions of the principal components of the motor vehicle and safety practices.
2. Understand the sealing and locking methods, seal and lock motor vehicle components/parts efficiently.
3. [illegible]
4. [illegible] different types of motor vehicles.
5. Understand the basic principles of the motor vehicle and carry out general maintenance work on them.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: SERVICE STATION PROCEDURE I	**COURSE CODE: CMV 11**			**CONTACT HOURS: 7hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives:1.0 Understand the layout, functions of the principal components of the motor vehicle and safety practices				**General Objectives:1.0 Understand the layout, functions of the principal components of the motor vehicle and safety practices**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Identify the principal components, auxiliaries and systems of a motor vehicle e.g. engine, gearbox, clutch, chassis, rear axle, connections to road wheels, and body. 1.2 Describe in details the functions of each component in a motor vehicle listed in 1.1 above. 1.3 Explain the principles of each component listed in 1.1 above. 1.4 Sketch a chassis layout showing relative position of the main components of a vehicle e.g. engine, transmission, prop-shaft, rear axle, suspension, front axle, suspension and steering control linkages to road wheels, etc.	• Introduce the students to vehicle lay-out, list the main components such as: - Engine, gearbox, clutch, chassis, rear axle, connection to road wheels and the vehicle body. • Explain the functions of: Engine, clutch, gearbox, propeller shaft, rear axle, suspension arrangement. • Ask student to sketch a chassis layout. • Assess the students	• Lesson plan • Posters • Sketches • Model vehicle • Flip charts • Instructional materials • Overhead projector	1.1 Carry out identification of the main unit and component parts 1.2 Use layout sketch to explain the functions in 1.1 above	• Guide students to carry out vehicle component identification on their own • Use overhead projector to display the relative position of the main components of a vehicle • Assess the students' ability to identify these components.	• Lesson plan • Posters • Sketches • Model vehicle • Flip charts • Instructional materials • Overhead projector
	General Objective 2.0: Understand the sealing and locking methods; seal and lock motor vehicle components/parts efficiently.			**General Objective 2.0: Understand the sealing and locking methods; seal and lock motor vehicle components/parts efficiently.**		

	2.1 Explain the functions, strength and limitations of the following devices: a. Securing devices e.g. thread types and sizes BSW, BSF, BSP, UNC, UNF, metric in nuts and bolts, set screws, stud, allen grub, Philip screw, etc. b. Locking devices e.g. springs, shakeproof and tap washers, locking plates, castellated and self locking nuts, split pins, circlip pins, bolt locking wire. c. Sealing devices, e.g. gasket, joints, plugs, compound, etc. d. Pipe union and joints e.g. copper, flexible plastic pipe, straight coupling, elbow and banjo unions, formed nipple, olive and union nuts, swages and pipe fixing, hose clips.	• Ask students to: Identify types of threads and sizes used in metric for bolts and nuts, set screws, studs, allen keys. • List locking devices: springs, shakeproof and tap washers, self locking nuts, split pins, circlips, etc. • Identify pipe union and joints; copper, flexible plastic pipes couplings, hose clips etc. • Assess students.	• Lesson plan • Chalkboard • Sample of bolts, nuts, studs etc.	1.1 Carry out identification of the devices in 2.1 with students and explain their functions, strength and limitations 1.2 Carry out securing, sealing and locking operations on component parts of types motor vehicle	• Guide students to carry out the identification on their own • Use overhead projector to display the devices in a vehicle • Assess the students ability to identify these devices • Pick up some of the devices and ask student to identify it and state its functions, strength and the reason why it is used. • Teacher to demonstrate correct working procedures as in 1.2 • Assess the students	• Samples of devices • Over head projector • Charts • models
	General Objective 3.0: Understand the basic services involved and carry out routine maintenance on different types of motor vehicles			**General Objective 3.0: Understand the basic services involved and carry out routine maintenance on different types of motor vehicles**		
	3.1 Explain the basic operations involved in	• Introduce the students to basic or	• Lesson plan • Charts	3.1 identify the routine operations in the	• Carry out some routine	• Lesson plan • Charts

	routine vehicle maintenance, e.g. change oil filter, spark plugs, contact breaker, clean and adjust carburetor, check distributor leads and petrol pump. 3.2 Identify lubricant types and their specific uses e.g. vegetable base grease, animal base grease, multi-purpose grease, high melting point grease, etc Oil - S.A.E. ratings, multigrade oil; Fluid - High and low boiling point fluid.	routine maintenance of motor vehicle. • Explain the importance of lubricants and types, and brake fluid. • Identify types of lubricants. • Explain oil grades • Assess students	• Tools and oil • Brake fluid • Grease	maintenance and indicate the necessary adjustment 3.2 list the different types of lubricant and their areas of applications 3.3 carry out change of engine oil and oil filter 3.4 carry out change or cleaning of spark plug 3.5 check distributor and set contact breaker point 3.6 carry out service of carburetor 3.7 carry out greasing of appropriate joints	maintenance with the students • Show students how to apply lubricants and why it is necessary to lubricate • Teacher to demonstrate correct working procedures • Assess the students to test their knowledge	• Tools and oil • Brake fluid • Grease • Other lubricants
	General Objective 4.0: Understand the basic construction of a battery and carryout preventive maintenance.					
	4.1 Explain the basic construction of a battery and its components.	• Explain the functions of battery cells and construction • Describe using diagram or chart hydrometer and its use • List battery faults and remedies • Assess students	• Lesson plan • Chalkboard • Used battery model • Hydrometer	4.1 Demonstrate the following: a. Top up battery electrolyte of correct specific gravity b. Check specific gravity of a battery with an hydrometer c. Check, clean or replace if necessary and tighten battery terminals.	• Teacher to demonstrate for students to practice till the become competent • Assess the students	• Lesson plan • Chalkboard • Used battery model • Hydrometer • charts
	5.0. Understand the basic construction of a battery and carry out preventive maintenance.					
	5.1 Explain the basic processes of routine vehicle maintenance.	• Introduce and list basic processes of routine vehicle maintenance	Manufacturers' specifications/recommendations	5.1 Demonstrate the basic processes of routine vehicle maintenance. 5.2 Check brakes	• Allow student to apply the processes in 5.1 • Guide students	• Over head projector • Models • Manufacturers

		• Explain causes of leakages in brake and clutch pipelines • Check burnt electrical components • Explain causes of radiator leakage • Explain methods of replacing fan belt • Explain causes of brake defects • Assess students		and effect repairs as appropriate 5.3 Clean air filter 5.4 Service carburetor 5.4 Grease joints 5.5 Change oil filter 5.6 Change or clean spark plugs 5.7 Change engine oil 5.8 Check distributor and contact point 5.6 Check under body for possible repairs or tighten bolts and nuts for body, suspension/spring 'U' bolts and exhaust system.	to understand the manufacturers manual or specifications • Assess and correct the students	' specifications/ recommendations

COURSE: General Metal Work I
CODE: GMW I
CONTACT HOUR: 5 Hours/week
Theoretical: 1Hour/week
Practical: 4Hours/week

GENERAL OBJECTIVES/THEORY

1. Understand workshop safety rules and its application in a machine shop
2. Know the physical properties, manufacturing processes and applications of ferrous and non-ferrous metals in common use
3. Understand the selection and use of common measuring. Marking out, cutting and striking tools
4. Understand the working principles of a drilling machine, use it to drill and ream holes on metals and other engineering materials
5. Understand the applications of various types of screw threads, rivet and cut screw thread by hand.
6. Understand the ISO system of tolerances and fits and its application in engineering production.
7. Produce simple Engineering components on the work bench.
8. Understand the essential features and working principles of the centre lathe and use it to carry out basic operations such as plain turning, stepped turning, facing taper turning, chamfering, and under-cutting.

For practical competence, students will be able to achieve the following at the end of the module:

i) Use all tools correctly ensuring the machinery guards and protective eye shields are used at all times.
ii) Comply with the general rules fopr safe practice in the work environment at all times.
iii) Select and use hand tools for carrying out various bench fitting and assembly tasks.
iv) Use tools: hacksaws, taps, reamers, drills, dividers, surface gauge.
v) Produce screw threads using taps and dies.
vi) Correctly grind drill point angles: Twist and flat drills
vii) Select and set drilling machine speeds to carry out a range of operations using the appropriate coolants, drilling, reaming, counter sinking, counterboring.
viii) Perform metal joining by a range of processes. Cut through the joints and investigate the depth of penetration of the metals at the Interface Processes: soldering, brazing, and fusion welding.
ix) Mark out on metals and other materials, datum lines, angles, radii/circles and hole positions using a range of tools.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: GENERAL METAL WORK I	**COURSE CODE: GMW 1**			**CONTACT HOURS: 5hrs/wk**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:						
General Objectives: 1.0 Understand workshop safety rules and its application in a machine shop						
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
1	1.1 State sources of hazards in the workshop and how to prevent occurrences/incidences: a. handling and using hand tools, portable power tools and machines: b. stepping on or striking obstructions left on floors or benches; c. lifting, moving and storing materials or jobs; d. using inflammable or corrosive liquids and gases; e. inhaling vapours or fumes. 1.2 Explain the applications of factory safety regulations in the machine shop. 1.3 Name safety equipment and wears essential in the machine shop and state their application in working situations; Note: Example of safety wears and equipment should include overall eye goggles, gloves, safety boots, helmet, fire extinguishers, etc.	▪ State sources of hazards in the workshop. ▪ Through questions and answers, determine whether or not students grasped the topic. ▪ Show a film on industrial safety. ▪ Through question and answer determine comprehension. ▪ Demonstrate how to treat emergency cases like artificial respiration, cold compress etc. ▪ List the safety equipment and wears that are essential in the workshop. ▪ Give detailed notes and explanation in each topic a-g. ▪ Use questions and answers to determine	▪ Safety posters, common hard tools like files hacksaw. ▪ Television, Video machine ▪ Overall. Goggles, gloves, head shield, head shield, fire extinguishers.	• Demonstrate safe use of basic hand tools, proper work dress, eye shield • Use wall charts to demonstrate workshop dos and don'ts. • Explain the need for accident prevention for associated risks. • Demonstrate safe storage methods. • Show a film on limitations of various fire extinguishers. • Show a film on workshop accident • Explain using question and answer approach to ascertain students understanding. • Assess the students	• Guide students on proper workshop rules for hazard prevention and management. • Use charts/films • Assess students understanding. • Allow students to demonstrate safe storage/handling of tools • Assist students as applicable • Guide students to master • Carryout safety drill with full students involvement • Demonstrate how to treat emergency cases like cold compression, artificial respiration, etc. • Assess the students	• Safety posters, wall charts and • Hand tools – (files, hack) • Workshop hand glove saw safety boots, eye shields overall • Television/Video m/c • Fire Extinguishers • First Aid kits • Tools • Manuals • Charts • Projector • Posters on artificial respiration • Video/TV

		comprehension. ▪ Assess the students.				
	1.4 Outline safety rules and regulations relating to: a. clothing and health hazards; b. workshop hygiene; c. movement and other behaviour of workers in the workshops; d. materials handling; e. tool handling, storage and usage; f. machine operation; g. fire protection. 1.5 Understanding appropriate procedures in the events of a workshop accident Examples of procedures may include: a. application of first aid to the victim; b. removal or rectification of the accident; c. reporting accident to the appropriate authority; d. keeping a record of accidents for management use.	▪ Give detailed notes and explanation as appropriate ▪ Explain the procedures to be taken in the event of workshop accident.		• Demonstrate best practices in handling and moving objects and delicate materials and machines • Observe safety precautions	• Show a film on industrial safety and best behaviours in industry • Guide students on first aid, accident prevention, reporting and management • Assess for comprehension	• Charts and tool rack • Charts on workplace hygiene and material storage units for safety • Factory ordinance rules (Federal Min. of Labour) • First Aid Kits • Fire Alarm • Accident record file
	General Objective 2.0: Know the physical properties, manufacturing process and application of ferrous and non-ferrous metals in common use					
2	2.1 Explain the meaning of the following general physical properties of metals:- ductility, malleability, strength, toughness, brittleness, elasticity, plasticity.	▪ Give detailed notes and explanations for the topics in 2.0.	•	• Describe the various methods of treatment of ferrous/non-ferrous metals of common use.	• Guide students in subjecting metals to different forming methods to confirm in-built properties • Assess the students	• Samples of common metals.
	2.2 Describe the basic composition	▪ Give notes and	▪ Video and television	• Subject samples	• Guide students on	• Lesson notes

	and properties of plain carbon steels, cast iron and alloy steel and state their application in the engineering industry. Note: Specific examples of tools and equipment made from the various types steel and cast iron should be mentioned. Examples, dead mild steels, mild steel, medium carbon steel, high carbon steel. Cast Irons – gray cast iron, malleable cast iron, alloy cast irons. Alloy Steels – High speed steels. High tensile steels, tungsten, carbide, stainless steels, satellite. 2.3 Outline: a. the cupola process of manufacture of cast iron; b. the blast furnace process of manufacture of pig iron; c. the direct reduction process of manufacture of steel. Note: A visit to a steel manufacturing plant is recommended. 2.4 Describe the physical properties and applications of non-ferrous metals below: copper, tin, zinc, aluminium and aluminium alloys brass (muntz metal, cartridge brass, gilding etc) metal, bronze manganese bronze tunmetal, bell metal, aluminium bronze,	specific examples of tools and equipment made from the various steels and cast iron. ▪ Examples of steels and cast irons should include plain carbon steels, dead mild steels, mild steel, medium carbon steel, high carbon steel, gray cast iron, malleable cast iron, alloy cast iron high speed steels, high tensile steels tungsten, carbide, stainless steels. ▪ Give notes and explanation on the cupola process. ▪ Blast furnace and the direct reduction process ▪ manufacture of steel. This can be proceeded by film show and a visit to a manufacturing plant. ▪ Give detail notes and explanations describing the physical properties and applications of the following non-ferrous metals: copper, tin, zinc, aluminium, aluminium alloys,	including cassettes on production processes.	of carbon steel, high carbon steel, cast iron, alloy steel, steel guiding, turning and destructive tests to differentiate various grades. • Describe the operating principles of cupola, blast furnace reduction system of steel manufacture • Demonstrate effects of temperature/heat on stability of metals • Describe strength and limitations of ferrous and non-ferrous metals commonly used in engineering workshops.	proper selection of particular metal for specific engineering applications. • Assess the students • Identify with students needs on meting metal, metal treatment methodologies • Assess the students	• Video/TV • Documentaries on production processes. • Lecture notes • On-site visit to steel processing plant. • Group visit to foundry works.

	phosphor bronze and lead.	brass, (muntzmetal, cartridge brass gilding metal) etc. bronze, manganese bronze bell metal, aluminium bronze phosphor bronze and lead. Assess the students.				
	General Objectives 3.0: Understanding the selection and use common measuring. Marking out, cutting and striking tools					
3	3.1 Select and use common measuring, marking out, cutting and striking tools. 3.2 Explain with examples the difference between "lime" and "end" measurement. 3.3 Explain the use of datum points, datum lines and datum faces in marking out. 3.4 Describe the functions and application of the following instruments used in metal-work; steel rule, dividers, calipers (inside, outside and odd-legs), trammel, scriber angle plate, vee-block, centre square. 3.5 Describe the various types of files, stating their grades and applications. Note: Types of files should include: flat, square, round, half round, three square, warding, mill and rasp. 3.6 Classify the common files used in metal work and state their material composition and used for their manufacture. 3.7 Sketch the bench vice, explain its clamping power and	▪ Prepare notes that will clearly differentiate between "line" and "end" measurement. ▪ Prepare notes and examples that will explain the use of datum points, datum lines, and datum faces in marking out. ▪ Demonstrate and give detailed notes and explanations regarding the functions and application of: steel rule, dividers, calipers (inside, outside and odd leg) trammel, scriber, angle plate, vee block, centre square. ▪ Prepare notes that will describe the various types of files stating their grades and applications, by	▪ Steel rule, divides calipers, trammel, scribe angle plate, vee block, centre square. ▪ Micrometer vernier calipers vernier height gauge combination set ▪ Flat file, hand file, round file square, half round, triangular warding, mill file, rasp file. ▪ Flat file, hand file engineers square. ▪ surface plate try square (engineers square) ▪ File card ▪ Flat file ▪ Bench vice. ▪ Ball pen hammers and mallets. ▪ Cold chisels, centre punches, dot punch, scrapers, power hacksaw blades ▪ Hacksaw blades ▪ Hacksaw frame ▪ Adjustable hacksaw junior hacksaw piercing saw.	• Describe the main features and application of micrometers, vernier caliper, vernier height gauge combination sets, steel rule, angle plate, files etc. • Maintain workshop instruments • Perform marking out on plane surfaces including profiles. • File a piece of metal to a given specification using any of the following: cross filing, draw filling, filling square and flat surfaces. • Test surfaces for flatness using try square. • Select and insert hacksaw blade	• Demonstrate the use of micrometer vernier caliper, vernier, height gauge combination sets; files angle place • Guide students on specific tasks of measurement by aforementioned workshop instruments • Demonstrate maintenance and care of instruments. • Demonstrate testing of flat surfaces using surface plate and try square. • Assess the students	• Micrometer • Vernier Calliper • Vernier height gauge • Combination sets. • Files • Angle plate, etc. • Steel rule • Callipers • Trammel • Veeblock • Centre square • Warding file • Punches • Bench drill • Pillar drill

4	demonstrate the technique of holding work in the vice for filling, tapping and other operations. 3.8 Describe and use the following tools; a. cold chisels (flat, cross, cut half round, diamond-point) b. centre punch and dot punch c. scapers (flat, triangular, half round) d. Power hack saw 3.9 Describe the various parts of a hack saw and function. 3.10 Describe the common types of hacksaw blades, their range of pitches and their applications. 3.11 Show a bench vice and demonstrate the technique of holding work in the vice for filing, taping and designing operations. Prepare detail notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operations. 3.12 State the safety precautions to be observed when using a hand hacksaw.	type, e.g. flat, square round, half round, three square, warding, mill and rasp. ▪ Prepare detailed notes that will classify the common files used in metal work as well as stating the composition of materials used for their manufacture. ▪ Show a bench vice and demonstrate the work on the vice for filing, tapping and designing operations ▪ Prepare detailed notes that will describe the functions of the various parts of a bench vice, its holding power while performing various operations. ▪ Assess the students ▪ Prepare detail notes and demonstrations that will describe the uses of: cold chisels, centre punch and power hacksaw. ▪ Prepare notes that will describe the various parts of a hacksaw and their functions.	▪ Bench drill ▪ Pillar drill ▪ Twist drill, flat drill, counter sink drill, counter bore drill combination centre drill.	correctly • Cut metals correct to specifications. • Demonstrate the correct use of cold chisels, centre punch, saw blade, etc.	• Students to be allowed to practice until they are competent on the use of identified tools and instruments • Assess students for comprehension	• Hacksaw frame • Hacksaw blade • Chisel • Centre punch • Lesson notes.

		▪ Show samples of hacksaw blades as well as prepare notes that will describe the common types of hacksaw blades, ▪ their range of pitches and their applications. ▪ Prepare notes that will show correct way of inserting blades ▪ Prepare detailed notes and explanation, stating the safety precautions to be observed when using a hand hacksaw. ▪ Prepare notes that will describe the uses of various hacksaws. Assess the students.				
	General Objective 4.0: Understand the working principles of a drilling machine, use it to drill and ream holes on metals and other engineering materials.					
	4.1 Identify the various types of drilling machines. 4.2 Describe, with sketches, the main features of a bench or pillar drilling machine. 4.3 Describe with sketches and state where each of the following types of drills are best suited: Twist drill (taper shank, parallel shank and jobbers drill, and their relative merits), flat drill, countersink, counter bore drill, combination centre	▪ Show different types of drilling machines ▪ Make notes and drawings that will identify the various types of drilling m/cs. ▪ Prepare detailed notes and drawings that will describe the main features of a bench or pillar	▪ Ball pein hammers, mallets, cold chisels, centre punches, hacksaw and hacksaw blades. ▪ Drilling machines and their accessories.	• Create simple jobs to show bench works and pillar drilling operations • Employ improper sharpened drills to show effects of using wrong tool and remedy by corrective action. • Sharpen a twist drill correctly to manufacturers	• Guide students to select drills best suited for hole initiation counterboring • Solve sample problems with students • Demonstrate how a twist drill can	• Drilling machines • Centre punches • Cold chisels • Mallers • Hammers • Lesson notes/drawings • Lesson notes/drawings

5-6	drill). 4.4 Explain the effects of the following faults in a ground twist drill bit: a. point angle too acute; b. point angle too abtuse; c. cutting edges at unequal angles; d. insufficient lip clearance e. excessive lip clearance. 4.5 Calculate spindle revolution or cutting speed for specified size of drill using the formulae:- $N = 1000S/\pi d$ $S = \pi dN/1000$ Where A = cutting speed (m/min) N = revolutions/minute D = diameter of drill (mm) $\pi = 3.142$ 4.6 State the causes and remedies of drilling faults such as:- a. drill breaking; b. drill coloured blue; c. walls of drilled hole left rough; d. chipped cutting lips. 4.7 State the safety precautions to be observed when using a drilling machine. 4.8 Explain the purpose of reaming and describe different types of hand and machine reamers. 4.9 Ream to given specifications by hand and machine method.	drilling machine. ▪ Solve many problems for students to practice. ▪ Prepare notes and drawings that will describe where each of the following drills are best suited. ▪ Twist drill (taper shank, parallel, shank, jobber drill and their relative merits), flat drill, counterbore drill and combination centre drill. ▪ Assess the students.		specifications • Carryout counterboring/counter drilling • Demonstrate safety controls on drilling m/c • Describe hand and machine reamers • Demonstrate hand and machine reaming process	be sharpened correctly. • Guide students to practice till they become competent • Assess the students. • Demonstrate counterboring/counter drilling • Students to be led to demonstrate safety skill during drilling • Guide students to handle hand/machine reamers • Assess students	• Twist drills, kits • Grinding machine • Radial drilling m/c • Bench drilling m/c • Pillar drilling m/c • Column drilling m/c • Reamers
	General Objective 5.0: Understand the applications of various types of screw threads, rivet and cut screws by hand.					
	5.1 Sketch the thread forms below and state their applications: a. the ISO metric thread	▪ Give detailed notes with diagrams that will show the	▪ Diagrams/charts of thread forms ▪ Parallel reamers,	• Carryout reaming operation on bench/lathe	• Demonstrate steps for reaming small and large	• Lathe • Reamers • Charts of thread

	b. the unified thread c. Whitworth and British fine threads d. British Association (BA) thread e. British Standard pipe f. Square thread g. Acme thread h. Buttress thread 5.2 Sketch and state the functions of:- a. taps (taper tap, second tap, plug) b. tap wrench c. die and die stock 5.3 Explain the meaning of tapping size or tapping drill and estimate its value in given situations using formulae such as:- T = D – P Where T = tapping diameter D = thread top diameter P = pitch	various forms of thread and their uses. ▪ Prepare notes that will state the functions of taps, tap wrench, die and die stock. ▪ Give detailed notes that will explain the meaning of tapping size or tapping drill and estimate its values using the formulae: T = D – P ▪ Where T = tapping Diameter ▪ D = thread top diameter and ▪ P = Pitch	taper reamers twist drills.	• Select correct speeds for reaming small and large holes • Carry out tapping on bench/lathe • Calculate with specific assumptions, halves of tapping drill and tapping sizes	holes. • Demonstrate steps for taping	forms • Twist drills • Jacobs, check/key • Reduction sleeves • Tap • Tap wrench • Die • Die stock
	5.4 State precautions to be taken when taping on the bench. 5.5 Describe and differentiate types of rivets, e.g. Snap and pan head, mushroom and counter-sunk head, flat head, doped rivet, etc. 5.6 Sketch the rivet set and state its use. 5.7 Calculate the diameter of rivet and riveting allowance in given situations.	▪ Prepare notes that will state precautions to be taken when tapping on bench. ▪ Give notes and diagrams that will describe and differentiate types of rivets, rivet sets, and its uses and guide to calculate the diameter of rivet and riveting allowance. ▪ Assess the students.	▪ Rivet sets, drills.	• Prepare sample exercises on tapping on the bench • Differentiate various types of rivets.	• Perform samople exercises on tapping on the nech • Students to be allowed to categorise rivet types • Assess the students • •	• Rivet sets • Drills of various stages/types • Posters and charts and tolerances, limits and fits.
	General Objective 6.0: Understand the ISO tolerances and fits and its application in engineering production.					
	6.1 Differentiate between the	▪ Give detailed notes	▪ Charts on tolerances,	• Display standard	• Employ the use of	

	following: a. nominal size b. limits (upper and lower) c. tolerance (unilateral and bilateral) d. fit (clearance, transition interference). 6.2 Explain the importance of tolerance and fit in engineering production and describe briefly the ISO system of limits and fits. 6.3 Determine by calculation the amount of tolerance and types of fit in given situations.	that will differentiate between nominal size, limits, tolerance and fits. ▪ Prepare detailed note and diagrams that will explain the importance of tolerance and fits in engineering production as well as describing the ISO systems of limits and fits. ▪ Give notes and explanations that will guide in calculating the amount of tolerance and types of fits in given situations. ▪ Assess the students.	limits and fits.	charts on tolerances, limits and fits • Produce specific components to ISO limits • Explain procedures in calculating tolerances and fits, given a set condition.	question and answer to test subject comprehension • Guide students to produce given part • Guide students in calculating tolerances and fits • Assess students	• Posters and charts and tolerances, limits and fits.
	General Objective 7.0: Produce simple Engineering components on the bench.					
	7.1 Explain layout procedures from working drawing of simple engineering components or tools such as:- a. open ended spanner b. engineer's try square c. tool maker's clamp d. plate bracket or gusset (involving rounds, angles, holes) e. centre square.	▪ Teachers to prepare notes and explanations to guide the students in producing simple engineering components in 7.1 ▪ Assess the students.	▪ Lesson notes. ▪ Diagrams and charts.	• Produce simple components froim drawings covering: open – ended spanner, try square, tool clamp, plate brackets etc.	• Guide the students to produce simple components • Assess the students	• Engineering design drawings • Lesson notes • Diagrams • Charts
	General Objective 8.0: Understand the essential features and working principles of the centre lathe and use it to carry out basic operations such as plain turning, stepped turning, facing taper turning, chamfering, and under-cutting.					
	8.1 Describe the essential features of a centre lathe and state their functions e.g. lathe bed, headstock, tailstock, saddle or carriage, etc. 8.2 Explain the working principles	▪ Prepare detailed notes that will describe the essential features of centre lathe and their functions. ▪ Give notes and	▪ Centre lathe and accessories like catch plates, face plates, centres fixed and traveling steadies. ▪ Charts of centre	• Demonstrate working principle of lathe m/c • Demonstrate lathe setting up lathe machine with	• Guide students to practice till competence • Demonstrate tool grinding and job setting procedures	• Centre lathe/accessories such as catch plates, face plates, traveling steadies • Charts of centre

10	of the centre lathe. 8.3 Identify and state the functions of centre lathe accessories such as: catch or driving plate, face plate, lathe dog or carrier, lathe centres, fixed and traveling steadies. 8.4 Explain the difference between the centre lathe, capstan lathe, in terms of their main features and functions. 8.5 Name types of cutting fluids used for lathe turning operations and state their composition and purposes. 8.6 Outline safety precautions to be observed when working on the lathe. 8.7 Sketch and describe common tools: e.g. butt-brazed tool, tipped tool, bit and holder. Note: Tool description should include tool materials, e.g. plain carbon steel, high speed steel, satellite, cemented carbide, diamond. 8.8 Explain with sketches the functions of tool angles (rake, clearance), and state their values for different metals to be machined.	diagrams that will explain the working principles of centre lathe and functions of its accessories. ▪ Give explanations that will show the difference between centre lathe and capstan lathe in terms of their main features and functions. ▪ Prepare notes that will list types of cutting fluid used for lathe turning operations and their composition and purposes. ▪ Prepare detailed notes and explanation that will outline safety precautions, common tools and materials used in marking them. ▪ Give detailed notes and diagrams that will explain the functions of tool angles (rake, clearance) stating their values for different metals to be machined. ▪ Assess the students.	lathe and capstan lathe. ▪ Round note turning tool, finishing tool, site finishing, knife tools, form tools, parting off tools, and boring tools.	accessories to include change of speed, fixing of chucks, holding of work. • Grind/sharpen a cutting tool correctly to needed tool angle • Perform with facility the following operations, turning, facing, boring, threading etc. • Demonstrate the use of contents • Discuss safety rules for lathe m/c • Carryout chuck work involving facing, knurling • Demonstrate importance of tool angles • Demonstrate how to produce simple components to specific finish	• Assess the students • Guide students in selecting coolants • Students to understand working safety with lathe m/c • Guide students to select appropriate tools • Guide students to produce simple components like open ended spanner, engineers, square etc. • •	lathe capstan lathe, • Turning tools • Forming tools • Parting off tools • Boring tools • 3-jaw chuck.
	8.9 Differentiate between various tool shapes and state their uses e.g. Round nose rougher, fine finishing, side finishing, knife tool, form tool, parting off tool, boring tool, etc. 8.10 Explain with sketches the effects of wrong setting cutting	▪ Give notes and diagrams of various tool shapes and their uses. ▪ Prepare detailed notes and explanations to cover 8.10 to 8.15. ▪ Solve many	▪ Charts on tool height ▪ Charts and diagrams of different machining operations.	Demonstrate work chattering/tool drag/vibration due to improper tool setting/cutting speed Carry out metal	Guide students on proper selection of speed, tool, and mounting tools to avoid rubbing, vibrations etc. Assess students	Ditto

11-12	tools: e.g. vibration and chatter, tool rubbing against or digging into the job. 8.11 Define cutting speed and feed with respect to lathe operation. 8.12 Calculate the cutting speed and feed for given turning operation. 8.13 Estimate the rate of metal removal and time required for carrying out specified turning operations. 8.14 State precautions to be observed when turning between centres. 8.15 Set up the lathe and carry out basic turning operations between centres. 8.16 Compute required taper dimensions from given data using taper ratio angle formulae, i.e. $\text{Taper Ratio} = \frac{D2 - d1}{L}$ OR $\text{Tan } \frac{o}{2} = \frac{d2\ d1}{2}$ Where o = taper angle D1 = small end diameter D2 = large end diameter L = length of taper	problems for the students to practice. ▪ Assess the students.		removal by turning operations Demonstrate safe turning operations Describe specific use of traveling steady and steps to ensure concentricity of centres. Demonstrate the requirement to prevent deflection arising from selection of wrong cutting speed and depth of cut.		

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Cooling and Lubrication Systems
CODE: CMV 12
CONTACT HOUR: 5 Hours/week
Theoretical: 1 Hour/week
Practical: 4 Hours/week

GENERAL OBJECTIVES

1. Understand safe working practices using tools, equipment and consumables while working on vehicle cooling systems
2. Understand cooling/heating systems
3. Know the main cooling/heating systems components and their functions
4. Understand the operating principles of cooling/heating systems
5. Know engine lubricating systems
6. Know the main engine lubrication system components and their functions
7. Understand the operational principles of engine lubrication systems

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS		
COURSE: Cooling and Lubrication	**COURSE CODE: CMV12**	**CONTACT HOURS: 5Hrs**
GOAL:		
COURSE SPECIFICATION: Theoretical Contents:	**Practical Contents:**	
General Objectives:1.0 Understand safe working practices using tools, equipment and consumables materials while working on vehicle cooling systems	**General Objectives: 1.0** Understand safe working practices using tools, equipment and consumables materials while working on vehicle cooling systems	

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	1.1 Explain safe use of tools/equipment and consumable when working on cooling and lubricating systems 1.2 Explain safe use, storage and disposal of hazardous material such as anti frozen agents, anti corrosive agents etc. 1.3 Explain hazards involved in working on a running engine. 1.4 Explain why battery/external electrical sources should be removed during work, electrical shock, damage to components/units due to removal procedures, electric welding etc. 1.5 Identify causes of accidents and accident prevention e.g - Human - Environmental 1.6 Identify the safety procedure to prevent injury to self and colleagues	• Demonstrate the safe use of these working tools/equipment and consumable • List safe ways at which hazardous materials can be used, kept and disposed. • List hazards involved in working on a running engine. • State the reason why battery /external electrical sources should be removed during work, electrical shock etc.	• Thermometer • Pressure gauge • Flip chart • Required hand tools/equipment • Consumable • White marker board • Charts • Overhead projector • Instructional materials • models	1.1 Demonstrate safe use of tools/equipment and consumable material. 1.2 Describe to the students the safe use, storage and disposal of hazardous materials. 1.3 List to students some hazards encountered when working on a running engine. 1.4 Describe why battery/external electrical sources should be removed during work, damage to component/unit due to removal procedures.	• Show safe use of tools/equipment and consumables. • Guide the students on the safe use, storage and disposal of hazardous materials. • Demonstrate common hazards involved in working on a running engine. • Demonstrate why battery/external electrical sources should be removed during work, electric shock, damage to component/unit due to removal procedure.	• Thermometer • Pressure gauge • Flip chart • Required hand tools/equipment • Consumable • White marker board • Charts • Overhead projector • models
	General Objective 2.0: Understand Cooling/heating system			**General Objective 2.0: Understand Cooling/heating system**		
	2.1 Explain the various types of cooling/heating system.	• State the various types of	• Flip chart • White board marker	2.1 Identify the various types of	• Show the student the different	• Water • Wet type model

	-Liquid -air 2.2 Explain types of water cooling system. 2.3 Explain types of air cooling system.	cooling/heating system. • List types of water cooling system. • List types of air cooling system. • Assess the student.	• Models • Lesson notes • Instructional materials • Over head projector	cooling/heating system. 2.2 Identify types of water cooling system. 2.3 Identify types of air cooling system.	types of cooling/heating system • Guide the student to identify the types of water and air cooling/heating systems • Assess the student.	• Dry type model • Chart • Over head projector
	General Objective 3.0: Know the main cooling/heating systems components and their function.			**General Objective 3.0: Know the main cooling/heating systems components and their function.**		
	3.1 List the main component of a water cooling/heating system. - Radiator/heater - Expansion tank - Hoses - Thermostat - Fans - Impeller/pump 3.2 Explain the functions of the main components. 3.3 List the main component of an air cooling/heating system. - Fan - Drive belt - cowling 3.4 Explain the function of the main components.	• State the function of the component. • Give detailed notes with diagram that will show the main components of water cooling system	• Flip chart • Hand tool • Wet model cylinder • Dry cylinder model	3.1 Use wet cylinder model to show the main component of water cooling/heating system. 3.2 State the function of the main component. 3.3 Use Dry cylinder model to show the main component of air cooling/heating system. 3.4 State the function of the main component.	• Using the model, dismantle to show the main components of the cooling/heating systems for air and water. • Test the student understanding	• Dismantling tools • Wet cylinder model • Dry cylinder model • Work bench • Flip chart. • Dismantling tools
	General Objective 4.0: Understand the operational principles of cooling/heating systems.			**General Objective 4.0: Understand the operational principles of cooling/heating systems.**		
	4.1 Explain the working principles for a. water b. air cooling/heating systems 4.2 Explain the heat transfer process involved.	• Give detail notes and explanation in each case. • Use questions and answers to determine comprehension. • Assess the	• Flip chart • White board marker • Models • Over head projector.	4.1 Using a flow chart diagram explain the explain the water flow circuit. 4.2 Assess the students. 4.3 Demonstrate how heat can be	• Demonstrate on the dismantled modul how heat can be dissipated in the system. • Assess the students.	•

		students.		transferred.		
	General Objective 5.0: Know engine lubricating systems			**General Objective 5.0: Know engine lubricating systems**		
	5.1 Define lubrication? 5.2 Explain the term lubricating system. 5.3 Explain the following: a. Wet sump b. Dry sump	• Use notes to explain to students wet and dry sump. • Assess the students.	• White board • Flip chart • Instructional materials • models	5.1 Use model to illustrate lubrication 5.2 Use model to illustrate a lubricating system. 5.3 Differentiate between wet and dry sump.	• Demonstrate on the dismantled modul how heat can be dissipated in the system. • Give notes as well as demonstrate with model a lubricating system of an engine. • Assess the students	• Audio visual aid • Flip chart • Model engine
	General Objective 6.0: Know the main engine lubrication system component and their function.			**General Objective 6.0: Know the main engine lubrication system component and their function.**		
	6.1 Identify the main component of a lubrication system such as oil pumps, main oil filters, pressure relief etc. 6.2 Explain the function of the main component of lubrication system. 6.3 Identify the various oil grade types. 6.4 Explain how oil is distributed by splash mist and pressure feed systems.	• List the main component of a lubrication system. • Use lesson note to explain the function of the main components. • Explain the viscosity, index and classification of lubricant. • List application of each system. • Identify each type. • Assess the students	• Dismantling tools. • Class of lubricant. • Models • Chart • Overhead projector • Red wood	6.1 Show the main parts of a lubrication system. 6.2 State the function of the main components. 6.3 Identify the various lubricants used in motor vehicle. 6.4 State how oil is distributed by splash mist and a pressure feed system.	• Show students the main parts and state their functions. • Show students the different Grade of lubricant. • Differentiate each application.	• Dismantle tools. • Class of lubricant. • Models • Chart • Overhead projector • Red wood
	General Objective 7.0: Understand the operating principles of engine lubrication system.			**General Objective 7.0: Understand the operating principles of engine lubrication system.**		

	7.1 Explain the working principles of engine lubrication system. 7.2 Explain a. Cooling effect b. Cleaning effect c. Corrosion resistance d. Noise reduction e. Reduction of frictional force in a lubrication system. 7.3 Explain the common faults within the lubrication systems.	• State the operational principle of engine lubrication system. • Use notes to explain the following in 7.2 • State the common faults within lubrication systems.	• Chart • White board • Pressure gauge • Models	7.1 Identify the operating principles of engine lubrication systems. 7.2 State the function of a lubrication system of an engine. 7.3 List the common faults of a lubrication system.	• Assess the students to test comprehension. • Demonstrate with the use of a model the effect of a faulty lubrication system. • Demonstrate with a model the common faults of lubrication system.	• Chart • White board • Pressure gauge • Models

CODE: CMV 13
CONTACT HOUR: 3 Hours/week
Theoretical: 1 Hour/week
Practical: 2 Hours/week

GENERAL OBJECTIVES

1. Understand safety precautions relating petrol engine maintenance.
2. Know the different varieties of petrol engines
3. Understand the construction and functions of petrol engine and restore it to peak performance.
4. Understand the working principles of valves fuel systems of the motor vehicle

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Introduction to petrol engine and fuel circuit		**COURSE CODE: CMV13**		**CONTACT HOURS: 3Hrs**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:			**Practical Contents:**			
General Objectives: 1.0 Understand safety precautions relating petrol engine maintenance.			**General Objectives: 1.0 Understand safety precautions relating petrol engine maintenance.**			
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain safe use of tools/equipment and consumable when working on petrol engine. 1.2 Explain safe use, storage and	• Demonstrate the safe use tools/equipment and consumable • List safe ways at	• Thermometer • Pressure gauge • Flip chart • Required hand tools/equipment	1.1 Demonstrate safe use of tools/equipment and consumable material. 1.5 Describe to the	• Show safe use of tools/equipment and consumables. • Guide the students on the	Ditto

	disposal of hazardous material such as anti frozen agents, anti corrosive agents etc. 1.3 Explain hazards involved in working on a running engine. 1.4 Explain why battery/external electrical sources should be removed during work, electrical shock, damage to components/units due to removal procedures, electric welding etc. 1.5 Identify causes of accidents and accident prevention e.g - Human - Environmental 1.6 Identify the safety procedure to prevent injury to self and colleagues	which hazardous materials can be used, kept and disposed. • List hazards involved in working on a running engine. • State the reason why battery /external electrical sources should be removed during work, electrical shock etc.	• Consumable materials • While marker board • Charts • Overhead projector	students on the safe use, storage and disposal of hazardous materials. 1.6 List to students some hazards encountered when working on a running engine. 1.7 Describe why battery/external electrical sources should be removed during work, damage to component/unit due to removal procedures.	safe use, storage and disposal of hazardous materials. • Demonstrate common hazards involved in working on a running engine. • Demonstrate why battery/external electrical sources should be removed during work, electric shock, damage to component/unit due to removal procedure.	
	General Objective 2.0: Know the different variety of petrol engine that exist.			**General Objective 2.0: Know the different variety of petrol engine that exist.**		
	2.1 Explain types of petrol engines e.g. 2 stroke engine, 4 stroke engine. 2.2 Explain the cylinder layout e.g. - single - multi - in-line - V - Horizontal - Opposed, etc. 2.3 Identify the various engine locations e.g. - front - rear - mid - transverse - longitudinal etc.	• Describe with aid of diagram 2 stroke 4 stroke • Use chart to show the different cylinder layout • Explain with the aid of a diagram/chart the various engine locations.	• Charts • Models • Overhead projectors • Lesson notes • While marker board • marker	2.1 Identify the types of petrol engine with the use of models. 2.2 Distinguish between the cylinder layouts using charts. 2.3 State the various engine locations.	• Demonstrate with the use of model the difference between 4-stroke and 2-stroke. • Use chart to show the different cylinder layout. • Use chart to show the various engine locations. • Assess the students to test their understanding	• Charts • Models • Overhead projectors • Lesson notes • While marker board • marker
	General Objective 3.0: Know the main engine components and their function			**General Objective 3.0: Know the main engine components and their function**		
	3.1 Identify the main component	• List the main	• Charts	3.1 Dismantle the	• Giude student to	• Charts

	of the petrol engine e.g. - cylinder lead - cylinder block - manifolds - valve mechanism - timing gears - cam shaft etc. 3.2 Explain the function of the main components of petrol engine. 3.3 Explain the following term: - compression ratio - top dead centre - bottom dead centre - cylinder bore - stroke - clearance volute - swept volume	component of a petrol engine and use lesson notes to explain. • State the functions of the main component of a petrol engine. • Use notes to explain the following listed in (3.3)	• Models • Overhead projectors • Lesson notes • White board • Marker • Instructional materials	engine model and identify various components. 3.2 Demonstrate using the model engine and explain the function of each. 3.3 Explain and show on the engine model to carryout compressor test. 3.4 Put the piston on a BDC and TDC.	dismantle the engine model and show the main petrol engine component. • Allow students to try the identification process • Present each component and explain function • Demonstrate using the engine model to explain BOC, TOC and carryout compression test, swept volume and check for clearance volume.	• Models • Lesson notes • White board • Charts • Modesl • Feeler guage • Lesson notes • White board • marker
	General Objective 4.0: Understand the basic working principles of petrol engine and restore it to peak performance.			**General Objective 4.0: Understand the basic working principles of petrol engine and restore it to peak performance.**		
	4.1 Explain the working principles of petrol engine e.g. convert chemical (heat) energy to mechanical energy/produce power and torque at the fly wheel. 4.2 Explain the four stroke cycle operation. 4.3 Explain the processes of engine tone-up (peak performance) 4.4 State the function of a	• Give detail notes and explanation as appropriate. • Use chart to illustrate every action of a stroke. • Use appropriate equipment to	• Charts • Models • Overhead projectors • Lesson notes • White board • Marker • tools	4.1 Show with the model how the mixture of air and petrol gets into the engine and process combustion. 4.2 Show the action of each of the four stroke with charts. 4.3 Explain steps and reason for carrying out tune-up.	• Demonstrate using a carburetor to show how mixture of air petrol is formed. • Demonstrate the combustion process. • Demonstrate using the model when each	• Charts • Models • Overhead projectors • Lesson notes • White marker board • Marker • Dismantling tools

	carburettor 4.5 Identify the different types of carburetors and their applications 4.6 Identify the main components of a caburretor and the operating principles. 4.7 State the causes and remedies of faults including checking fuel pump pressure and fuel leakage.	carryout tune-up. • Use lesson notes to explain • Assess the students		4.4 Demonstrate procedures for the disassembly and assembly of a carburetor including cleaning of parts	cylinder is at a particular stroke. • Carry-out adjustment settings and measurement on the engine to the manufacturer specifications. • guide students to disassembly and assembly of a carburetor unit • assess students	
	General Objective 5.0: Understand the vehicle fuel systems components, principles and operation			**General Objective 5.0: Understand the vehicle fuel systems components, principles and operation**		
	5.1 Explain carburetor systems. 5.2 Single/multiple out petrol injection systems. 5.3 List the main component of a petrol fuel system such as: 3.5 fuel tanks 3.6 filler cap 3.7 venting 3.8 level sensor 3.9 mounting 3.10filters 3.11carburetor 3.12petrol injection unit 3.13fuel lift pump etc. 5.4 Explain the function of the main components. 5.5 Explain the operational principles of the fuel system.	• Give detail note on the carburetion system. • Differentiate the difference between carburetor and fuel injection system. • Use lesson notes to explain the functions of the main component. • Assess the students • Use lesson note	• Flip Charts • Models • Lesson notes • White board • Marker • Instructional materials • Over head projector	5.1 Distinguish between the carburetor and petrol injection system. 5.2 Demonstrate with a dismantled model to show the main components of petrol fuel system. 5.3 Explain the function of the main component. 5.4 State the operational principles of the fuel system. 5.5 Identify the procedure used to mount fuel tank	• Dismantle the carburetor and show all the main parts. • Dismantle the injection system part. • Demonstrate their function. • Use model to show the various component of the fuel system. • Use notes to explain. • Use model to illustrate the operational	• Charts • Models • Overhead projectors • Lesson notes • White marker board • Marker • Dismantling tools • Instructional materials

	5.6 Describe the properties of fuel and their applications 5.7 Explain the procedures for mounting fuel tank 5.8 Explain the common faults on fuel tank, their causes and remedies, to include leakages, blockages, dilution and corrosion 5.9 Explain the routine maintenance and system adjustment necessary on petrol engines and fuel systems. 5.10 Explain systematic testing procedures by aural, visual and functional methods to establish the condition of, and locate faults in petrol engines and fuel systems	to explain • Study manufacturer data or manual with students		5.6 Apply manufacturers data	principles. • Guide the student to mount a fuel tank • Guide the students to dismantle the fuel tank • Guide the students to locate information on the manual • Assess the students	

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Introduction Diesel and Fuel System
CODE: CMV14
CONTACT HOUR: 3 Hours/week
Theoretical: 1 Hour/week
Practical: 2 Hours/week

GENERAL OBJECTIVES

1. State the purpose of diesel fuel system
2. Understand the constructional difference between petrol and diesel engine
3. Understand the different variety of diesel engine in existence
4. Understand the diesel fuel system, functions and operational principle

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS					
COURSE: INTRODUCTION TO DIESEL ENGINE AND FUEL SYSTEM	**COURSE CODE: CMV 14**		**CONTACT HOURS: 3Hrs/week**		
GOAL:					
COURSE SPECIFICATION: Theoretical Contents:			**Practical Contents:**		
General Objectives: 1.0 State the purpose of diesel fuel system			**General Objectives: 1.0 State the purpose of diesel fuel system**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 State and explain major component of the fuel system. 1.2 Distinguish between diesel fuel system and petrol fuel system. 1.3 Explain and illustrate the	• Use note to explain. • Use note to show them where the both engine differs.	• Chart • Overhead projector • Models • C-D rom	1.1 Explain and identify major component of the system. 1.2 Identify the diesel engine	• Show the components and name them. • State their likely faults. • Show and compare the differences. • On a chart show a line	• Components of a diesel fuel system. • Model • C-D rom • Charts

	diesel fuel circuit. 1.4 Identify diesel injection pump component and function. 1.5 Apply safety measure while working on fuel injection system.	• Illustrate with aid of diagram the diesel fuel circuit. • Use drawings to state function of component • List hazards relating to the fuel injection system.		and petrol engine differences. 1.3 Show and explain the fuel line from tank to injector nozzle. 1.4 Dismantle the pump and identify its parts. 1.5 Mobility to carry out safe working principle.	diagram of the fuel line and show position of each component • Demonstrate the correct methods to dismantle fuel pump and identify its parts. • Demonstrate on how to use equipment to perform injector test safely.	• Injector nozzle pressure tester.
	General Objective 2.0: Understand the constructional difference between petrol and diesel engine.					
	2.1 Explain the combustion processes of the C.I.E. and compare with S.I.E. 2.2 Explain the following terms - phasing - calibration 2.3 Explain the procedure for phasing and calibrating various types of injector pumps. 2.4 State safety measure to be observed while phasing and calibrating the injector pump. 2.5 Determine manufacturer's specifications for the various types of pump. 2.6 Explain ways to perform functionality test.	• Use comprehensive note to explain • Illustrate the combustion processes • Use note to explain • Use note and charts to explain • Use note and lecture on safety during the calibration/phasing a pump. • Use manufacturers data to explain and give note. • Use note to explain.	• Overhead projector • C-D rom • Charts • Manual • Model	2.1 Understand combustion processes of the C.I.E and compare with S.I.E. 2.2 Understand key point or actions e.g. [phasing and calibration) 2.3 Carry out calibration and phasing of various injector pump. 2.4 Carry out safe operation during calibration/phasing the injection pump 2.5 Use manufacturers specification in carrying out injection pump works. 2.6 Carry out functionality test	• Show with the aid op visual aid explain the difference • Demonstrate on the model. • Demonstrate on the model while students watch. • Engage students to carry out the operation while teacher supervise. • Demonstrate and engage students to carry out the operation following manufacturers specification. • Use equipment or manual way to carry out test.	• Notes • Text books • Overhead projector • Model • Notes • Phase and calibrate machine • Injector pressure tester • Universal diagonizer (sun scanner) • Manufacturer data • Calibrate and phase machine.

				on injector and injector pump.		
	General Objective 3.0: Understand the different variety of diesel engine in existence.					
	3.1 List and explain types of diesel engine in use. 3.2 Explain and identify various diesel engines e.g. Direct injector system, Indirect Injection, Electronic diesel engine and unit injection pump engine. 3.3 Explain both multi and single cylinder engine.	• Lecture to explain and give notes. • Give a comprehensive note to describe • Give note and explain.	• C-D rom • Overhead projector • Note • Text book	3.1 Identify and describe types of diesel engine 3.2 Identify location of component of different types of diesel engine. 3.3 Carryout repair on both multi and single cylinder engine. Determine types of injector nozzles.	• Note and explain • Show on the model or overhead projector • Demonstrate sequence of identifying type of engine and its data.	• Model • Overhead projector • Text book • Charts.
	General Objective 4.0: Understand the diesel fuel system, functions and operational principle.					
	4.1 State the functions of fuel injection system. 4.2 Illustrate the fuel circuit of a fuel injection. 4.3 Explain the operational principles of fuel injection. 4.4 State the causes and remedies of faults including checking fuel ump pressure and leakage. 4.5 Distinguish between idling speed and MPM. 4.6 Apply procedures for setting idling speed.	• Give note and explain. • Note and drawing the circuit. • Use diagram to explain the operating principles • Use note to explain. List faults and remedies. • Give note to explain the term. • Give note stating procedures for setting idling speed.	• Overhead projector • C-D rom • Text books	4.1 Explain the functions of fuel injector system. 4.2 Carry out fault finding of all kind with the fuel circuit	• Demonstrate faults finding procedures • Guide students in faults finding task • Assess the students performances	• Overhead projector • C-D rom • Text books • Test equipment • tools

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Service Station Procedures II
CODE: CMV15
CONTACT HOUR: 7 Hours/week
Theoretical: 2 Hours/week
Practical: 5 Hours/week

GENERAL OBJECTIVES

1. Maintain tyres in good working condition and carry out wheel alignment.
2. Understand the construction and operation of compression ignition engines.
3. Understand the safety precautions relating to the handling and storage of fuels and oils.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: SERVICE STATION PROCEDURES II	**COURSE CODE: CMV 15**			**CONTACT HOURS: 7hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0 Maintain tyres in good working condition and carry out wheel alignments				**General Objectives: : 1.0 Maintain tyres in good working condition and carry out wheel alignments**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain markings and codes on tyres e.g. load/speed ratings, tyre size/aspect ratio 1.2 With the aid of sketched identify tyre construction e.g. radial bias belted. 1.3 Identify different tyres of wheels construction e.g.	• Explain with appropriate aids • Ask students to explain topics • Assess students	• Tyres and appropriate teaching materials	1.1 Demonstrate to students how to: - To vulcanize tube and tubeless tyres - Carry out wheel balancing with the appropriate equipment	• Teacher to demonstrate for students to practice till they become competent • Assess the students	• Tyres • Tools box • Live vehicles • charts

	split rim well tyre etc. Explain reason for well 1.4 List materials used in wheel manufacture and explain reason 1.5 Explain procedure involved in tyre removal and refitting. Identify safety aspects.			- Check tyres for various wear and possible wheel distortion - Repair or replace distorted wheels - Identify tyres sizes for categories of vehicles		
	General Objective 2.0: Understand the combustion process in spark and compression ignition engines					
	2.1 Identify the names of the main components/parts of a multicylinder engine and draw line diagrams of cylinder arrangements, crank throws and vee-arrangements. 2.2 Explain constructional details of cylinder blocks, heads and gaskets, cylinder liners and sumps. 2.3 Explain the working sequence of two, and four stroke engine. 2.4 Explain the functions of a cylinder gasket and state the faults that can occur due to incorrect tightening of cylinder head gasket. 2.5 Explain the viscosity of lubricants, its variation with temperature and viscosity index. 2.6 Explain the use of additives to control detonation and deposits. **2.7** Draw/sketch the lubricating systems of an engine showing valve arrangements and camshaft	• List parts of a 4 cylinder engine. • Sketch an in-line 4 cylinder and V-type 4 cylinder engine. • Sketch cylinder head of an engine showing details, and explain the importance of gasket. Explain cylinder liners and their importance. • Describe sump and state its functions. • State the firing orders/sequences of two, four, six and eight cylinder engines. • State the importance of choosing engine oil in relation to its viscosity with temperature	• Complete engine	2.1 Demonstrate with the aid of a 4 cylinder model identify the main components 2.2 use chart to show those components that cannot be readily seen and the working principles of a 2 and 4 stroke engine 2.3 explain the need for additives 2.4 Dismantle a model engine and remove, check and replace cylinder head gasket	• Guide student to identify the main components and their basic functions to the engine system • Guide student to differentiate the difference between 2 and 4 stroke engine • Use chart to show valve arrangement in the engine system • Demonstrate for students to practise • Assess the students	• Complete engine • Charts • Lesson notes • Instructional materials

	drives, fuel supply systems, air and water cooling systems and circuit diagrams for ignition and starting systems.	change. • Explain the purpose of additives in engine oil. • Sketch lubricating system of an engine and show all the important points of lubrication.				
	General Objectives 3.0: Understand Service Station Operation Procedures					
	3.1 State the features, applications and properties of fuels, lubricants, tyres, batteries and vehicle accessories. 3.2 Explain forecourt procedure. 3.3 Operate forecourt equipment such as battery charger, air compressor, water compressor, vehicle light/beam setter, etc.	• List service station equipment. • Explain functions of a service station. • List services offered at service station. • Explain forecourt procedure • Demonstrate the use of battery charger, beam setter, etc.	• Lesson plan • Chalkboard • Poster/Charts, hand tools • Battery charger • Beam setter etc.	3.1 apply the forecourt procedure on compressors	• Ask students to list service station equipment and the basic services offered by service station	• Lesson plan • Chalkboard • Poster/Charts, hand tools • Battery charger • Beam setter etc
	General Objective 4.0: Understand the properties of fuels and oils					
	4.1 Define the following properties of fuel, and oil – viscosity index, volatility, flash point, cloud point, composition, calorific value, cetane rating, octane rating, oil additives	• Define properties of fuel • Define properties of oils. • Define viscosity index, volatility, flash point, cloud point, composition, calorific value,	• Lesson plan • Testing equipment • Different types of graded oils • Sketched	4.1 Define the following properties of fuel, and oil – viscosity index, volatility, flash point, cloud point, composition, calorific value, cetane rating, octane rating, oil additives	• Ask students to explain the various properties. • `Assess the students	• Lesson plan • Chalkboard • Poster/Charts, hand tools • Battery charger • Beam setter etc

		octane rating, octane rating and oil additives. • Explain safety conditions necessary in handling or storing fuels and oils				
	General Objective 5.0: Understand the safety precautions relating to the handling and storage of fuel and oil.					
	5.1 Define safety precautions in using fuels and oils 5.2 Enumerate the precautions necessary to avoid fuel oil contamination when stored or handled. 5.3 Describe the health hazards due to handling of fuel oil and the required precautions. 5.4 State the safety precautions to be observed when dealing with high pressure fuel injection system in-situ and when using test equipment. 5.5 Draw a cross section of a sedimentor and state its function and indicate the fuel flow path. 5.6 Define or explain the action of an agglomerator filter 5.7 Sketch a typical duel filter and state the need for constant maintenance.	• Explain the functions of fuel in motor vehicles • List functions of oil in the motor vehicle • Name and sketch types of fuel pumps • Name and sketch types of oil pumps • Explain steps in changing engine oil. • Assess students	• Use typical fuel pump models • Chalkboard • Posters	5.1 demonstrate these safety precaution on live vehicle for the students to see 5.2 use a model to show fuel flow path 5.3 show students the different types of filters 5.4 apply safety precautions	• Guide students carry out these safety standards. • Assess the students	

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Electrical Science
CODE: CMVS 1I
CONTACT HOUR: 3 Hours/week
Theoretical: 2 Hours/week
Practical: 1 Hour/weeks

GENERAL OBJECTIVE:

1. Understand the concept of magnetism and magnetic
2. Understand the concept of electromagnetism and electromagnetic induction
3. Understand the concept of inductance and its applications
4. Understand the fundamentals of a.c. theory

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHNAICS						
Course: ELECTRICAL SCIENCE			**Course Code: CMVS II** **Contact Hours: 3Hrs/week**			
Course Specification: Theoretical Content				**Course Specification: Practical Content**		
	General Objective: 1.0 Understand the concept of magnetism and magnetic circuits.			**General Objective 1.0: Understand through experiments the a.c fundamentals and circuits**		
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Special Learning outcome**	**Teachers Activities**	**Resources**
	1.1 Define magnetic flux, magnetic flux density magnetic motive force, magnetic field strength, reluctance, permeability of free space (magnetic constants), relative permeability. 1.2 State the symbols, units and relationships of terms in 1.1 1.3 Draw the electrical	State the general concept of magnetism and electromagnetism The teacher is to derive formulae for field strength force etc. Show analogies between electrical and magnetic circuits.	• Magnetic Writing Board, textbooks, coil of conductor, magnetic materials, magnet, calculator writing materials.	1.1 Determine by experiment the B-H curve for magnetic material (Hysterisis curve) 1.2 Perform experiment on a magnetic energy loss in a magnetic material.	Ask students to perform the experiments with minimum error	Magnet, inductors, voltmeter, ammeter, flux meter, practical manual, practical notebook, measurement and instrumentation laboratory.

	equivalent of a magnetic circuit, with or without air-gap. 1.4 State analogies between electrical and magnetic circuits 1.5 Solve simple magnetic circuit problems 1.6 Distinguish between soft and hard magnetic materials.	Solve problems in the class.				
	General Objective: 2.0 Understand the concept of electromagnetism and electromagnetic induction					
Week	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**			
	2.1 Explain the magnetic effect of electric current 2.1 Draw magnetic fields around straight conductors, adjacent parallel conductors and solenoids. 2.2 Explain the force on a current carrying conductor in a magnetic field. 2.3 State the direction of the force in 2.4 2.4 Derive the expression for the magnitude of the force in 2.4 (i.e. F = BIL Newton) 2.5 Explain the concept of electromagnetic induction. 2.6 State Faraday's Laws of electromagnetic	The teacher to show right hand rule and explain the concept of electric field and electromagnetic Induction.	Chalk Board, textbooks, coil of conductor, magnetic materials, magnet, and Calculator/ writing materials.	2.1 Verify by experiment faraday's law of electromagnetic induction. 2.2 Perform experiment on Lenz's law of electromagnetic induction.		

	induction. 2.7 State Lenz's law of electromagnetic induction 2.8 Derive the expressions for magnitude of e.m.f induced in a conductor or a coil. 2.9 Solve problems involving 2.6 to 2.10 above. 2.10 State the applications of electromagnetic induction.					
	General Objective: 3.0 Understand the concept of inductance and its applications					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	3.1 Define self and mutual inductance. 3.2 State the symbols and units of the terms in 3.1 above. 3.3 State the expression for the equivalent inductance of inductances connected in series and in parallel. 3.2 State the expression for the induced voltage across an inductor. 3.3 State the expression for inductance in coupled coils.	Explain mutual inductance and how to calculate various parameters. Show with examples how energy is stored.	Recommended textbooks, writing materials, chalkboard, chalk, and calculator.	3.1 Determine by experiment the inductance of a coil. 3.2 Determine by experiment energy lost in an inductor.	Conduct the experiments with students. Arrange the practical session in such a way that students participate actively in it.	Basic Electricity, Measurement and Instrumentation Laboratory, Inductors, Power Supply Unit.

	connected in series aiding or opposing. 3.4 Derive an expression for energy stored in an inductor. 3.5 Solve problem involving 3.3 to 3.6. 3.6 Describe using suitable diagram, the operation of the induction coiled in a car ignition system.					
	General Objective: 4.0 Understand the fundamentals of a.c. theory.					
WEEK	**Specific Learning Outcome:**	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	4.1 Describe the production of an alternating e.m.f. by a rotating coil in a magnetic field. 4.1 Sketch a.c. waveforms both to scale and not to scale. 4.2 Define r.m.s, instantaneous, average, and peak values, period, and frequency of an a.c. waveform. 4.3 State relationship between instantaneous and peak values of a sinusoidal wave. 4.4 Solve problems involving 4.2. to 4.4 4.5 Solve problems graphically on a.c	• The teacher should explain in detail the theory of alternating current and voltage. • Solve problems on a.c circuits.	• Recommended textbooks, writing materials, chalkboard, chalk, and calculator.	4.1 Demonstrate by experiment the relationship between the following: Frequency period and amplitude of sinusoidal wave. 4.2 Determine by experiment the Q factor of circuit containing R, L, and C in a. Series b. Parallel	Show the students the necessary precautions to be taken during the experiment. Provide well developed practical manuals for the experiments.	Basic Electricity, Measurement and Instrumentation Laboratory, Resistors, Inductors, Capacitors, Ac circuits, Practical manual and Notebooks.

	circuits with different combinations of resistance, inductance and capacitance. 4.6 Differentiate between series and parallel resonance. 4.7 Explain phase lag or phase lead as applied to a.c. circuits. 4.8 Explain the difference between single-phase and three-phase supply. 4.9 State advantages and disadvantages of three phase supply over single phase supply.					

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Transmission and Clutch Systems I
CODE: CMV 17
CONTACT HOUR: 7 Hours/week
Theoretical: 2 Hours/week
Practical: 5 Hours/weeks

GENERAL OBJECTIVE:
On completion of this module, the trainee should be able to:

1. Understand the operating principles of automatic transmission gear box.
2. Understand the operation of synchromesh gear, assemblies and describe the types of bearings used in them.
3. Understand the clutch systems and safety practices involved in its repair
4. Know the clutch components, their functions and the operational principles

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Transmission and Clutch Systems I	**COURSE CODE: CMV 19**			**CONTACT HOURS: 7Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:			**Practical Contents:**			
General Objectives: 1.0: Understand the operating principles of automatic transmission gear box.			**General Objectives: Understand the operating principles of automatic transmission gear box.**			
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the principles of operation of automatic transmission.	• Describe with the aid of sketches the major parts of Automatic transmission and how they function. • Explain the concept of automatic transmission	• Lesson plan] • Chart • Automatic transmission	1.1 Dismantle and re-assemble a gear box 1.2 Carry out the repair on a gear box using the following procedure: • Dismantle gear box, clean and display all the parts on a neat table • Assess wear on parts by	The Teacher should demonstrate the practical • Students should practice till they become competent • Assess the students	• Lesson plan • Relevant tools • Service Manual • Gear box

		• List the advantages and disadvantages of automatic transmission. • Assess the students		inspection/measurement, replace worn out parts and bushes and re-assemble the unit components of gear box as appropriate. •		
	General Objective 2.0: Understand the operation of synchromesh gear, assemblies and describe the types of bearings used in them.					
	2.1 Describe the operation of constant load and bulk ring type of synchromesh device. 2.2 State reasons for the use of helical gears in the gear box and the solution of problems arising from them. 2.3 State types of bearings used in a gear box: a. to absorb end thrust b. to support gears in casing.	• Explain the operation of the constant load and baulk-ring synchromesh devices, state the reason why the constant load is no longer in use. • Discuss the various types of gears that can be used in the manual type gearbox e.g. helical gears. State their faults and possible remedies. • Explain the type of bearings that can absorb various load imposed by the actions of the gears.	• Overhead Projector and transparencies. • Chalk board • Chalk • Lesson plan • Charts	2.1 Examine gearbox synchromesh unit 2.2 Replace synchromesh type gear box. 2.3 Test gear box for correct gear ratio, couple the assembled gear box to engine and to the propeller shaft. 2.4 Examine and adjust gearbox remote control mechanism	The Teacher should demonstrate the practical • Students should practice till they become competent • Assess the students	• White Board • Chart • Models • Marker • Instructional material • Lesson notes

		• Assess the students.				
	2.5 Describe a gear control mechanism and its operation 2.6 State the reason for the utilization of the remote control mechanism 2.7 State the purpose of overdrive units 2.8 Describe the operation of two-speed transfer box in: a. rear wheel drive only b. four wheel drive	• Explain with sketches the gear control mechanism and its operation. • Discuss the need for remote control mechanism and state some of its advantages. • Discuss the functions and advantages of overdrive units. • Explain the operation and the need to have a transfer gear box on the vehicle transmission system. • Assess the students.	• Lesson plan • Chart • Chalkboard • Overhead projector and transparencies • Overdrive unit • Transfer gear box			
	General Objectives: 3.0: Understand the clutch system and safety practices involved in its repairs.					
	3.1 Explain clutch system the function of clutch system 3.2 Identify the different types of clutch systems 3.3 State the advantages, disadvantages and applications of clutch systems. 3.4 Explain the safety precautions and	• Describe the clutch system and its function. • List the advantage and	• White Board • Chart • Models • Marker • Instructional material • Lesson notes	1.1 Show students with models the different types of clutch	• Teacher should guide students to identify the types and their advantages	• White Board • Chart • Models • Marker • Instructional material • Lesson notes • Clutch units

	practices involved in working with clutch system.	disadvantage of clutch systems • Use chart to explain the safety precautions			as well as disadvantages. • Apply safety precaution involved when working on clutch systems	
	General Objective 4.0: Know the clutch components, their functions and the operational principles					
	a. Identify the main components of a clutch system. b. State the functions of the main components. c. Describe the working principles of a clutch system.	• List the main components of a cutch system • Explain the working principles using lesson notes.	• White Board • Chart • Models • Marker • Instructional material • Lesson notes	4.1 Dismantle, examine and re-assemble a single dry plate friction clutch	• Guide students to dismantle and re-assemble the clutch • Examine the dismantled clutch with students	• White Board • Chart • Models • Marker • Instructional material • Lesson notes • Clutch units

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Engine Fault Diagnosis I
CODE: CMV 18
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/weeks

GENERAL OBJECTIVES:

1.0 Understand the working principles of a car air- conditioning system
2.0 Diagnose and rectify faults in the air-conditioning systems.
3.0 Select and install new automobile air conditioners
4.0 Carry out routine service

PROGRAMME: NVC in Motor Vehicle Mechanics						
COURSE: Engine Faults Diagnosis I		**Course Code: CMV 18**		**Contact Hours: 4 Hours/Week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**COURSE SPECIFICATION: Practical Contents:**		
General Objective: 1.0 Understand various safety requirements.				**General Objective: 1.0 Understand various safety requirements**.		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Identify the various safety precautions and signs. 1.2 Discuss the importance of safety precautions and warning signs. 1.3 Discuss when to apply safety various safety precautions notes. 1.4 State the purpose of vehicle specification for models and components 1.5 State the advantages of vehicle specification for models and components	▪ Explain the various safety precautions and warning signs. ▪ Ask the students to state the importance of safety. ▪ Discuss when to apply safety precautions and warning signs. ▪ Classify models and components ▪ Explain the purpose of vehicle specification for models and components ▪ Ask the students to state the reasons for specification for model	▪ Whiteboard & Marker ▪ Recommended textbooks ▪ Lecture notes etc. ▪ National Safety Council for posters.	1.1 Demonstrate procedures for checking/adjusting. ▪ Incorrect mixture setting ▪ Incorrect valve clearance. ▪ Exhaust gas leakage ▪ Oil pressure ▪ Compression test Demonstrate the procedures for: ▪ Fitting a new timing belt/chain/gear ▪ Checking valve timing with and without manufacturers timing marks. ▪ Read faults code on diagnostic scan tool.	▪ Guide the students to carry out the procedures in 1.1. ▪ Explain causes of fault read from scan tool.	▪ Diagnostic Equipment ▪ Live Vehicle Engine ▪ White Board & Maker ▪ Recommended textbooks ▪ Models of engine ▪ Lecture notes. ▪ Workshop Manual

		and components				
	General Objective: 2.0 Understand application of Engine diagnostic equipments					
	2.1 Explain safety notes/warning notes signal test. Design and maintenance worksheet. 2.2 Explain how to carry out maintenance inspection of an engine using engine test bench or endoscope. 2.3 Describe the application of Engine/Analyser scan tools. 2.4 Explain how to carry out a familiarisation visit to a standard engine maintenance shop.	• Perform a signal test on safety notes/warning notes. • Ask the students to calculate maintenance interval. • Perform routine test using engine test bench. • Take the students out to visit a standard automobile workshop. • Guide the students to identified hand tools and equipment use in engine maintenance.	• Signal tester • Worksheet • Engine test bench • Endoscope • Hand tools etc • Engine analyser • Engine CAN Tool	2.1 Test to diagnose the following: • Serviceability • Correct ignition timing • Correct mixture adjustment • Leaking induction system • Exhaust systems • EGR Exhaust gas recirculating • Exhaust gas analyser. 2.2 Demonstrate the following test procedures: • Compression test • Cylinder leak test ▪ Abnormal oil pressure ▪ High/low/intermittent ▪ Cylinder balance test	• Guide the students, to carry out diagnosis process in 2.1 & 2. • Explain tests procedures to students. • Assign them to carry out tests procedure for each item.	• Diagnostic Equipment • Live Vehicle Engine • White Board & Maker • Compression Tester • Exhaust Gas Analyser
	General Objective: 3.0 Understand Fuel Injection System Diagnosis**.**					
	3.1 Describe the concept of engine fuel economy and emission systems. 3.2 Discuss factors affecting fuel consumption. 3.3 Describe the diagnostic and repair techniques of modern petrol engines and fuel system using: Analysers, gauges, Meters etc.	• Explain (EGR) • Explain catalyst convert. • Hydro carbon emission. • Compare the modern diagnostic and repair techniques with the current practice	• White Board & Maker • Recommended Textbooks • Workshop Manual • Vehicle Owner Handbook	3.1 Diagnose the following using electronic engine tester; • Injectors, cold start injectors • Thermal sensors • Pressure regulators 3.2 Demonstrate the procedures for remedying the following	• List various test to be performed. • Assign students on engine tester and demand report appropriatel y. • Assess students ability to	• White Board & Maker • Flip chart Board • Live Vehicle Engine • Exhaust Gas Analyser • Co-Meter

				faults: • Difficult cold starting • Lack of acceleration • High fuel consumption • Poor control of exhaust gas emission. 3.3 Demonstrate methods of checking/adjusting mixture strength CO emission (with specialised equipment).	detect faults in starting vehicles.	

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Braking Systems
CODE: CMV 19
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/week

GENERAL OBJECTIVES

1. Understand the braking systems and safety practices
2. Know the main components of braking systems, their functions and the operational principles.
3. Understand the routine maintenance and system adjustments running on vehicle braking systems
4. Understand diagnostic procedures and faults rectifications in hydraulic brakes.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS					
COURSE: Braking System	**COURSE CODE: CMV19**			**CONTACT HOURS:4Hrs/week**	
GOAL:					
COURSE SPECIFICATION: Theoretical Contents:			**Practical Contents:**		
General Objectives:1.0 Understand the braking systems and safety practices involved			**General Objectives: 1.0 Understand the braking systems and safety practices involved**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the following: - drum brakes - disc brakes - disc brakes - parking brakes - hydraulic - pneumatic - brake fluid 1.2 Explain the braking system of	• Dismantle model to show the components • Use notes and charts to explain the braking system of motor vehicle	• Charts • Models • White board • Marker • Hand tools • Over head projector	1.1 Describe with the model the action of the components 1.2 Show the layout of hydraulic brake	• Guide the student to dismantle and identify the components. • Use model to	• Charts • Models • White board • Marker • Hand tools • Instructional materials • Over head

	motor vehicle 1.3 State the safety precautions to be observed when working on brakes and brake fluids	• Use notes to explain		system. 1.3 Apply safety precautions. 1.4 Carry out the dismantling of component parts of a braking system taking appropriate care for the hydraulic/air pipes	explain the hydraulic brake system. • Use chart to demonstrate the safety precautions.	projector
	General Objective 2.0: Know the main components of braking systems and their functions					
	2.1 Identify the main components of a brake system such as master cylinder, wheel cylinder flexible holes, etc. 2.2 Explain the functions of the main component 2.3 Explain the functions of a hydraulic brake system. 2.4 Explain the operating principle of a hydraulic brake system.	• Use a model to identify the component of a hydraulic brake system • Use notes to explain the functions of the main component • Use lesson to explain the function • Assess the students • Use drawing to describe the operating principles of hydraulic brake system.	• Charts • Models • White board • Marker	2.1 Identify the main component of a hydraulic brake system. 2.2 State the functions of the main components. 2.3 State reasons why braking system is necessary in a motor vehicle. 2.4 Show students how the operating principles of a hydraulic brake system works.	• Guide to dismantle hydraulic brake system. • Help students to identify the components. • Show the students the various components. • State the function of the components to the hydraulic brake system. • Use lesson notes to explain. • Assess the student understanding • Use chart to explain hydraulic brake system. • Distinguish between hydraulic and pneumatic brake system.	• Charts • Model • White board • Marker • Hand tools
	General Objective 3.0: Understand the routine maintenance and system adjustment running on vehicle braking system.					

	3.1 Describe the function of component parts of the hydraulic, air and mechanical brakes. 3.2 Identify common faults on hydraulic brake system and their causes, effects and remedy. 3.3 Outline the procedure to carryout bleeding a hydraulic brake system.	• Use notes and charts to show serviceable components, e.g. master cylinder kits, show/pad working surface and adjusters. • Use notes to explain. • Use notes to explain CD-rom charts.	• Charts • CD-roms • White board	3.1 Demonstrate the operation of the following brake systems - Hydraulic - Mechanical - Air 3.2 Differentiate different break system faults. 3.3 Carryout bleeding on hydraulic brake system to show students the procedures. 3.4 Assess wear and locate leakages in the air/hydraulic system 3.5 Show students how to fit replacement units such as break valve lock actuator, road sensing valve, compressors, reservoirs and break chamber 3.6 Demonstrate to students how to check air line for system leaks 3.7 Diagnose and rectify faults associated with the braking system e.g. brake failure, brake seizure, free play. 3.8 Test vehicle braking system when the vehicle is in stationary position 3.9 Test vehicle braking	• Use live vehicle and model to demonstrate the application of the type of brake systems. • Demonstrate using live vehicle or model to explain common faults; causes and remedy. • Perform air bleeding on the hydraulic brake system • Demonstrate using a live vehicle or model. • Demonstrate each practical for the students to learn • Ensure that the students use the correct tools • Ensure that the students work according to the standard practice • Encourage safe working procedure • Students to practise they are until they are competent	• Live vehicle 3.14model 3.15overhead projector • Tools/equipment

				system on the road		
	General Objective 4.0: Understand diagnostic procedures and fault rectification in hydraulic brakes.					
	4.1 Understand the standard procedure for fault diagnosis. 4.2 Explain the safety precaution in working on breaking system	• Use note, chart and manufacturers to explain the need for standard procedures.	• Notes, datas, text books. • CD-roms	4.1 Apply standard procedure in diagnosing brake faults. 4.2 Diagnose faults and rectify faulty power braking system 4.3 Apply safety precautions associated with braking system	• Demonstrate the standard procedures.	• Manufacturers • Data • Note books • CD-roms • Board

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Workshop Technology
CODE: CMV 20
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/weeks

GENERAL OBJECTIVE:

1. Know auto workshop, its various units, its fundamental set up equipments for proper functioning.
2. Know safety precautions.
3. Use simple measuring and testing instruments.
4. Use and maintain various hand tools.
5. Know drilling and reaming operation.
6. Know various tapping and metal joining operation.
7. Know various welding operations.
8. Know the various wood working tools and operations.
9. Know simple operations on plastics

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECAHANICS						
COURSE: WORKSHOP TECHNOLOGY AND PRACTICE			**Course Code: CMV 20**			**Contact Hours 4hrs/wk**
Course Specification: THEORETICAL CONTENT				**PRACTICAL CONTENT**		
Week	**General Objective: 1.0 Know auto workshop, its various units, its fundamental set up requirements for proper functioning**			**General Objective1.0: Know auto workshop, its various units, its fundamental set up requirements for proper functioning**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	1.1 Explain the purpose and functions of an	• List and describe what	• Plan of a standard	1.1 Acquaint students with the functions of	• Arrange a visit to a standard	• Plan of a standard

	automobile workshop. 1.2 Discuss the various workshop classifications and their applications 1.3 Explain the requirements and procedures for setting up an auto workshop. 1.4 State the importance of the following in a workshop: - Adequate space - Lighting - Environmental control 1.5 Explain the purpose and types of workshop utilities 1.6 Explain the purpose and types of workshop	constitutes an automobile workshop • Describe the various units of an automobile workshop using the layout sketch of a standard workshop. • Describe in detail the procedure of setting up a standard workshop. List out machines and equipment needed and how to properly locate and install, and level them horizontally and vertically • Explain in detail why a good workshop should have adequate space for machine and other equipment. • Also highlight the importance of having	workshop • Plan of a standard auto workshop.	a standard auto workshop. 1.2 Familiarize students with all aspects of auto workshop building, machines equipment and tools for auto servicing and repairs.	auto workshop for students to see for themselves all they have been taught. • Arrange a visit to a standard auto workshop for students to see for themselves all they have been taught. • Arrange a visit to a standard auto workshop for students to see for themselves all they have been taught.	workshop • Plan of a standard auto workshop.

		enough space to move around the workshop without the tendency to stumble onto machines or equipment accidentally. • State the purpose of enough natural lighting during the day and artificial on at night or on cloudy day. • Explain the need for adequate ventilation for auto workshop and the consequence of its absence. • Where appropriate, state the purpose of heating or cooling of the environment as it affects output and productivity • List all the utilities required for the operational purposes of a workshop, like				

		water, electricity, air, gas, etc. • Explain in detail their uses for the auto workshop activities.				
	General Objective: 2..0 Know safety precautions			**General Objective: 2.0 Know safety precautions**		
1 - 2	2.1 State safety precautions 2.2 Explain protective wears 2.3 List all safety rules and regulation.	Explain in details safety rules and regulations in workshop practice.	• White board marker • Test books • Safety poster	2.1 Observe safety precautions 2.2 Operate safety equipment e.g. fire extinguishers, safety water hose etc. 2.3 Use of protective wears 2.4 Observe all safety rules and regulations	• Demonstrate activities 1.1 to 1.4 for the students to learn and ask them to carry out all the activities. • Assess students' knowledge of safety precautions	• Fire extinguisher • Water hoses • Sand buckets • Overalls • safety boots • Goggles • hand gloves.
`Week				**General Objective 3.0:** : Know how to **use simple measuring and testing instruments**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
3 - 4		.		3.1 Perform simple measuring exercises using steel rules, vernier callipers and micrometers. 3.2 Use dial indicators to (i) set up job jobs on the lathe (ii) roundness testing etc. 3.3 Carry out exercises involving flatness squareness, straightness and surface finish test.	• Demonstrate activities 3.1 to 3.3 for the students to learn and ask them to carry out all the activities.	• Micrometers • external & internal Vernier callipers • Steel rule Test • mandrel/test bars, 070 x 300 mm long dial indicator with stand, etc.

Week				**General Objective 4.0 Understand the skills in the use of hand tools.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
5 - 6				4.1 Use marking-out tools on the bench correctly 4.2 Produce simple objects using bench/hand tools such as files, chisels, scrapers, saws etc. 4.3 Maintain files, dividers, saws, gauges try squares, bevel edge square etc.	Demonstrate activities 4.1 to 4.3 for the students to learn and ask them to carry out all the activities	Work bench Bench vice Hammers Set of drills Steel rule Scribers Scribing blocks Inside and outside calliper Surface plate, etc.
Week	**General Objective 5.0: Know drilling and reaming operations**			**General Objective 5.0: Know skills in drilling and reaming operations**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

7-8	5.1 Discuss the nomenclature of a twist drill. 5.2 Discuss the formulae for calculation of speed of various sizes of drills: N = [v x 1000]/ [1xd] Where N = no. of rev/min d=dia. of drill in mm v = cutting speed in mms^{-1}	• Explain in details the features and processes of drilling and reaming operations. • Guide the students to calculate the speed of various sizes of drills	Recommended textbook, Lecture notes, Chalkboard, Chalk ,Duster, etc	5.1 Operate different types of drilling machines 5.2 Carry out operations such as counter-boring and counter-sinking 5.3 Grind drill bits accurately 5.4 Select correct drilling speeds 5.5 Carry out reaming operations i. on the bench ii. on drilling/lathe 5.6 Select correct speeds for reaming small and large holes.	• Demonstrate activities 4.1 to 4.6 for the students to learn and ask them to carry out all the activities.	Radial drilling machine, Bench drilling machine, Pillar drilling machine, Column type drilling machine, Hand reamers, Machine reamers, Tap wrench, Jacobs chuck and key, Medium size Lathe, and Reduction sleeves,

	General Objective 5.0: Know various tapping and metal joining operations.			**General Objective 6.0 Know skills in tapping and metal joining operations.**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	6.1 State the correct tapping drill size 6.2 Explain how to select correct taps 6.3 Explain the processes of fabrication of metal container by knock-up joining. 6.4 Explain soft soldering Process.	• Explain in details the principles of tapping and metal joining operations. Guide the students to calculate the tapping drill size for v-threads.	Recommended textbook, Lecture notes, Chalkboard, Chalk ,Duster, etc	6.1 Select correct tapping drill size. 6.2 Select correct taps 6.3 Carry out tapping operation (i) on the work bench (ii) on drilling machine (iii) on lathe 6.4 Fabricate metal container by Knock-up joining 6.5 Join metals by the grooving technique 6.6 Carry out soft soldering	• Demonstrate activities 6.1 to 6.6 for the students to learn and ask them to carry out all the activities.	_ Taps and wrenches _ Drill chuck and key _ Lathe machine - medium size _ Bench drilling machine _ Pillar drilling machine _ Cutting fluid or lubricants
	General Objective 7.0: Know various welding operations			**General Objective 7.0: Know how to Cut and join metals by gas welding**		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	7.1 List various welding operations. 7.2 Explain the operations listed in 6.1 above	Explain in details the various welding operations e.g. Arc Welding, Gas Welding, etc.	Chalkboard, Chalk, Lecture notes, etc.	7.1 Assemble OXY-acetylene welding plant 7.2 Select various welding regulators, clips, blow pipe and nozzles. 7.3 Perform gas welding by various welding techniques and cut by flame cutting technique	• Demonstrate activities 6.11 to 6.13 for the students to learn and ask them to carry out all the activities.	OXY-acetylene gas welding set Manual rolling machine Guillotine shear Assorted cutting snips Bending machine.
				General Objective 6.2: Know skills in arc welding operations		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

				7.21 Regulate current and determine polarity for metal arc welding. 7.22 Determine polarity and select current 7.23 Select and prepare metal edges for various thickness and technique welding 7.24 Perform various arc-welding by up and down operations.	• Demonstrate activities 7.21 to 7.24 for the students to learn and ask them to carry out all the activities.	Electric arc welding Machine and its accessories
				General Objective 7.3: Understand various techniques for controlling distortion in welding operations.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
				7.31 Apply correctly the stop back and skip method of controlling distortion 7.32 Apply pre and post heating technique	• Demonstrate activities 7.31 to 7.32 for the students to learn and ask them to carry out all the activities.	Electric arc welding Machine, OXY-acetylene welding plant, etc.

	General Objective 7.0: Know the various wood working tools and operations.			General Objective 8.0: Know the skills in the use of various wood working tools.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**
	8.1 State and explain the applications of the following: a. Geometric/ marking out tools e.g. try square, divider and gauges. b. Planing tools e.g. jack, smooth, try planes, spokes shaves, etc. c. Cutting tools e.g. saws, chisels, knives, etc. d. Boring tools. e. Impelling tools e.g hammer and mallet f. Pneumatic tools. 8.2 Describe portable electric hand tools in woodwork e.g. portable saw, planer, drill, sander and jig saw. 8.3 List basic wood working machines such as Surface planning and thicknessing machine, Circular Sawing Machine, Morticing Machine, etc.	• Explain in details the features and operations of various wood working tools.	Recommended textbook, Lecture notes, Chalkboard, Chalk, Duster, etc	8.1 Carry out the applications using the following a. Geometric/ marking out tools e.g. try square, dividers and gauges. b. Planing tools e.g. jack, smooth, try planes, spoke shaves, etc. c. Cutting tools, e.g. saws, chisels, knives, boring tools. d. Impelling tools e.g. hammers and mallets. e. Pneumatic tools. 8.2 Mark out and prepare wood to a given specification using the tools in 7.1 above. 8.3 Maintain all tools in 7.1 above. 8.4 Carry out various wood work operations using the tools in 7.1 above.	• Demonstrate activities 8.1 to 8.4 for the students to learn and ask them to carry out all the activities.	Try square Dividers, Gauges Jack plane, Smooth plane Try plane, Panel saws Chisels, Knives Boring tools Hammers, Mallets Oil stone, Bench/table grinder, Oil can Portable saw Portable planner Portable drill Portable sander Jig saw
				General Objective 9.0: Know skills in simple operations on plastics.		
	Specific Learning Outcome	**Teachers Activities**	**Resources**	**Specific Learning Outcome**	**Teachers Activities**	**Resources**

				9.1 Identify various types of plastic groups such as thermo-setting and thermo-plastic. 9.2 Use conventional metal cutting tools to perform operations on each type in 12.1. 9.3 Carry out joining operations using plastics in 12.1. 9.4 Review previous activities and assess students.	Demonstrate activities 9.1 to 9.4 for the students to learn and ask them to carry out all the activities. Assess the students' practical works and reports.	Set of drills, Wood lathe, HSS cutting tools, Adhesives, etc.

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Workshop Administration
CODE: CMV 21
CONTACT HOUR: 2 Hours/week
Theoretical: 2 Hours/week
Practical: 0 Hour/weeks

GENERAL OBJECTIVE

1.0 Understand automobile workshop staff organization and organizational structure
2.0 Understand basic standard workshop tooling
3.0 Understand basic workshop supervisory management
4.0 Understand the concept of planning and control in automotive workshop
5.0 Understand loading and schedules in automobile workshops
6.0 Understand human relations, industrial psychology and staff motivation
7.0 Understand the capital expenditure budget proposal.

PROGRAMME: NVC in Motor Vehicle Mechanics						
COURSE: Workshop Administration			**COURSE CODE:** CMV 21		**Contact Hours:** 2Hours/week	
Course Specification: Theoretical						
	General Objective: 1.0 Understand automobile workshop staff organization and organizational structure**.**					
	1.1 Describe automobile workshop staff organization. 1.2 State the various types of organization structure. 1.3 Draw and label organization structure.	▪ Guide students on the organization of staff in an automobile workshop. ▪ Assess to produce simple workshop organogram. ▪ Explain using diagrams various types of organization structure.	▪ Whiteboard & Marker ▪ Sample of organogram ▪ Textbook ▪ Flip chart ▪ White Board ▪ Organ Chart Model ▪ Textbooks			
	General Objective: 2.0 Understand standard workshop tooling					
	2.1 Identify various measuring tools, shop hand tool, shop equipment and power tools. 2.2 Explain the differences between various tools and handling precautions. 2.3 Explain tools preservation and accountability.	• List down all the expected tools in a standard workshop relevant to each department. • Demonstrate their uses and identify their areas of application. • Mention various way of tools preservation. • Outline methods of accountability for each tool at every job period.	▪ Whiteboard & Marker ▪ Textbook on Workshop Administration ▪ Flip Chart ▪ Various types of tools.			
	General Objective: 3.0 Understand basic workshop supervisory management					
1	3.1 Describe single workshop organization chart. 3.2 Explain workshop procedure and its	▪ Explain the feature of a workshop organization chart. ▪ Distinguish the various features in	▪ Whiteboard and Marker ▪ Textbook ▪ Automotive /Journal (internet)			

	application. 3.3 Discuss workshop procedure and controls.	a workshop. ▪ Assess the students on a workshop procedures & control.				
	General Objective: 4.0 Understand the concept of planning and control in automotive workshop					
	4.1 Understand the concept of planning and control. 4.2 Differentiate planning and control. 4.3 Discuss the importance of time sheet.	▪ Explain and ask students the concept of planning. ▪ The difference between planning and control. ▪ Explain and ask students the importance of time sheet.	▪ Whiteboard & Marker ▪ Textbooks on Supervision Management ▪ Sample of time sheet.			
	General Objective: 5.0 Understand loading and schedules in automobile workshops					
	5.1 Explain simple chart of events in the workshop. 5.2 Explain the function of reception technician in the workshop. 5.3 Explain the process of work schedule.	▪ Explain and ask students to draw a simple chart of events in the workshop and its hierarchy and their functions. ▪ Assess the students on the organ gram of the workshop. ▪ Evaluate students on allocation of work schedule.	▪ Whiteboard & Maker ▪ Workshop Journal i.e IMI-SAE- (Internet)			
	General Objective 6.0 Understand human relations, industrial psychology and staff motivation**.**					
	6.1 Explain human relations and industrial psychology (details of bonus scheme) 6.2 Explain customer relations. 6.3 Explain elements of motivation. 6.4 Discuss MASLAW Hierarchy of needs.	▪ Explain and ask students to enumerate human relations and industrial psychology. ▪ Give assignments on the customer relations strategy ▪ Assess students. ▪ Explain and ask the students to state the elements of	▪ Whiteboard & Marker ▪ Textbook on Supervision Management ▪ Flip Chart			

		motivation.				
	General Objective: 7.0 Understand the capital expenditure budget proposal.					
	7.1 Know the concept of capital expenditure budget proposal. 7.2 Draw up list of materials of expenditure budget proposal.	▪ Explain and ask students the concept of capital expenditure budget proposal. ▪ How to arrange materials of capital expenditure budget proposal.	▪ Sample of Capital expenditure proposal. ▪ Whiteboard & Maker			

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Petrol engine maintenance
CODE: CMV 22
CONTACT HOUR: 7 Hours/week
Theoretical: 2 Hour/week
Practical: 5 Hours/weeks

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:

1 Understand general safety precautions.
2 Understand the basic working principles of petrol engine and restore it to peak performance.
3 Understand the working principles of valves.
4 Understand the working principles of the fuel system of the motor vehicle.
5 Understand the operation of an ignition system and carry out repairs and adjustments.
6 Understand the working principles of engine cooling system and restore a faulty cooling system to acceptable standard of performance.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Petrol engine maintenance		**COURSE CODE: CMV 22**		**CONTACT HOURS: 7Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0 Understand general safety precautions.				**General Objectives: 1.0 Understand general safety precautions**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Apply safety and use service manual and service tools correctly with particular attention to: a. workshop manual and tools b. Service manual and tools c. Job completion to manufacturers specifications d. (Use special techniques where applicable)	• Explain the use of correct grooming safety wear in the workshop. • Use charts and drawings to remind students of safety • Explain the importance of using workshop service manual for correct adjustments and detailed technical information	• Lesson plan • Charts • Workshop • Manual • Chalk board • Chalk	1.1 Demonstrate to students the correct use of tools and to get information from service manual	• Demonstrate each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	• Lesson plan • Charts • Workshop • Manual • Chalk board • Chalk
	General Objective 2.0: Understand the basic working principles of a petrol engine and restore it to peak performance.					
	2.1 Explain in detail the working principles of petrol engine e.g. two stroke and four stroke cycle engine.	• Describe the action of the components of the four stroke cycle engines. • State the functions of the three piston	• Lesson plan • Charts • Modes • Overhead projector and	2.1 Demonstrate the working principles of petrol engines 2.2 Show students the types piston rings and explain their functions	• Demonstrate each practical for the student to learn • Ensure that the students use the	• Lesson plan • Charts • Modes • Overhead projector

	2.2 Explain the types and function of all types of piston rings and gudgeon pins used on a motor vehicle engine. 2.3 State the difference between two stoke and four stroke engines 2.4 Explain the principles of operation of different types of carburetors used in motor vehicles. 2.5 Explain the operation and the use of contact breaker points. 2.6 Describe the functions of the advanced and retard mechanisms. 2.7 Explain the process of timing the valve and the ignition of an engine. 2.8 Explain the general principles and types of combustion chamber designs. 2.9 Draw and explain the operation of electric and mechanical fuel pumps. 2.10 Draw and label a diagram showing the correct sequence of securing the cylinder head-bolts.	rings. • Explain the role of the dudgeon pin in coupling the piston and the connecting rod together. • Explain the constructional differences between a two stroke and a four stroke engines. List the advantages and disadvantages of each engine. • Explain the operation of constant choke and variable choke carburetors. • Explain the importance of correct gap setting • Assess the students.	Transparencies • Chalk board • Chalk	2.3 show students with the use models or charts the basic difference between two and four stroke engines 2.4 Demonstrate how to dismantle and service carburetors 2.5 Demonstrate how to clean set contact breaker point to manufacturer's specification. 2.5 use charts or model to show the major difference between electric and mechanical fuel pumps 2.6 show students how to carry out valve adjustments to maker's specifications 2.7 show students how to check valve clearance	correct tools • Ensure the observation of safety rules • Assess students	and Transparencies • Chalk board • Chalk • Tools • Instructional materials
	General Objective 3.0: Understand the working principles of valves					
	3.1 Explain the basic principles of inlet and exhaust valves 3.2 Explain the layout of various engine valve gear arrangements, e.g. overhead, side and over head value.	• Discuss the functions and operation of the inlet and exhaust valves • Explain with the aid of sketches the valve train and the	• Inlet valves • Exhaust valves	3.1 show students a typical engine valve and explain the principle of inlet and exhaust valve 3.2 Shoe with the aid of model or charts valve train the method of driving camshaft	• Remove, inspect, replace and adjust the valve • Allow students to do same • Assess the students	• Inlet valves • Exhaust valves • Tools • Charts • Overhead projector • models

		methods of driving the Camshaft • Assess students				
	General Objective 4.0: Recondition the fuel system of a motor vehicle					
	4.1 With the aid of sketches describe the general working principles of the fuel system of a motor vehicle 4.2 Explain the principles and functions of a simple and multi Jet carburetors. 4.3 With the aid of sketches explain the methods of mixture correction, and slow running devices. 4.4 State the difference between constant choke and constant vacuum carburetors. 4.5 Explain the effect of dirty fuel tank on engine performance and show how to clean the dirty tank.	• Discuss the major components of the fuel system and their functions e.g. fuel filter and carburetors • Explain the types of carburetors and the way they function giving examples of the applications of each. • Explain the operation of the two carburetors and the slow running circuit. Mixture compensating jet. • Explain the choke devices as the cold starting aid, the design of venture, and the direction of fuel flow into the engine. • Explain fuel starvation which results in loss of power and consequently lead to Road Side break down. • Assess students.	• Lesson plan • Charts • Modes • Overhead projector and Transparencies • Chalk board • Chalk • Models of Carburetors	4.1 Use a model to explain the working principles of a fuel system 4.2 Trace and repair leakages in the fuel systems 4.3 Demonstrate to students the basic difference between simple and multi jet carburetors 4.4 Show students how to dismantle the carburetor 4.5 Demonstrate the steps involve in servicing carburetors 4.6 Demonstrate how to carry out simple maintenance of dirty fuel tank 4.7 Show students how to overhaul fuel pump	• Demonstrate each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	• Lesson plan • Charts • Modes • Overhead projector and Transparencies • Chalk board • Chalk • Models of Carburetors
	General objective 5.0: Understand the operation of an ignition system and carryout repair and adjustments					
	5.1 Explain the working	• With the aid of a	• Experimenta	5.1 Show students how to	• Demonstrate	• Experiment

	principles of the ignition system of a motor. 5.2 Explain the action of a simple Coil ignition system: advantages and disadvantages. 5.3 Explain the basic principles of magnetic induction and operating principle of the coil. (primary and secondary circuits. 5.4 Explain the working principle of the ballast resistor ignition system. 5.5 Diagnose the problem with automatic advance and retard mechanisms 5.6 Explain and identify the differences in spark plug (heat range) 5.7 Explain the term dwell angle. Explain the effect of contact breaker gap on dwell angle. 5.8 Explain the operating principles of the following electronic ignition system: a. capacitor discharge system b. inductive system c. computerized ignition system d. operation of ECVs	sketch explain the function of the coil ignition system of a motor car. Also explain firing orders and firing intervals. • Explain the operation of the Coil ignition system, and explain the low tension and high tension circuit. • Basic experiments in electromagnetism and performance of a transformer. • Compare ballast resistor system with standard coil system on vehicles • Demonstrate with appropriate equipment the effect of contact breaker gap on dwell angle and compare system on vehicles. Demonstrate testing procedure using appropriate equipment. • Explain the purpose of each component. For each system, outline safety procedures.	l equipment in electro magnetic and basic transformer. • Appropriate vehicles • Appropriate devices • Related spark plugs • Vehicles with standard ignition system, feeler gauges and dwell meters • Modern engine diagnostic equipment.	rewire the ignition system 5.2 Remove, inspect, replace and adjust ignition system 5.3 Show students how to adjust spark to maker's specifications 5.4 Demonstrate to students how to determine the correctness of dwell angle using electronics equipment 5.5 Determine the ignition point using timing light	each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	al equipment in electro magnetic and basic transformer. • Appropriate vehicles • Appropriate devices • Related spark plugs • Vehicles with standard ignition system, feeler gauges and dwell meters • Modern engine diagnostic equipment.
	General Objective: 6.0 Understand the working principles of engine cooling system and restore a faulty cooling system to acceptable					

	standard of performance.					
	6.1 Explain the working principles and the functions of the cooling system of an engine e.g. water and air-cooling system. 6.2 Describe the main features of the air cooled and water cooled engine. 6.3 Explain how heat is dissipated in the air cooled engine 6.4 List the faults attributable to air cooled engine and how to rectify those faults. 6.5 Draw a fan used in air cooling assembly. 6.6 Explain the working principles and testing techniques of thermostat, immerse a thermostat in hot and/or cold water and watch reaction. 6.7 Explain the functions of the different types of water pumps 6.8 State the principles and actions of impeller and pressurized cooling system. 6.9 Explain the temperature control of the cooling system.	• Explain the thermosphon and the pump assisted cooling system. • Explain the function of main components of the air cooled engine • Discuss the role of a blower and fins attached to the sleeves of the air-cooled engine. • Explain air cooled engine faults and their remedies. • Draw a fan used in air cooling assembly. • Describe the process of testing the thermostat for effective operations • Describe the operations of the major types of water pumps in use on motor vehicle engines, list cooling system faults. • Explain what happens to the boiling point of water when it is under pressure (e.g. increase in pressure increase the boiling point of water.) • Explain the	• Experimental equipment in electro magnetic and basic transformer. • Appropriate vehicles • Appropriate devices • Related spark plugs • Vehicles with standard ignition system, feeler gauges and dwell meters • Modern engine diagnostic equipment.	6.1 Demonstrate the ability to flush a cooling system 6.2 Remove, inspect, replace and adjust fan belt	• Demonstrate each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	• Experimental equipment in electro magnetic and basic transformer. • Appropriate vehicles • Appropriate devices • Related spark plugs • Vehicles with standard ignition system, feeler gauges and dwell meters • Modern engine diagnostic equipment.

		operation of temperature control devices such as thermostats, Radiator blinds, etc.				
	6.10 Explain the concept of pressure (negative and positive) temperature and volume relationship as related to the pressurized cooling system) 6.11 Explain the safety rules associated with working on cooling system. 6.12 Explain the danger in radiator cap when the engine is hot and under pressure which can result in scalding. 6.13 Draw a radiator showing details of water passages etc.	• Explain the concept of pressure/temperature and volume relationship. • Discuss the risks and the consequence of removing the radiator cap when the engine is hot. • Discuss other safety measures that should be taken when working on the cooling system. • Explain with the aid of sketches the various components parts of the radiator				

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Transmission and Clutch Systems II
CODE: CMV 23
CONTACT HOUR: 6 Hours/week
Theoretical: 2 Hour/week
Practical: 4 Hours/weeks

GENERAL OBJECTIVE:
On completion of this module, the trainee should be able to:

1. Understand the functions and operations of double reduction final drive differential assembly, diagnose faults and rectify them.
2 Understand the purpose and the operation of the components of propeller and drive shafts.
3 Understand the identification of clutch faults
4 Understand how to carry out repairs or replacements of clutch assembly

PROGRAMME: National Vocational Certificate in Motor Vehicle Mechanics						
COURSE: Transmission and Clutch Systems II		COURSE CODE: CMV 23		CONTACT HOURS: 6hrs/week		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objectives: 1.0 Understand the functions and operations of double reduction final drive differential assembly, diagnose faults and rectify them.				General Objectives: 1.0 Understand the functions and operations of double reduction final drive differential assembly, diagnose faults and rectify them		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.2 Explain the basic principles of double reduction final drive differential and from wheel drive assembly. 1.3 Describe the means of lubrication and oil retention of the final drive unit. 1.4 Describe the action of the bevel gear differentials 1.5 Describe the banjo axle casing.	• Describe the principles of power versus speed, as applied to double reduction and differential gearing. • Explain how the final drive unit is lubricated and the type of lubricant used and provision to take care of pressure build-up in the axle casing. • Explain the action of the differential gearing during cornering and straight motion. • Explain with the aid of diagram the banjo axle casing and how it differs from other casings • Assess the students	• Lesson plan • Constant velocity joint • Banjo axle casing • Text book • Overhead projector transparencies • Chart • Chalk board	1.1 Dismantle, examine and assemble a two speed axle (double reduction) 1.2 Dismantle, examine and assemble a heavy duty rear axle of the worm and wheel type 1.3 Inspect a vehicle for roadworthiness and compile report	• The Teacher should demonstrate the practical and allow the students to practice till they become competent • The Teacher should assess the students	• Lesson plan • Relevant tools • Service Manual • Gear box • Rear axle • Propeller shaft
	General Objective 2.0: Understand the purpose and the operation of the components of propeller and drive shafts.					

	2.1 Describe the purpose of universal joints on the drive shafts of vehicles. 2.2 Describe the followings: Lay rub, rubber cruciform coupling and potts joints 2.3 Explain the use of front wheel drive of: Solid drive shafts, Tubular drive shafts. 2.4 Explain the reason for the usage of torque – tube drive 2.5 Describe the arrangement of drive shafts when a transfer box is fitted in transmission	• Explain the forces acting on the front wheel drive axle e.g. cornering, driving and braking forces. • Explain with the aid of sketches their advantages and disadvantages. • Explain with the aid of sketches coupling the advantages and disadvantages of each coupling. • State the disadvantages one has over the other and state their differences. • Explain the torque tube features and the reason why they are used on some	• Lesson plan • Text book • Overhead projector • transparencies • Chart • Chalk board • Propeller shaft • Universal joints • Constant velocity joint	2.1 Examine the axle shaft splines for wear and replace shaft if necessary 2.2 Examine hub bearing for wear, replace or adjust where necessary 2.3 Dismantle the differential unit, and assess the degree of wear. 2.4 Replace worn parts and reassemble, ensuring that the planetary gears are in correct mesh and within Specifications 2.5 Reassemble the differential assembly in the logical sequence. 2.6 Carry out	• With the aid of sketches illustrate the method of detecting wear on splined shaft • Illustrate with sketches likely faults on hub bearings and discuss remedy • Explain how to diagnose faults through road test • Students should be allowed to practice till they become competent • Assess the students	• Lesson plan • Measuring tools • Splined shaft • Chalk board • Diagrams • Lesson plan • Live vehicle

		vehicles. • With the aid of sketches, explain the layout and operation of the various parts of the transfer box. • Assess the students.		the road test and compile report for rectification .		
	General Objective 3.0: Understand the identification of clutch faults.					
	3.1 State common faults on a clutch system e.g. clutch judder and clutch slip 3.2 State the causes of the common faults in clutch system e.g. uneven wear of the friction plate. 3.3 State the effect of such common faults e.g. worn out friction plates. 3.4 List common faults, e.g. replacement friction plates. 3.5 Explain the procedures for the identification of faults on a clutch system.	• List the faults and explain each. • Discuss the most common faults and the remedy and give notes. • Discuss and give notes. • Use notes to explain the remedy according to faults.	• White Board • Chart • Models • Marker • Instructional material • Lesson notes	3.1 Diagnose faults in any clutch assembly by inspection 3.2 Identify the type of faults diagnose	• Guide student to these techniques of diagnosis • Allow student to try on their own to detect faults • Assess students	• White Board • Chart • Models • Marker • Instructional material • Lesson notes • Tools • Clutch Units
	General Objective 4.0: Understand how to carryout repair or replacement of clutch assembly.					
	4.1 Describe the	• Show	• White Board	1.1 show	• Guide student to	• White Board

	steps involved to dismantle a clutch system. 4.2 Explain the process of clutch Component examination for wear and tear. 4.3 Explain a. Clutch adjustment b. Clutch bleeding.	students the procedure to dismantle a dry plate clutch using the appropriate tools • Help students to carry out the necessary adjustment	• Chart • Models • Marker • Instructional material • Lesson notes • Tools	students how to identify worn out or replaceable components 1.2 show students how to carry out repairs and replacement of worn-out components	effect repairs in faulty clutch system • teacher should allow the students to try their hands on the job • assess the students to test their understanding	• Chart • Models • Marker • Instructional material • Lesson notes • Tools • Clutch Units

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Steering Systems
CODE: CMV 24
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3Hours/week

GENERAL OBJECTIVES

1. Understand the steering systems and safety practices involved in its repair
2. Know the main components of steering systems, their functions and the operating principles.
3. Understand the routine maintenance and system adjustments running on vehicle steering systems
4. Understand diagnostic procedures and faults rectifications on vehicle steering systems

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Steering Systems	**COURSE CODE: 24**			**CONTACT HOURS: 4Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0 Understand the steering systems and safety practices involved				**General Objectives: 1.0 Understand the steering systems and safety practices involved**		
WEEK	Specific Learning Objective	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Identify types of steering systems 1.2 Identify the different types of steering boxes 1.3 State the advantages of the different types and their applications 1.4 Explain the safety precautions and practices involved in steering works.	• Explain to students the types of steering systems. • Explain with notes and model the different types of steering boxes. • List the applications and advantages of the types • Use chart to illustrate the safety precautions.	• Chart • Overhead projector • Models • Lesson notes	1.1 Show students the types of steering systems 1.2 State the different types of steering boxes. 1.3 State their advantages and applications. 1.4 Apply the safety precautions involved in steering repair works.	• Ask the students to identify the types of steering systems. • Assess the students • Show the students the different types of steering boxes. • List applications and advantages. • Engage students to dismantle a steering box and guide towards safe application.	• Chart • Overhead projector • Models • Lesson notes • Tool box
	General Objective 2.0: Know the main components of steering systems, their functions and the operating principles.					
	2.1 Identify the main components of a steering system 2.2 Explain the functions of the main components of the steering system. 2.3 State the operational principles of the steering system. 2.4 Describe the steering gear	• List the main components of a steering system. • Assess the students • State the functions of the main components. • Give detailed notes to explain.	• Chart • Models • Overhead projector • Lesson notes • White board • Marker • Instructional materials	2.1 Dismantle the model to show the various components of steering system. 2.2 State the function of the main components. 2.3 State the operating principles.	• Guide the students to dismantle the model. • Assess students to identify components • Use the dismantled components to	

	layout of: a. beam type b. Independent front suspension 2.5 State "ACKERMAN" Principle in relation to steering linkage	• Give detailed notes to explain the operating principles. • Test the students' comprehension of the operating principles.			explain the functions. • Assess the students, • Use model to explain the operating principles.	
	General Objective 3.0: Understand the routine maintenance and system adjustments running on vehicle steering systems.					
	3.1 List the common steering system faults e.g. - Alignments - Steering - under steer - Toe in and toe out, etc. 3.2 State the causes and effects of common faults. 3.3 Define wheel alignment. 3.4 Explain the purpose, importance and types of alignment. 3.5 Explain the general steps involved in steering maintenance.	• State the common faults in steering systems. • Assess the students • State likely causes of the common faults • Explain the effects of such faults. • Use lesson notes to explain the steps involved in the maintenance	• White Board • Chart • Models • Tool box • Overhead projector • Wheel equipment	3.1 State the common faults associated with steering system. 3.2 Identify the causes and the effects associated with wheel alignment. 3.3 State the importance and the purpose of wheel alignment. 3.4 Demonstrate the effect of defects in steering on tyre wear	• Demonstrate to students how to detect the common faults. • Demonstrate the use of tools and equipment used in wheel alignment. • Guide the students to carry out wheel alignment and emphasize the key terms used in wheel alignment	• White Board • Chart • Models • Tool box • Overhead projector • Wheel equipment
	General Objective 4.0: Understand diagnostic procedures and fault rectification on vehicle steering system.					
	4.1 Understand the standard procedure for fault diagnosis.	Use note charts and manufacturer data to explain the need for standard procedures.	Notes, data, textbooks	4.1 Apply standard procedure in diagnosing faults and rectification using the optical and electronic equipment. 4.2 Conduct steering geometry checks and adjust toe-in,	• Demonstrate the standard procedures.	Manufacture data Note book CD roms Board.

				toe-out, King pin inclination, camber, caster etc		

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Diesel Engine Electronics
CODE: CMV 26
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/weeks

GENERAL OBJECTIVE:

1. Understand Electronic Diesel Engine Operation.
2. Understand Diesel Fuel Electronic Injection pump
3. Understand the procedures for electronic diesel engine maintenance

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Diesel Engine Electronics		**COURSE CODE: CMV26**		**CONTACT HOURS: 4Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0 Understand Electronic Diesel Engine Operation.				**General Objectives: 1.0 Understand Electronic Diesel Engine Operation**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the need for electronic diesel engine 1.2 Differentiate the constructional features between an electronic diesel engine and the mechanically controlled diesel engine. 1.3 Identify the operational differences in 1.2 above. 1.4 List the main components of an electronic diesel engine and state their functions. 1.5 Explain the applications of diesel electronic engine 1.6 State the advantages of diesel electronic engine.	• Provide materials and guide students learning. • List the main components of an electronic diesel engine • Assess the students understanding	• Charts • Models • Tools • Instructional materials • Over head projector	1.1 Use charts as well as models to show the students electronic and mechanical controlled diesel engine and highlight their differences	• Guide students to identify the main components of electronics diesel engine. • Assess the students performance	• Charts • Models • Tools • Instructional materials • Over head projector
	General Objective 2.0: Understand Diesel Fuel Electronic Injection pump					
	2.1 State the function of diesel fuel injection pump. 2.2 Mention types of diesel fuel electronic injection pump 2.3 State the operational principles of 2.2 above. 2.4 Explain the applications of various electronic fuel injection pumps. 2.5 State the advantages of diesel electronic fuel injection pumps. 2.6 Identify common faults, causes and remedies of diesel electric	• Provide materials and guide students learning. • List the main function of an electronic injection pump • List the common faults and remedies of diesel electronic fuel injection pumps • State the routine	• Charts • Models • Tools • Instructional materials • Over head projector	2.1 Demonstrate the application and function of diesel fuel injection pump 2.2 Demonstrate the identification of faults and the necessary maintenance, service and adjustments to students.	• Guide the students to carry out identification of faults and maintenance • Allow students try their hands • Assess the students	• Charts • Models • Tools • Instructional materials • Over head projector

	fuel injection pumps. 2.7 List procedures for the service and maintenance of electric fuel injection pumps.	maintenance procedures for fuel injection pumps • Assess the students understanding				
	General Objective 3.0: Understand the procedures for electronic diesel engine maintenance.					
	3.1 List the service/maintenance tasks on an electronic diesel engine. 3.2 State the tools and equipment used in performing 3.1 above. 3.3 Identify the safety measures relating to 3.2 3.4 State the procedures for diesel electronic maintenance service. - Manufacturers Data - Tools Selection, etc.	• Provide materials and guide students learning. • Use charts and models to explain the tools/equipment used • Use manufacturers manual to explain the procedures to students	• Charts • Models • Tools • Instructional materials • Over head projector • Manufacturers manual	3.1 Show tools and equipment to students 3.2 Apply the tools/equipment to carry out the maintenance procedures in the manufacturers manual	• Guide students to identify the tools/equipment. • Allow the students to practice • Assess the students	• Charts • Models • Tools • Instructional materials • Over head projector • Manufacturers manual

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Diesel engine maintenance
CODE: CMV 34
CONTACT HOUR: 5 Hours/week
Theoretical: 1 Hour/week
Practical: 4 Hours/weeks

GENERAL OBJECTIVES:
On completion of this module, the trainee should be able to:

1. Understand the operations of the compression ignition engine and carry out repairs of the components of fuel delivery system.
2. Understand the working principles of inline and rotary fuel injection pumps, effect overhaul and carry out repairs
3. Understand working principles of a diesel engine and carryout engine tune up and test for efficiency.
4. Understand the fuel injection bleeding procedure.
5. Understand the working principles of different types of fuel injection pumps and governors.
6. Understand the constructional differences between petrol and C.I. engine main component parts.
7. Understand the engine wet sump lubrication system layout and methods of oil distribution.
8. Understand the dry pump lubrication system, crank case ventilation and the action of pressure gauges and oil warning lights.
9. Understand the cams and camshafts drive arrangements for side and overhead camshafts.
10. Understand the valve and valve port timing diagrams for both spark and compression ignition engine.
11. Understand the principles of crankshaft balancing and vibration damping.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS		
COURSE: Diesel engine maintenance	**COURSE CODE: CMV 34**	**CONTACT HOURS: 5Hrs/week**
GOAL:		

COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objectives: 1.0 Understand the operations of the compression ignition engine and carry out repairs of the components of fuel delivery system.				**General Objectives: : 1.0 Understand the operations of the compression ignition engine and carry out repairs of the components of fuel delivery system**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Describe the pump room and test equipment observing the safety and health precautions associated with fuel oil testing procedures. 1.2 Explain the principles of atomization and how this is used in motor vehicle engine.	• Explain pump room • Machines (e.g. Injector pump tester, nozzle tester). a. State the necessary safety precautions to be observed when handling diesel fuel. • Explain atomization as related to motor vehicle engine. • Assess students	• Lesson plan • Chalk board • Overhead projector and transparencies • Injector Pump and nozzle testers	1.1 Demonstrate to students the working operation in pump room 1.2 Show students how to use the test equipment 1.3 Apply the safety precautions in working on pump room 1.4 Demonstrate to the students what happens in the combustion chamber 1.5 Show to students the various types of nozzle and explain the characteristics of each	• Use chart and models to describe the pump room and test equipment. • Allow students to use the test equipment • Allow students try to remove, adjust and assemble injectors • Assess the students	• Lesson plan • Chalk board • Overhead projector and transparencies • Injector Pump and nozzle testers • tools
	1.3 Explain the types and functions of the combustion chamber as related to compression ignition engine. 1.4 Explain the characteristics of various types of nozzle designs and pressure collapse in injector nozzles. 1.5 Identify and correctly use the various tools and equipment for removing, assembling, adjustment and	• Explain the functions and types of combustion chambers • With neat diagrams illustrate characteristics of various types of nozzle designs and pressure	• Lesson plan • Chalk board • Overhead projector and transparencies • Injectors	1.6 show students how to remove, assemble, adjust and test injectors	• Demonstrate each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	•

	testing of injectors.	breaking points of injector nozzles. • Explain the uses of various types of tools and equipment for testing injectors. Ask questions on injector testing. • Assess students.				
	General Objective 2.0: Understand the working principles of inline and rotary fuel injection pumps, effect overhaul and repairs on them.					
	2.1 State the working principles of in-line and rotary pumps 2.2 State the need and define the process of phasing the in-line pump. 2.3 Describe the functions of all types of injectors. 2.4 Sketch in good proportion the various component parts of the fuel injection system.	• Explain the functions of in-line and rotary pumps. Name their component parts. • Explain the meaning of the term phasing. • List types of injectors. Draw neat sketch of each type. • Explain reasons for high precision of component parts of fuel injection system. • Assess students.	• In-line and rotary pumps. • Injectors. • Tools • Instructional materials • Manuals • Charts • models	2.1 show the types of pumps and list their functions 2.2 identify the main components of fuel injection system 2.3 Demonstrate to students how to adjust governors 2.4 demonstrate to students how to carry out timing of in-line pump on C.I. engine	• Demonstrate each practical for the student to learn • Ensure that the students use the correct tools • Ensure the observation of safety rules • Assess students	• In-line and rotary pumps. • Injectors. • Tools • Instructional materials • Manuals • Charts • Models • Phase machine • Pressure test machine
	2.5 Describe the provision for adjustment of the following types of governors: a. hydraulic b. mechanical c. pneumatic 2.6 Describe the method of timing in-line pump on C.I.	• Explain the need for adjustment of various types of governors. • Draw sketches of governors in	• Lesson plan • Chalkboard • Overhead Projector and transparencies • Hydraulic • Mechanical and	2.5 show students how to detect and remedy such faults in governors		

	engine. 2.7 Explain with the aid of diagrams the operations of the distributor type pump. 2.8 Explain the action of the mechanical (centrifugal) governor in relationship to the distributor type pump. 2.9 List common faults which could make the mechanical governor in-operative.	use on engines. • Emphasize the significance of accurate pump timing on engine. Ask questions on timing process and procedures. • State advantages of in-line and distributor type of pump. Sketch and explain operation of distributor type pump. • With neat sketches, explain the action of mechanical and hydraulic governors in relation to the distributor type. • Explain the common faults associated with each type of governor and give possible remedies.	pneumatic governors. • In-line pump.			
	General Objective 3.0: Understand the working principles of a diesel engine and carry out engine tune up and test for efficiency.					
	3.1 Explain the principles of operation of the diesel engine. 3.2 Explain the concepts of	• With neat diagrams explain the 4 stroke cycle and	• Lesson plan • Chalkboard • Diesel engines • Feeler gauge,	3.1 Demonstrate the model to show the working principle of the engine	• Dismantle with student and show necessary engine components.	• Diesel engine, different types of fuel pump • Injector nozzles

	pressure, (negative and positive) and relationship between volume and pressure. 3.3 Explain the working of the fuel injection system. 3.4 Observe the need for correct engine valve clearance setting to minimize engine noise.	2 stroke cycle principles of operation of diesel engine. • Explain the concepts of pressure (negative and positive) and relationship between volume and pressure. • Draw and explain the functions of the fuel injection component parts. • State procedure for accurate valve setting to maker's specifications. • Assess students	assorted hand tools and equipment.	3.2 Show the various effects on the combustion chambers 3.3 Show and explain the component parts of the fuel injection system e.g. the EC, the motor pump nozzle. 3.4 Show component through which noise could result if not properly checked.	• Physically examine the variation of pressure with student on the piston within the cylinder • Trace the fuel part with the student on the displayed components. • Ask the students to trace the fuel line through the displayed components. • Show the clearance of valves using the feeler gauge and how to adjust valve clearance • Explain the replacement of shims using the dial indicator	• Pressure gauge • Assorted hand tools • Feeler gauge • Dial indicator • Vernier caliper.
	General Objective 4.0 Understand the fuel injection bleeding procedure					
	4.1 Explain the purpose of bleeding a diesel engine and how the presence of air in the fuel system affects the performance of an engine.	• Define the term bleeding and explain why it is necessary to carry it out. • Assess students.	• Injection pump • Fuel lift pump • Live diesel engine • Spanners and screw drivers.	4.1 Demonstrate injector pump bleeding.	• Guide students to undertake injector bleeding procedure. • Emphasize safety • Assess the students by asking questions.	• Diesel engine, spanners and screw drivers.
	General Objective 5.0: Understand the working principles of different types of fuel injection pumps and governors.					
	Describe the common faults and symptoms attributed to diesel engine.	• List diesel engine common faults and symptoms (e.g. engine emitting black smoke etc).	• Lesson plan • Chalkboard • Live diesel and petrol engines	5.1 Show the visible effects of the known faults on the various component in the engine e.g. the valve clearance above the recommended	• Apply the tools to check the various affected parts with students • Assess the students.	• Diesel engine, different types of fuel pump • Injector nozzles • Pressure gauge • Assorted hand tools

		• Assess students		standard using the filler gauge to measure it. 5.2 Demonstrate the use of the pressure gauge to check low pressure with students.		• Feeler gauge • Dial indicator • Vernier caliper.
	General Objective 6.0: Understand the constructional differences between petrol and CI engine main component parts.					
	Compare the following engine components of the petrol and compression ignition engine stating differences in construction and materials used: a. Injection pumps b. Injectors c. Air Horn] d. Governors e. Crankshafts f. Valves g. Cylinder head h. Cylinder blocks i. Connecting Rods j. Pistons etc.	• Give reasons for differences in the physical construction of main engine components of petrol and diesel engines. • Sketch each component part neatly on the chalkboard. • Assess students	• Lesson plan • Chalkboard • Live diesel and petrol engine	6.1 Demonstrate to show the various components of both the S.I. and C.I. engine, showing the major differences in construction, material and mode of operation of ; - Injector pumps- - injectors - airhorn, - Valves- - cylinder heads, Piston, etc.	• Dismantle with students while showing the major difference in the combustion process between the two engines S.I. and C.I. system. • Assess students by asking questions.	• Lesson note books] • Chalkboard • Live petrol and diesel engine. • Dead petrol and diesel engine • Complete tool box.
	General Objective 7.0: Understand the wet sump lubrication system layout and methods of oil distribution.					
	7.1 Draw a line diagram to show the layout of wet sump engine lubrication for full flow and by-pass flow. 7.2 Explain how oil is distributed by splash mist and pressure feed systems. 7.3 Sketch three types of oil pump. 7.4 Explain the operation of pressure relief valves. 7.5 Sketch the construction of oil flow path through	• Explain major differences between full flow and by-pass flow system of lubrication. • List application of each system • Identify each type. • Draw neat diagram to	• Lesson plan • Chalkboard • Live diesel engine with wet sump lubrication.	7.1 Demonstrate to show the various layout of wet sump engine lubrication for full flow and by-pass flow on the model. 7.2 Dismantle model engine to demonstrate, examine and explain the activities of 7.2 – 7.9	• Guide the student through the activities in 7.1 to 7.9.	• Chalk board • Life diesel engine with wet sump lubrication manufacturer's specification/data .

	engine oil lubricating filters. 7.6 Describe with the aid of sketches the types of gasket and seals used in the retention of engine oil. 7.7 Explain the importance of using correct types and grades of oil. 7.8 State the effect of incorrect oil level in engine. 7.9 State the sources of oil contamination and the necessity of regular renewal of oil on time or mileage basis.	explain the function of pressure relief valve. • Explain the need for efficient oil filtration in engines. • List sealing devices commonly used in automobile engines. • List and explain properties of oil and their significance • Explain the causes and effects of incorrect oil level. • Explain the need for strict adherence to manufacturers' service manual on oil change. • Assess students.				
	General Objective 8.0: Understand the dry sump lubrication system, Crankcase ventilation and the action of pressure gauges and oil warning lights.					
	8.1 Explain the operation of dry sump lubrication system. 8.2 Draw a line diagram of a dry sump. 8.3 Explain the need for crankcase ventilation system. 8.4 Sketch a typical crankcase ventilation system. 8.5 Explain with the aid of a	• Explain in details, the construction and operation of dry sump lubrication. • With neat sketches explain the principle of dry sump lubrication.	• Lesson plan • Chalkboard • Dry sump engine	8.1 Dismantle the model crank case and show the oil supply from the sump to the upper lubricating part through the oil gallery 8.3 On the dismantled crank case discuss	• Dismantle the model while students participate in the action. • Ask students questions • Observe student method of carrying out job and make correction where	• Model • Note book • Tool box • Black board • Chalk

	sketch the operation of an oil pressure gauge. 8.6 Draw a line diagram of an oil warning light circuit. 8.7 Draw a cross-sectional view of an oil pressure switch. 8.8 Describe the operational principle of an oil cooler.	• Ask questions on lubrication system in general. • Illustrate with sketch crankcase oil ventilation. • Ask students to draw – oil warning light circuit, oil pressure switch and describe the principles of oil cooler. • Assess the students.		the need of ventilation and show the vent way of the crank case. 8.5 Show how the pressure affects the oil gauge and its electrical circuit. 8.8 Show how oil is cooled.	necessary.	
	General Objective 9.0: Understand the cams and camshafts drive arrangements for side and overhead camshafts					
	9.1 Sketch and label a typical cam shape showing valve lift, valve open period and its variation. 9.2 Sketch the method of locating the drive gear to the camshaft 9.3 Explain how end float of the camshaft is controlled 9.4 Describe the methods of camshaft drive (e.g. chain gear or toothed belt) 9.5 Draw a chain tensioner and fix tensioner. 9.6 Describe methods of camshaft lubrication 9.7 Locate drive gear to camshaft correctly.	• Inspect valve arrangements and operating mechanism • Explain the construction, function and operation of cams and camshaft drives. • Check for wear on valve operating mechanism using feeler gauge and by visual inspection. • Ask the students to describe camshaft drive methods, draw chain tensioners	• Lesson plan • Chalkboard • Overhead projector and transparencies • Live engine	9.1 Dismantle the engine model and identify various types of valve arrangement 9.2 Examine the valve arrangements and name the component parts e.g. drive gears, cam lobe etc. 9.3 Carryout checks on the camshaft. 9.4 Distinguish between chain gear, belt and toothed belt. 9.5 Carryout replacement of tension and adjuster. 9.6 Carryout camshaft, crankshaft timing correctly.	• Dismantle the engine with students and explain. • Engage students in studying the components and ask questions. • Distinguish between a worn out component and good component. • Make a general examination of the camshaft and valve mechanism. • Ask students to describe different types of camshaft drives and draw any types chain tensioner.	• Live engine C.I.E. & S.I.E. • Model • Charts • Tool box • Freeler gauge • Petrol • Emerate cloth

		and fix them • Assess the students.			• Assess them while they assemble.	
	General Objective 10.0: Understand the valve port timing diagram for both spark and compression ignition engine.					
	10.1 Sketch and label a typical valve timing diagram for spark ignition engine. 10.2 Distinguish valve timing diagram for compression ignition engine with that of spark ignition engine. 10.3 Describe the following terms: a. Valve overlap b. Valve lead c. Valve lag	• Explain the function of valves, valve construction and valve timing. • Explain the effects of 10.3 on engine performance. • Ask the students to describe the following valve overlap, valve lead, valve lag.	• Lesson plan • Chalkboard • Overhead projector and transparencies • Inlet valves • Exhaust valves • Valve timing diagrams	10.1 Distinguish between S.I.E. combustion processes and C.I.E. on the model 10.2 Demonstrate on the live engine what happen during the following: a) valve overlap b) Valve lead c) Valve lag 10.3 Carry out valve clearance setting using feeler gauge.	• Show the difference on the model • Demonstrate on the live engine and while student watch. • Allow students to examine the arrangements and ask them question. • Carryout valve clearance setting and ask students to replicate the action.	• Live engine both petrol and diesel. • Spark ignition system model • Tool box • Feeler gauge etc.
	General Objective 11.0: Understand the principles of crankshaft balancing and vibration damping.					
	11.1 Explain the principles of crankshaft balancing 11.2 Describe the causes of crankshaft vibration. 11.3 Sketch the method of mounting crankshaft-damper	• State the functions of crankshaft and the need for engine crankshaft balancing • List instruments available for crankshaft alignment checks • State effects of unbalanced crankshaft. • Assess the students.	• Lesson plan • Chalkboard • Crankshaft • Measuring tools (e.g. gauge)	11.1 Demonstrate the principles of crankshaft balancing 11.2 Demonstrate the effect of crankshaft vibration and method of mounting damper	• Show the students the effect of vibration in 1.2 • Guide students to mount damper	• Lesson plan • Chalkboard • Crankshaft • Measuring tools (e.g. gauge) • Tools • Chart • models

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Petrol Engine Electronics
CODE: CMV 28

CONTACT HOUR: 5 Hours/week
Theoretical: 1 Hour/week
Practical: 4 Hours/week

GENERAL OBJECTIVES:

1. Understand the principles of operation of petrol engine electronics
2. Understand petrol engine electronics main components networking system.
3. Understand petrol engine electronics maintenance procedures
4. Understand safety and legal requirement for petrol engine electronics operations

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS		
COURSE: PETROL ENGINE ELECTRONICS	**COURSE CODE: CMV 28**	**CONTACT HOURS: 5Hrs/week**

GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0 Understand the principles of operation of petrol engine electronics.				**General Objectives: 1.0 Understand the principles of operation of petrol engine electronics.**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the need for petrol engine electronics 1.2 Explain the principles of operation of a patrol engine electronics 1.3 Differentiate the constructional features between an electronic petrol engine and the mechanical controlled petrol engine in 1.3 above.	• Provide materials and guide students learning • Assess the students understanding	• Chart • Models • Tools • Instructional materials • Overhead projector • White marker board	1.1 Use charts as well as model to show the students electronic and mechanical controlled petrol engine and apply the difference 1.2 Dismantle and assemble with appropriate tools, to show the parts to students	Guide students to identify themain component parts of electronics petrol engine. Demonstrate with modem the operating principles of electronics petrol engine. Allow students to try their hands.	Tools Charts Models Manual Overhead projector White marker board
	General Objective 2.0: Understand petrol engine electronics main components networking system					
	2.1 List the main components of a petrol engine electronics networking systems. 2.2 State the functions of the component parts in 2.1 above. 2.3 Explain the application of petrol engine electronics 2.4 State the advantage of petrol engine electronics	• Provide materials and guide students learning • List the main component of a petrol engine electronic. • Use model or flip chart to identify the main components • Assess the students.	• Model • Chart • Instructional materials • Overhead projector • White marker board	2.1 Dismantle and assemble a model and identify the main parts and state their functions. 2.2 Compare with the use of model the electronic and mechanical controlled engine and highlight advantages.	• Guide students to practice • Assess the students	• Tools • Model • Chart • Manual • White board marker
	General Objective 3.0: Understand petrol engine electronics maintenance procedures.					
	3.1 List the service/maintenance tasks on an electronic petrol engine 3.2 State the tools and equipment	• State the routine maintenance procedures involved in	• Tools • Manual • Charts • Instrument and	3.1 Perform routine maintenance on an electronic petrol engine	• Demonstrate this maintenance procedures • Guide students to	• Tools/equipment • Manual • Testing tools • Models

	used in performing 3.1 above 3.3 Identify common faults, causes and remedies of petrol engine electronics	electronic petrol engine • Use manufacturer manual to explain • Apply tools and equipment in the maintenance • List the common faults, causes and ways of rectifying such faults.	materials • White board marker • Models	3.2 Show students how to detect faults using appropriate tools/equipment 3.3 State the causes of such faults in 3.2 3.4 Show students how to rectify such faults.	identify faults • Guide students to rectify the faults • Assess the students	• Charts • Instructional materials
	General Objective 4.0: Understand safety and legal requirement for petrol engine electronics operations.					
	4.1 State the safety procedures for petrol electronic maintenance service - manufacturer data - tools selection etc.	• Show students the need for the safety precautions • Explain some common accidents when working on electronic petrol engine • Explain the procedure of maintenance using the manufacturer data and tools selection	• Tools/equipment • Model • Manual • Charts • White board marker • Instructional materials	4.1 Apply safety precaution 4.2 Show student how to get information from the manufacturer manual regard safety, maintenance and legal requirements.	• Guide students to apply precaution • Assess the students on their understanding of safety and legal requirement from manufacturer • manual	• Tools/equipment • Model • Manual • Charts • White board marker • Instructional materials

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Engine Fault Diagnosis II
CODE: CMV 29

CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/week

GENERAL OBJECTIVES

1.0 Understand how to identify symptoms of complex system faults
2.0 Understand how to select and use diagnostic equipment and procedures to identify and confirm faults
3.0 Understand how to identify and describe alternative rectification strategies
4.0 Understand how to rectify faults and confirm system integrity.

GOAL: To enable learners to apply fault diagnosis and rectification techniques to a range of vehicle mechanical, electrical and electronic systems.						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objective 1.0 Understand how to identify symptoms of complex system faults						
Week	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain faults relating to vehicle mechanical, electrical and electronic systems, individually and in combination 1.2 Describe mechanical systems such as; engine and ancillary systems, transmission, steering, suspension and brakes 1.3 Describe electrical and electronic systems such as starting, charging, ignition, lighting and auxiliary systems, vehicle instrumentation, driver information systems, engine management systems, chassis control systems (eg ABS, stability control, transmission control), security and alarm systems	• Identify and describe fault symptoms • Associate symptoms with specific vehicle systems and components • Analyse complex system test results and recommend actions needed to rectify the problems	• Videos, • Simulations • Recommended textbooks • White Board & Maker • Models of engine • Lecture notes. • Workshop Manual • Compression Tester • A variety of hard-copy and IT data sources will be required to support the lecture.	2.1 Perform test to diagnose the following: • Serviceability • Correct ignition timing • Correct mixture adjustment • Leaking induction system • Exhaust systems • EGR Exhaust gas recirculation • Exhaust gas analyser.	• Guide the students, to carry out diagnosis process in 2.1 & 2.2 • Explain tests procedures to students. • Assign them to carry out tests procedure for each item.	• Videos, • Simulations, • Diagnostic Equipment • Live Vehicle Engine • Compression Tester • Exhaust Gas Analyser • Rigs, a range of vehicle types and equipment • Manufacturer/vehicle-specific equipment and non manufacturer/vehicle-specific equipment (eg meters, oscilloscopes, etc). A variety of hard-copy and IT data sources will be required to support the training.
	General Objective 2.0 Understand how to select and use diagnostic equipment and procedures to identify and confirm faults					
	2.1 Describe diagnostic equipment associated with the range of vehicle mechanical, electrical and electronic systems such as hand and service tools, measuring equipment, electrical and electronic test equipment , steering and suspension alignment and geometry equipment, wheel balancing and brake testing equipment	• Select and access appropriate sources of data • Select, prepare and use appropriate diagnostic equipment • Correctly identify and locate complex system faults • Justify and use alternative	• Videos, • Simulations, • Recommended textbooks • White Board & Maker • Models of engine • Lecture notes. • Workshop Manual • Variety of hard-copy and IT data sources	2.1 Determine ignition system operations using the following: Meters, test lams, cathode-ray, oscilloscope, fault code analysis. 2.2 Diagnose the following using electronic engine tester; Injectors, cold start injectors, Thermal sensors and Pressure regulators 2.3 Demonstrate the following test procedures:	• Justify selection of diagnostic and repair equipment and processes • Accessing appropriate data sources • Present reports relating to diagnosis	• Videos, • Simulations, • Diagnostic Equipment • Live Vehicle Engine • Compression Tester • Exhaust Gas Analyser • Rigs, a range of vehicle types and equipment • Manufacturer/vehicle-specific equipment and non manufacturer/vehicle-

	2.2 Explain diagnostic procedures associated with the range of vehicle mechanical, electrical and electronic systems and equipment such as visual, aural, performance monitoring, road and roller tests, procedures employed with electrical, electronic and systems diagnostic equipment, with particular reference to considerations of safety and vehicle/system protection, assessing vehicle information systems and data in a variety of formats (eg workshop manuals, diagnostic information, CD-Roms, IT-based data retrieval systems and fault code analysers)	diagnostic equipment to diagnose faults • Analyse and explain the characteristics, advantages and disadvantages of a range of diagnostic equipment and justify their use for given system applications		• Compression test • Cylinder leak test • Abnormal oil pressure • High/low/intermittent • Cylinder balance test	and repair, complete documents and records	specific equipment (eg meters, oscilloscopes, etc). A variety of hard-copy and IT data sources will be required to support the training.
	General Objective 3.0 Understand how to identify and describe alternative rectification strategies					
	3.1 Explain dismantling, inspection and assessment and compare against manufacturers' specifications, vehicle data, operational, safety and legal requirements 3.2 Explain adjustments associated with the range of vehicle mechanical, electrical and electronic systems with reference to manufacturers' specifications,	• Carry out rectification processes in conformity with manufacturers' specifications and safety and legal requirements • Describe at least two alternative rectification strategies for a range of vehicle systems requiring	• Whiteboard, & Marker • Duster • Recommended textbooks • Maintenance schedule sheet • Lecture notes. • Vehicle owner handbook • Preventive maintenance chart • Videos,	3.1 Provide opportunities for students to compare the advantages and disadvantages of alternative strategies and equipment in practical situations under a variety of conditions. 3.2 Plan for diagnostic and maintenance procedures 3.3 Select materials and research for information (eg safety, diagnostic and repair data) 3.4 Research for methods and	• Guide the students to carry out 3.1 & 3.4 • Explain some reasonable number of conditions to students • Assign them	• Videos, • Simulations, • Diagnostic Equipment • Live Vehicle Engine • Compression Tester • Exhaust Gas Analyser • Rigs, a range of vehicle types and equipment • Manufacturer/vehicle-specific equipment and non manufacturer/vehicle-specific equipment

	tolerances, operational limits, safety and performance 3.3 Discuss replacements using new, overhauled and factory or third-party reconditioned components and units. 3.4 Compare cost of replacement/repair to include consideration of service life expectancy, reliability, warranty status 3.5 Carry out multi-stage calculations to do with: • Amounts and sizes • Scales and proportion • Handling statistics 3.6 Interpret results of calculations, present findings and justify methods with at least one graph, one chart and one diagram.	fault rectification • Identify and describe the advantages of alternative diagnostic procedures including the use of dedicated test equipment	• Simulations	procedures 3.5 Carry out diagnostic and repair procedures 3.6 Plan, and interpret practically, the information from two different types of sources, including a large data set.	to carry out tests procedure for each item.	(eg meters, oscilloscopes, etc). A variety of hard-copy and IT data sources will be required to support the training.
	General Objective 4.0 Understand how to rectify faults and confirm system integrity					
	4.1 Explain how to test against manufacturers' specifications and data, legal requirements, performance test data 4.2 Make comparisons with vehicle/system/unit of equivalent type, performance or specification	• Ask the students to calculate maintenance interval. • Perform routine test using engine test bench. • Use appropriate equipment and procedures to confirm system integrity • Compare test results with manufacturer's	• Whiteboard, & Marker • Duster • Recommended textbooks • Maintenance schedule sheet • Lecture notes. • Vehicle owner handbook • Preventive maintenance chart • Videos,	Encourage students to keep a 'logbook' of evidence which would typically include workbooks, incomplete handouts, drawings and assessment material.	• Carry out performance tests • Evaluate diagnostic and repair strategies	• Signal tester • Worksheet • Engine test bench • Endoscope • Handtools etc • Engine analyser Engine SCAN Tool

		data and make recommendations	• Simulations,			

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Auto Electrical/Electronics
CODE: CMV 30
CONTACT HOUR: 5 Hours/week
Theoretical: 1 Hour/week
Practical: 4 Hours/week

GENERAL OBJECTIVES

1. Understand the principles of electricity generation as applicable to automobiles diagnose faults and effect repairs to batteries.

2. Understand the procedure for effective maintenance and repairs of all units of the charging system in a motor vehicle without supervision.

3. Understand the operation of the starter motor, diagnose and effect repairs to a faulty one.

4. Understand the operation of all electrical components of a vehicle, trace and rectify faults in them.

5. Understand the wiring diagrams of a motor vehicle and be able to use such diagrams, symbols and signs as an aid in rewiring a faulty system.

6. Understand the operation of the coil ignition system, diagnose faults and rectify them.

7. Understand the operation of the transistorized ignition system, diagnose faults and rectify them.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: AUTO-ELECTRICITY/ ELECTRONICS		**COURSE CODE: CMV 30**		**CONTACT HOURS: 5 Hrs/weeks**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:			**Practical Contents:**			
General Objectives: 1.0: Understand the principles of electricity generation as applicable to automobiles diagnose faults and effect repairs to batteries.			**General Objectives: : 1.0: Understand the principles of electricity generation as applicable to automobiles diagnose faults and effect repairs to batteries.**			
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	2.4 Explain the principle of	• Describe the	• Lesson plan	1.1 demonstrate to	• Demonstrate each	• Lesson plan

	electricity generation and electrolysis, chemistry of reaction in a lead acid battery e.g. vehicle battery. 2.5 Explain storage procedure for batteries.	process of current generation in both A.C and D.C. generators • Explain the chemical reaction that takes place during charge and discharge process in the battery. Emphasize basic battery maintenance. • Explain the process of storing electricity in chemical form and physical storage of the battery • Assess the students.	• Battery • Battery charger • Volt meter • Hydro meter • 12-13 Spanner • Charts • Sulphuric acid • Distilled water	students how to generate A.C and D.C currents 1.2 Demonstrate the process of storing electricity in chemical form and physical storage of the battery 1.3 Diagnose common battery faults and their symptoms 1.4 Conduct initial battery charge and recharge 1.5 Carry out bench test of - D.C generator (dynamo) - A.C generator (alternator) - Control box (dynamo)	practical for the students to learn • Allow students to try their hands • Assess the students	• Battery • Battery charger • Volt meter • Hydro meter • 12-13 Spanner • Charts • Sulphuric acid • Distilled water
	General Objective 2.0: Understand the procedure for effective maintenance and repairs of all units of charging system in a motor vehicle without supervision.					
	2.1 Explain the principles of electromagnetism in action and generation of electricity (A.C and D.C) 2.2 Explain the principles of commutation, rectification	• Explain the process of generating electric current using electro-magnetism in	• Lesson plan • Chart • Chalk board • Alternator • Volt meter • Ammeter	2.1 apply the principles in 2.1 and 2.2 2.2 demonstrate the process of generating	• Demonstrate each practical for the students to learn • Allow students to try their hands • Assess the students	• Lesson plan • Chart • Chalk board • Alternator • Volt meter • Ammeter

	and regulation of electricity	A.C and D.C forms • Explain how the commutators are used to rectify current output from the dynamo. • Explain the function of a regulator.		electric current using electro-magnetism in A.C and D.C forms 2.3 carry out bench test on regulator assembly	on the function of a regulator	
	2.3 Explain the principles of operation of semi conductor devices	Describe how the semi conductor functions.	• Semiconductor			
	General Objective 3.0: Understand the operation of the starter motor diagnose and effect repairs to a faulty one.					
	3.1 State the principles of operation of the starter motor 3.2 Explain the principle of electro-magnetism 3.3 Describe the part played by electro-magnetic induction in the conversion of electrical energy to mechanical energy 3.4 Sketch the various types of starter motor system.	• With the aid of sketches, explain the operation of the starter motor • Explain how magnetism is produced using electric current • Explain how magnetic field helps in generating currents • With the aid of sketches, explain the various types of starter system available, explain starter motor common faults • Assess the	• Lesson plan • Chart • Starter motor • Ammeter • Volt meter • Armature Growler	3.1 Apply the principles in 3.1 and 3.2 Show students the various types of starter motor system with the aid of an overhead projector or flip chart 3.3 Show students how to diagnose common starter motor faults using test equipment, such as voltmeter, ohmmeter and ammeter with shunt 3.4 Determine wear on drive pinion of a starter and ring gear and adjust pinion clearance where applicable 3.5 Demonstrate how to assemble starter motor component appropriately and	• Demonstrate to students how magnetism is produced using electric current • Guide students to carry out this practical on their own • Demonstrate to students how magnetic field aid in generating currents • Guide students to determine the serviceability of components • Assess the students in their ability to diagnose starter motor faults	• Lesson plan • Chart • Starter motor • Ammeter • Volt meter • Armature Growler • Over head projector • Tester • Live vehicle

		students.		bench test starter motor (pre- engaged and co-axial)		
	General Objective 4.0: Understand the operation of all Electrical Components of a vehicle, trace and rectify faults in them.					
	4.1 State the principles of light reflection and refraction. 4.2 State the characteristics of various types of lamp unit, e.g. sealed beam flash unit)	• Explain how to set headlamp beam, characteristics of various types of lamp unit	• Lesson plan • chalkboard	4.3 Identify and state the characteristics of various types of lamp unit e.g sealed beam flash unit 4.4 Trace and rectify faults in the following circuits: a. lighting circuit/repair fuse, light units, b. direction indicator (trafficator) c. windscreen wiper circuit and drive system d. heater circuit e. windscreen washer circuit f. petrol pump circuit g. warning light circuit h. instrument panel circuit i. door glass circuit j. Fit replacement units where necessary k. Select correct cable size length l. Test circuit for excessive resistance m. Renew all types	• Demonstrate practical for the students to learn • Students to practice till they become competent • Assess the students	• Lesson plan • • Relevant tools • Manufacturer's manual • Live vehicle

				of cable termination points n. Trace and rectify faults in a circuit using the appropriate instruments e.g. voltmeter, ammeter etc. o. Diagnose common coil ignition system faults and explain possible remedies. p. Carry out tests on transistorized ignition system q. Trace and rectify faults on transistorized ignition r. Use Hand Held Tester (HHT) to trace electrical/electronic faults s. Use star diagnostic machine to diagnose electronic faults in vehicle t. Carry out checks on High Energy Ignition system		
	General Objective 5.0: Understand the Wiring Diagram of a motor vehicle and be able to use such diagrams, symbols and signs as an aid in rewiring a faulty system.					
	5.1 Identify the symbols used in electrical wiring 5.2 Interpret wiring diagrams of an automobile 5.3 Interpret the various	• With the aid of sketches, show common electrical symbols with	• Electrical symbols	5.1 Show the symbol to students 5.2 Show students how to interpret the various systems of	• Demonstrate practical for the students to learn • Students to practice till they	• Electrical symbols

	systems of wiring e.g. insulated and earth return system.	reference to automobile • Explain a wiring diagram as it applies to the motor vehicle. • Explain the advantages and disadvantages of earth return and insulated return systems • Assess the students		wiring	become competent • Assess the students	
	General Objective 6.0: Understand the operation of the Coil Ignition System, diagnose faults and rectify them					
	6.1 Explain the theory of current generation by electro-magnetic induction. 6.2 Describe the operation of the coil. 6.3 Explain the relationship between correct gap size and dwell angle for distributor contact breaker points 6.4 Describe the action of a speed sensitive advance and retard mechanism. 6.5 Describe the distribution of the high tension supply. 6.6 Describe the action of the spark plug and the importance of correct gap setting. 6.7 Explain the need for correct ignition timing and the effect of incorrect ignition timing. 6.8 Describe and discuss the risks of accidents when working on electronic	• With the aid of sketch, explain the function of coil ignition system. • Explain how to set contact breaker points and how it affects the dwell angle. • Explain the need for advancing and retarding the ignition in relation to the speed of the engine. • With the aid of diagram, explain the function of the spark plug and how it is adjusted.	• Lesson plan • Overhead • Projector with transparencies • Chalkboard • Diagrams • Relevant measuring tools • Circuit diagram • Coil • Condenser • Distributor • C.B. Points	6.1 Diagnose common coil ignition systems faults and explain possible remedies 6.2 demonstrate how to set contact breaker points and its effect on dwell angle 6.3 carry out test on transistorized ignition system 6.4 trace and rectify faults on transistorized ignition 6.4 carry out checks on high energy ignition system 6.5 apply safety precaution necessary when working on ignition systems.	• • Demonstrate the process of each of the items on the practical guide • Students should be allowed to practise till they become competent • Assess the students • Use model to demonstrate the process of ignition and combustion and understand the firing order of a four and six cylinder engine.	• Lesson plan • Overhead • Projector with transparencies • Chalkboard • Diagrams • Relevant measuring tools • Circuit diagram • Coil • Condenser • Distributor • C.B. Points • Relevant tools • Live vehicle

	ignition system. 6.9 Identify and explain the items of electrical equipment and wiring methods. 6.10 Explain and show the effects of open and short circuits using a number of conductors wired in series and parallel.	• With the aid of diagrams, explain the operation of the distributor. • Explain the process of ignition and combustion and understand the firing order of a four and six cylinder engine. • Explain in detail the safety precaution necessary when working on ignition systems. • Explain and identify the items of electrical equipment. • State the wiring system namely:- Series wiring • Parallel wiring • Explain with diagrams and illustrations. • Assess the students				
	6.11 Explain the limitations of conventional ignition system. 6.12 State the use of capacitors for	• List the limitation of the conventional	• Lesson plan • Overhead slides • Chalkboard • Measuring			

	a. Spark quenching e.g. as surge absorbers b. By-passing alternating currents c. Timing purpose e.g. as neon lamp flashers 6.13 Explain the process of measuring forward and reverse resistance of typical diodes. 6.14 Explain the types and function of diodes.	ignition system. • Explain how capacitors can be used to: Absorb electrical surge By-pass alternating current • Describe the function of diodes • Discuss methods of measuring electrical resistance • Assess the students	instruments • Diagrams • Diodes circuits			
	General Objective 7.0: Understand the operation of the transistorized ignition system					
	7.1 Explain the operation, function and repairs of: a. Transistorized coil ignition with contact breaker control] b. Breakless transistorized oil ignition c. Transistorized coil ignition with inductive pulse generator d. Transistorized coil ignition with Hall effect generator 7.2 Explain the operation and function of high tension (HT) capacitor ignition. 7.3 Compare different methods of the transistorized ignition systems. 7.4 Explain the	• Discuss safety when work on this system is being done • Illustrate with the aid of sketches different methods of transistorized ignition system. • Explain with the aid of sketches, the operation of transistorized ignition system. • Explain with sketches the	• Lesson plan • Wall charts • Overhead slides • Chalkboard	7.1 Carry out test on transistorized ignition system 7.2 Trace and rectify faults on transistorized ignition	• Demonstrate practical for the students to learn • Students to practice till they become competent • Assess the students	• Lesson plan • • Relevant tools • Manufacturer's manual • Live vehicle

	function/operation of magneto ignition system.	operation of magneto ignition system.				
	7.5 Describe the process of high tension capacitor magneto ignition. 7.6 State the functions of major components of high energy ignition system such as a. Electronics spark control (ESC) b. Electronic module retard (EMR) c. Electronic spark selection (ESS)	• With the aid of sketches illustrate different types of high energy ignition system. • Assess the students.				

PROGRAMME: NVC in Motor Vehicle Mechanics
COURSE: GENERAL METAL WORK II
CODE: GMW II
CONTACT HOUR: 6 Hours/week
Theoretical: 2 Hours/week
Practical: 4 Hours/week

GENERAL OBJECTIVES/THEORY

i. Understand the basic principles and processes of heat treatment of metal in the workshop;
ii. Produce simple engineering components by forging; and
Ii.Understand the basic principles and techniques of gas and metal arc welding and apply them in fabricating simple metal components.

For practical competence, students will be able to achieve the following at the end of the module:

i. Carry out heat treatment of metal in the workshop;
ii. Produce simple engineering components by forging; and
iii. Carry out gas/arc welding and apply them in fabricating simple engineering components.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: GENERAL METAL WORK II	**COURSE CODE: GMW II**			**CONTACT HOURS: 6Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents/THEORY:			**Practical Contents:**			
General Objectives: 1.0 Understand the basic principles and processes of heat treatment of metal in the workshop.						
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain briefly the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000^{o}C for: a. hardening b. temperature c. annealing d. normalizing e. case-hardening 1.2 Explain the meaning of hardening metal work. 1.3 Outline safety precautions relating to heat treatment processes and apply them for a given situation.	• Prepare detailed notes that will explain the structural behaviour of plain carbon steel as it is heated from room temperature to about 1000^{o}C • Prepare detailed notes that will explain the meaning of hardening in metalwork. • Prepare notes that will outline safety precautions relating to heat treatment processes. • Assess the students	• Recommend Text books • Lesson notes, etc.	Heat Treatment 1.1 Carryout the following heat treatment processes: Hardening, tempering, annealing, normalizing, case hardening on given plain carbon steel, engineering components or tools 1.2 Anneal copper, brass and aluminium for various purposes.	• Demonstrate heat treatment processes and explain the stages. • Demonstrate the annealing process on brass, copper and aluminium for various purposes • Assess the students.	• Furnace, Forge tongs ,quenching medium and its container or cooling medium.
	General Objective 2.0: Produce simple engineering components by forging.					
	2.1 Explain with outline sketch the main features and working principles of the black smith's	• Prepare detailed notes and diagrams that will		Forging Process 2.1 Select appropriate forging tools and	• List and identify gas and metal arc welding	• Anvil, swage block, leg vice, forging hammers,

	forge. 2.2 Describe and state the functions of common forging tools, e.g. anvil, swage block, leg vice, forging hammers, hot and cold sets, set hammer, punches and drifts, hand fullers, top and bottom swages flatter, tongs (open mouth, closed mouth, hollow bit, etc.) 2.3 Describe with sketches the following forging operations: upsetting drawing down, setting down, twisting forge welding (scarf and splice welds) bending, forming closed ring, forming an eye.	explain the main features and working principles of the black smith's forge. • Prepare notes and diagrams that will describe the functions of common forging tools. • Prepare detailed notes that will describe the following forging operations: upsetting, drawing down, setting down, twisting, for welding, bending, forming closed ring, forming an eye. • Assess the students.		produce to specifications given engineering components by forging processes a. upsetting drawing down b. setting down – twisting] c. forge welding (scarf and spice welds) d. bending, tubing closed ring e. forming an eye	equipment • Demonstrate with appropriate forging tools how to produce some engineering components and let the students practice till they become competent • Assess the students	hot set, cold set, sets of hammer, punchers, drifts, fillers, top swage, bottom swage, flatter, open tongs, hallow bit.
	General Objective 3.0: Understand the basic principles and techniques of gas and metal arc welding and apply them in fabricating simple metal components					
		•	•	Welding Processes 3.1 Set up and operate gas or metal arc welding equipment in given situations. Note: Equipment operation should include choice of correct nozzles or electrode. Adjustment for	• List and identify gas and metal arc welding equipment • Demonstrate the use of both gas and metal arc welding equipment; for all the students to practice • Demonstrate to	• Acetylene regulators • Oxygen, cylinders, welding machine, goggles, shield, electrodes, diagrams and charts covering various welding joints.

				correct gas pressure/flame or voltage. 3.2 Prepare joints for welding in given situations 3.3 Weld sample of given components by arc or gas welding methods and state safety precautions to be observed.	the students how to prepare joints for welding purposes • Guide students to weld various components using both gas and arc welding processes and state associated safety precautions.	

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Car Air Conditioning
CODE: CMV 32
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/week

GENERAL OBJECTIVES:

1.0 Understand the working principles of a car air- conditioning system
2.0 Diagnose and rectify faults in the air-conditioning systems.
3.0 Select and install new automobile air conditioners
4.0 Carry out routine service

PROGRAMME: NVC in Motor Vehicle Mechanics						
COURSE: Car Air-Conditioning		**COURSE CODE:** CMV 32		**CONTACT HOURS:** 4 Hours/week		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**COURSE SPECIFICATION: Practical Contents:**		
General Objective: 1.0 Understand the working principles of a car air-conditioning system.				**General Objective:** 1.0 Know the components of automotive air conditioning units and their functions.		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the working principle of air-conditioning system. 1.2 Explain the function of different parts of the system. a. compressor. b. condenser. c. liquid receiver. d. sight glass. e. Refrigerant control. f. thermostat. 1.3 Identify the necessary precautions to be taken when working on the car air-conditioning system. 1.4 Describe the operation of a car air – conditioning system.	• Ask the students to draw and explain the working principle of car air-conditioning system. • Identify the components of a car air-conditioning system. • Show the parts of the system to students and ask them to identify purpose of each part. • Identify the components of a car air-conditioning system. • Ask the students to : draw and explain the working principle of car air-conditioning system • Ask the students to : draw and explain the working principle of car air-conditioning system. • Identify the components of a car air-conditioning system.	• Chalk. • Board. • Diagrams of air conditioning system • Projector. • Textbook • Diagrams of the parts of system •	1.1 Explanation of the main components of an automotive air conditioning unit: • Compressor • Condenser • Liquid reservoir • Expansion valve • Evaporator	• Explain unit components • Ask the students to compare the components of domestic air conditioners. • Ask the students about the function of each part.	• Disassembled car air conditioning unit. • Drawings • Illustrations
	General Objective: 2.0 Know how to diagonise and rectify faults of the air-conditioning systems			**General Objective:** 2.0 Know the types of compressors and refrigerants used in automotive air conditioning units.		
	2.1 Diagnose any faults in automobiles. 2.2 2.2 Knowing the correct tools and equipment to use.	• Ask the students to draw and explain the functions of various components.	• Chalk. • Board. • Charts. • Projector.	2.1 Explanation of types of compressors used in automotive air conditioning units:	• Explain the practical exercise. • Ask the	• Compressors of different types. • Sectioned models.

	2.3 Discharge and vacume. 2.4 2.4 Installing and testing a new air-conditioning system in a car. 2.5 Diagnose faults such as: a. Shortage of gas. b. Blockage of air- filter. c. Faulty evaporators and condensers. d. Faulty compressor. 2.6 Leakage of gas hose and tube. 2.7 Rectify faults such as: a. Complete change. b. Cleaning the filter. c. Replacing evaporators and condensers. d. Replacing compressors. e. Replacing the tubes. 2.8 Charge the unit with lubricating oil.		• Textbook	• Reciprocating compressors • Rotary compressors 2.2 Disassembling the compressor, checking internal valves and reassembling 3.1 Explanation of the types of refrigerants used in automotive air conditioning units: • R12 • R134a 2.4 Comparing the refrigerants.	students to work on the exercise. • Evaluate the students' works. • Explain the practical exercise. • Ask the students to work on the exercise. • Evaluate the students' works • Explain the types and properties of the refrigerants. • Ask the students about the possibility of replacing a refrigerant with another type and what kind of modifications should be made, if possible.	• Drawings. • Illustrations. • R12 cylinder • R134A cylinder • Thermodynamic properties tables of each refrigerant
	General Objective: 3.0 Understand how to select and install new automobile air conditioners.			**General Objective:** 3.0 Explain causes of problems, diagnosis and repair		
	3.1 Design the layout of the equipment within the car. 3.2 Install the components and connect the components together	• Ask the students to draw and the wiring circuit of a car with A/ C.	• Chalk. • Board. • Charts. • Projector	3.1 Explaining the problems that may happen in the unit and its troubleshooting methods. 3.2 Checking the cooling cycle. 3.3 Interpretation of reading of	• Explain the problems that may happen in the unit. • Ask students	• A car air conditioning unit. • Charging gauge.

	3.3 Wire the circuit. 3.4 Pressure test the system. 3.5 Vacuum the system. 3.6 Charge the system. 3.7 Carry out efficiency test on the system.			measuring devices	to explain the indications of trouble and how to repair them. • Explain how to interpret the readings of measuring devices (high and low pressure).	
	General Objective: 4.0 Explain the procedure for routine service.			**General Objective**: 4.0 Explanation of discharging, charging and testing the unit		
	4.1 Explain the importance of routine service to air conditioners. 4.2 Design a routine service chart for use in the service of an air-conditioning system 4.3 Service the various component of the system: a. cleaning of condenser, filters evaporator. b. checking of joints for leak. c. check and clear water drain pipe. d. check the operation of the system.	• Ask the students to design a routine service chart.	• Chalk. • Board. • Charts. • Projector	4.1 Explanation of how to discharge the unit and the connection of discharging pump. 4.2 Explanation of the steps of charging the units with exact amount of proper refrigerant. 4.3 Leakage inspection and stopping 4.4 Testing the unit performance	• Explain the practical exercise. • Ask students to explain the consequences of excess and lack of charge. • Explain leakage tests.	• Discharging pump. • R 134a cylinder. • Propane flame • Freon leakage detector

PROGRAMME: NVC in Motor vehicle mechanics

COURSE: Engine Repair and Overhaul
CODE: CMV 33
CONTACT HOUR: 5 Hours/week
Theoretical: 1 Hour/week
Practical: 4 Hours/weeks

GENERAL OBJECTIVES:

1 Understand the safety procedure and their applications in relation to automobile engine reconditioning.
2 Understand the operation of all types of automobile engine
3 Understand how to recondition worn out engine to good working condition
4 Understand the process of carrying out cylinder reboring
5 Understand the method of grinding crankshaft to manufacturer's specifications.

PROGRAMME: NVC in Motor Vehicle Mechanics						
COURSE: Engine Repair and Overhaul		**COURSE CODE**: CMV 33		**CONTACT HOURS:** 5 Hours/Week		
GOAL: The trainee will acquire knowledge and skills to recondition a worm out engine (petrol or diesel) to a satisfactory working condition.						
COURSE SPECIFICATION: Theoretical Contents:				**COURSE SPECIFICATION: Practical Contents:**		
General Objectives: 1.0 Understand the safety procedure and their applications in relation to automobile engine reconditioning**.**						
Week	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain general safety and safety at work place. 1.2 Analyse the application of service manual 1.3 Identify the service tools 1.4 Discuss manufacturers' specifications.	▪ Explain the various safety precautions to be observed at working places. ▪ Ask the students to mention the importance of safety at work places. ▪ Discuss when to apply safety precautions in engine reconditioning. • Explain the importance of service manual to ensure the long life of the engine • Explain the advantages of using the correct tools • Explain the danger of ignoring manufacturers' specifications	• Lesson plan • Wall charts • Films • Chalkboard • Service manual • Assorted tools	1.1 Demonstrate safety procedures required for the following: • valve gasket replacement • Timing gear/chair and spocket • Removal of cylinder bear • Replacement of valve guide etc. 1.2 Demonstrate the use of appropriate tools for specific job. 1.3 Assess the students	• Guide students in carrying out activities define under 1.1 • Assign them to identify appropriate tools.	• Complete tool box • Damaged engine • Engine in good working condition • Service manual (manufacturer's specification) • Flip charts • Video.
	General Objective 2.0: Understand the operation of all types of automobile engine.					

	2.1 Explain the operation of all types of automobile engines 2.2 State the operations involved in engine overhaul. 2.3 Identify and use various tools and equipment for repair or adjustment of components parts of the engine assembly. 2.4 Explain how to diagnose faults by inspection and by Road Test. 2.5 Describe cam shaft arrangements for side and overhead camshafts 2.6 Explain the concept of force, torque and brake horse power as applicable to motor vehicle. 2.7 Explain the process of replacement of defective components e.g. bearings, cylinder sleeves, Pistons, Crank shafts, connecting rods, valve assembly etc. 2.8 Explain ways of reassembling engine components in given sequence, adjust and test run engine.	Explain:: • The 4-stroke spark ignition engine construction and operating principles • The diesel engine design features • The four stroke diesel engine operating principle • Explain the different cylinder arrangements, principle of fitting cylinder liners, valves, valve guide, and set tappets • Select tools for identified jobs • Select special tools for special jobs • Explain the procedure for removal of different engine types from vehicle	• Lesson plan • Wall charts • Chalk board • Engine Hoist • Assorted Vehicles • Limits and Fits • Measuring tools • Service manuals and manufacturer' specifications • Lesson plan • Wall charts • Chalkboard • Demonstrating models	2.1 Demonstrate different types of limits and fits, interference fits, push fits, clearance jobs, and relate their applications to various components of the automobile system e.g. Piston and cylinder	Guide students on how to use measuring instruments such as vernier caliper, micrometer, dial gauge to determine the extent of wear on a component making reference to a variety of service manuals.	• Lesson plan and notes • Tool box • Service manual • Vehicle diagnostic tool • Micrometric dial indicator • Vernier caliper • Life and dead engines • Model engine parts • Piston ring compressor, cramps, mallet, valve guide etc. • Complete Engine

	General Objective: 3.0 Understand how to recondition worn out engine to good working condition					
	o Remove engine from vehicle for overhauling. o Dismantle engine following a proper sequence. o Apply the concept of limits and fits in relation to effects and requirements of engine components and other parts in assembling operation e.g. Piston free play, crank shaft sizes o Know how to assess suitability of existing parts for possible re-use. o Know how to measure and determine sizes of worn crank shaft journals and crank pins.	• Explain the use of lifting devices • Explain dismantling procedure • Explain the process of examining and measuring parts using manufacturers' manual as a guide. • Describe simple treatment of bell cranked pivoted levers to show (a) the perpendicular forces and (b) Inclined forces. Simple calculations involving moments as applied to clutch and brake mechanisms, calculation of torques • Demonstrate the processes involved in assembling pistons and rings using clamp, Fitting cylinder liners, Fitting of valve guides and valve seat inserts, Fitting of roller & ball bearing and use of torque wrenches. • Describe sequentially the reassembling of engine components and how to make necessary adjustments. • Explain the test run procedure	• Lesson plan • Wall charts • Chalk board • Engine Hoist • Assorted Vehicles • Limits and Fits • Measuring tools • Service manuals and manufacturer' specifications • Lesson plan • Wall charts • Chalkboard • Demonstrating models	• Demonstrate steps and action to be taken during engine overhaul. • Guide students to undertake engine faults diagnosis and parts replacement. • Demonstrate steps involved in setting tappet, valve guide, and cylinder liners. • Demonstrate the use of measuring instrument in determining worn crankshaft journal • Demonstrate crankshaft positioning for DIHC, single overhead and side crankshaft. • Demonstrate the use of pullers. • Demonstrate the current use of cramp filling piston rings, valve guide tools and mallet for cylinder liner • Demonstrate steps in engine component assembly.	• Carryout activities listed under 2.1 and test students comprehension • Guide students to perform task under 2.10 • Guide students in undertaking the processes in 2.12 •	• Lesson plan and notes • Tool box • Service manual • Vehicle diagnostic tool • Micrometric dial indicator • Vernier caliper • Life and dead engines • Model engine parts • Piston ring compressor, cramps, mallet, valve guide etc. • Complete Engine
	General Objective: 4.0 Understand the process of carrying out cylinder reboring					
	4.1 Explain the processes of cylinder reboring 4.2 Explain the use of sizes in	• Explain the process of: - • Setting the cylinder on	• Lesson plan • Service manual	4.1 Demonstrate cylinder re-boring process	• Guide students on how to	• Boring machine, micrometer,

	determining the bore size 4.3 Explain how to rebore cylinder to the required specification and select rings and piston sizes to match.	reboring machine • Setting the boring tools on the reboring machine • Checking the accuracy of the boring tool and cylinder setting • Using service manual to determine the correct bore size • Selecting correct sizes of rings, and pistons from the manufacturers' manual • Assess the students	• Flip chart • Boring machine • Vernier calipers • Chalk board • Sizing tools • Pistons • Rings etc.		determine correct bore size and selecting right sizes of piston and ring. • Assess the students	piston rings, service manual, manufacturers manual for selecting the correct sizes of rings.
	General Objective 5.0 Grind Crankshaft to correct specifications					
	5.1 Explain the process of crank shaft grinding 5.2 Explain the sizes of bearing to fit what sizes of crank shafts 5.3 Explain how to check crank shaft sizes before grinding 5.4 Explain how to grind crankshaft to appropriate sizes and fits.	• Explain, using diagrams and models the process of crank shaft grinding • Using the manufacturer's manual, find the size of bearing to suit the crankshaft size. • Ask the students to: • Measure the crankshaft size using micrometer looking up for next correct size from manual. • Demonstrate the process of mounting crankshaft on the crankshaft-grinding machine. Grind to the correct size using outside micrometer to check. • Assess the students.	• Lesson plan, chalk board, crankshaft, grinding tools • Service manual chalk board • Lesson plan, service manual, micrometer, • Models, Crankshaft Grinding tools.	Measure crankshaft sizes to determine bearing to match Demonstrate steps involved in crankshaft grinding Grind crankshaft to size.	• Guide students to achieve defined goals in 5.1 to 5.3	• Service manual micrometer, crankshaft grinding tools, models, etc.

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Computerized engine diagnosis
CODE: CMV 34
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/weeks

GENERAL OBJECTIVES

1. Understand Electronic Engine Diagnosis
2. Understand sensors, Actuators and Electronic Control Units
3. Understand the application of different diagnostic tools equipment.

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN MOTOR VEHICLE MECHANICS						
COURSE: Computerised engine diagnosis	**COURSE CODE: CMV 27**			**CONTACT HOURS:4Hrs/week**		
GOAL:						
COURSE SPECIFICATION: Theoretical Contents:				**Practical Contents:**		
General Objectives: 1.0: Understand Electronic Engine Diagnosis.				**General Objectives: 1.0: Understand Electronic Engine Diagnosis**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Explain the function and purpose of modern diagnosis. 1.2 State the advantages of computerized diagnosis. 1.3 Identify the safety precautions to observe while performing p.c. based diagnosis. 1.4 Describe the various applications of computerized diagnosis in a modern vehicle.	• Provide materials and guide students learning. • Assess the students performance	• Text books, journal, lecture notes. • Various diagnostic tools/equipment	1.1 Demonstrate the application of computerized diagnosis in a modern vehicle.	• Allow students try demonstration on their own • Teacher should assist students to diagnose a fault using computer in a live vehicle • Assess the student	• Text books, journal, lecture notes. • Various diagnostic tools/equipment • Live vehicle
	General Objective 2.0 Understand sensors, Actuators and Electronic Control Units.					
	2.1 Define sensors, actuators and ECUs 2.2 Explain the functions of 2.1 in a modern vehicle. 2.3 Identify the various types of 2.1 and their applications. 2.4 Explain the operations of 2,1 and their relationship. 2.5 Discuss common sensor, Actuator and ECU faults, symptoms and remedies.	• Show the sensors, actuator and ECUs to students • Provide materials and guide students learning. • Assess the students performance	• Text books, journal, lecture notes. • Sensors, actuators and ECUs • Charts • Instructional materials	2.1 Demonstrate the application of sensors, actuators and ECUs to students in a live and modern vehicle	• Allow students try demonstration on their own • Teacher should assist students to use the sensors, actuators and ECUs in a live vehicle • Assess the students	• Text books, journal, lecture notes. • Sensors, actuators and ECUs • Live vehicle • Other materials necessary
	General objective 3.0: Understand the application of different diagnostic tools equipment.					
	3.1 List the various types of diagnostic tools in use.	• State the various of diagnostic	• Text books, journal, lecture	3.3 Guide students to	• Demonstrate for students to	• Text books, journal, lecture

	3.2 Differentiate between customized and universal diagnostic tools in vehicle diagnosis. 3.3 State the safety precautions in diagnostic tools handling, usage and applications based on manufacturer's data. 3.4 Outline the procedures for computerized engine diagnosis.	tools and highlight their differences • Assess the on their understanding of the safety precautions involved when handling diagnostic tools	notes. • Various diagnostic tools/equipment	differentiate customized and universal diagnostic tools. 3.4 Apply the safety precautions enumerated in 3.3 to drive home the points	practice • Allow students try demonstration on their own • Assess the students	notes. • Various diagnostic tools/equipment

PROGRAMME: NVC in Motor vehicle mechanics
COURSE: Wheels Alignment, Balancing, Chassis and Suspension
CODE: CMV 35
CONTACT HOUR: 4 Hours/week
Theoretical: 1 Hour/week
Practical: 3 Hours/weeks

GENERAL OBJECTIVES:

1.0 Understand the techniques of wheel alignment and the application of computerized wheel alignment
3.0 Understand the techniques for fitting, inflating and balancing wheels
3.0 Understand the concept /functions of chassis system
4.0 Understand the vehicle suspension system

PROGRAMME: NVC in Motor Vehicle Mechanics						
COURSE: Wheels Alignment, Balancing, Chassis and Suspension Systems			**Course Code:** CMV 35		**Contact Hours:** 4 Hours/Week	
Course Specification: THEORETICAL CONTENT			**Course Specification: PRACTICAL CONTENT**			
Week	**General Objective: 1.0** Understand the techniques of wheel alignment and the application of computerized wheel alignment					
	Special Learning outcome	**Teachers Activities**	**Learning Resources**	**Special Learning outcome**	**Teachers Activities**	**Learning Resources**
	1.1 Define wheel alignment. 1.2 Describe the implication of the non alignment of a wheel 1.3 List the various methods of wheel alignment 1.4 Define Camber, castor and king pin inclination. 1.5 State the measuring units for castor camber angles and king pin inclination. 1.6 Identify the elements that make up the computerized unit system. 1.7 State the different types of camber and castor angles.	▪ Explain the concept of wheel alignment ▪ Guide the students to (a) list the various method of wheel alignment (b) Identify the elements that make up the computerized wheel alignment machine. (c) Apply computerized units for alignment and measuring of castor and camber angles including Toe-in and toe-out	• Whiteboard & Marker • Recommended textbooks • Lecture notes etc. .	1.1 Demonstrate procedures for checking/adjusting wheel alignment 3.1 Check wheel alignment using computerized alignment gauge.	• Guide the students on how to carry out the procedures in 1.1. • Explain causes of mis-alignment in motor vehicles. • Guide students on hoe to perform wheel alignment using the computerized alignment equipment	• Live Vehicle Engine • White Board & Maker • Wheel alignment equipment • Hand tools • Services manual etc.
	General Objective: 2.0 Understand the techniques for fitting, inflating and balancing wheels.					

	2.1 Describe the procedure for tyre inflation and fitting 2.2 Explain the implication of under inflation and over inflation 2.3 Identify various types of tyre valves 2.4 Define Wheel Balancing 2.5 Establish the need for wheel balancing 2.6 State the types of balancing methods.	• Explain the procedure for tyre inflation and fitting techniques e.g. tyre positioning and safety precautions. • Explain dynamic and static balancing • Describe a wheel balancing machine • Discuss the implication for tyre under inflation or over inflation.	• Maker Whiteboard, Duster • Recommended textbooks • Lecture note etc.	2.1 Demonstrate procedures for checking/adjusting wheel balancing. 2.2 Check wheel balancing using computerized balancing gauge.	• Guide the students on how to perform wheel balancing operations • Explain tests procedures to students. • Assign them to carry out tests procedure individually.	• White Board & Maker • Inflated tyres • Wheel balancing equipment • Hand tools • Services manual etc.
	General Objective: 3.0 Understand the concept /functions of chassis system.					
	3.1 Identify types of wheels tyres. 3.2 (a) state the purpose of rims/tyres 3.3 Describe the construction of tyres and state the rims tyre sizes/marking 3.4 Distinguish between tyre designs e.g. radial, cross-ply and tubeless tyres. 3.5 Discuss tyre servicing.	• Explain the need for tyres. • Explain functions of wheel/tyres. • Explain tyre construction and markings. • Help students to identify various rims and tyres • State the safety precautions in tyre servicing.	• Marker White board, Duster • Recommended textbooks • Models of wheel/rim and tyres • Lecture notes etc.	4.1 Show tyre thread pattern and rims tyre sizes/marking 4.1 Carryout wheel balancing 4.1 Carryout tyre inflation and fitting 4.1 Carryout maintenance on steering system 4.1 Carryout wheel alignment exercise using computerized alignment gauge.	• Guide the students to identify tyre pattern and perform tyre fitting and inflation • Guide the students on how to; ✓ gauge correct pressure ✓ Positioning of the tyre and rim ✓ Safety precaution to be observed ✓ Carryout steering maintenance ✓ Explain tyre markings.	• Workshop air compressor. • Pressure gauge • Hand tools • Services manual etc.
	General Objective: 4.0 Understand the vehicle suspension system.					

	4.1 Explain how the suspension system affects the steering and stability of a vehicle 4.2 List the different types of suspension system. 4.3 Describe with the aid of diagram, the component parts of a compressed air suspension system 4.4 Explain the operation of reactive and non-reactive suspension 4.5 Describe with sketches:(a) coil spring (b) torsion bar (c) rubber springs (d) leaf springs 4.6 Describe with sketches hydro-pneumatic and fluid/gas suspension systems. 4.7 Describe independent suspension utilizing, system etc 4.8 Describe rigid suspension.	▪ Discuss the functions of a suspension system in motor vehicles ▪ Describe the function and operation of a leveling valve in a suspension system ▪ Describe with the aid of diagram, the component parts of a compressed air suspension system ▪ Explain how driving and braking torque in multi-axle suspension arrangements are affected by load distribution. ▪ Explain the difference between reactive and non-reactive types of suspension system. ▪ Explain hydro-pneumatic and fluid/gas suspension system ▪ State the advantages of hydro-pneumatic over gas suspension system ▪ List the reasons for the use of independent front suspension.	▪ Chalk, chalkboard, Duster ▪ Recommended textbooks ▪ Lecture notes etc. .	4.1 Inspect suspension system for component malfunction and draw up repair procedures. 4.2 Identify body designs, construction and safety features 4.3 Identify the function and operation of the main components of independent front and rear vehicle suspension systems 4.4 Produce a list of typical faults and state the corrective action to take for a suspension system.	▪ List various ways to carry out inspections of suspension systems ▪ Assign students to identify body designed, construction and safety features ▪ Assess student's ability to identify faults and corrective action**.**	▪ White Board & Maker ▪ Loose Suspensions/absorbers ▪ Hand tools ▪ Pressure Guages ▪ Handling/Holding tools, etc.

Required Workshops/Laboratory for the Programme

A standard Automobile Workshop is required for the smooth commencement of the National Vocational Certificate in Motor Vehicle Mechanics Programme. This standard workshop must have the following Sections:

1. Machine section
2. Welding section
3. Fitting section
4. Automobile section (the underlisted sub-sections should make up the Automobile section)

    - ❖ Charging/Electrical section
    - ❖ Pump room
    - ❖ Engine room
    - ❖ Auto pit/Wheel balancing/Alignment/Vulcanizing section
    - ❖ Diagnosis/computer/Simulator section
    - ❖ General store/Tool room

List of Books and References

1. Motor Vehicle Technology and Practical Work by Dolan
2. Fundamentals of Motor Vehicle Technology by Hillier
3. Technology for Motor Mechanics: 1-5 By S.C. Mudd
4. Automobile Workshop Practice by Staton Abbey
5. Automoive Fault-Tracing by Staton Abbey
6. Automotive Mechanics by William H. Crouse and Donald L. Anglin

List of Equipment

WORK TOOLS AND EQUIPMENT FOR NVC MOTOR VEHICLE MECHANICS

S/No	Tools/Equipment	Minimum Quantity Required
	10 tool boxes with keys each comprising one of the following items:	
1.	Set of flat, round, half round and triangular files	10 each
2.	Set of warden files	10 sets
3.	Flat chisels	10
4.	Cross cut chisels	10
5.	Diamond point chisels	10
6.	Set of pin punches parallel and taper	10 each
7.	Hollow punches of various sizes	10 each
8.	Ball pein hammesr	10
9.	Plastic hammers/mallets	10
10.	Hacksaws with extra blades	10
11.	300mm engineers rule	10
12.	Centre punch	10
13.	6-32mm socket spanner sets with ratchet, brace, extension, U.J and handles	10
14.	6-32mm open and flat spanners	10 sets
15.	6-32mm ring spanners	10 sets
16.	Emery stone/block or cloth	10
17.	Plug spanners	10
18.	Magneto spanners	10
19.	Allen keys	10 sets
20.	Philips screw drivers	10 sets
21.	Feeler gauges	10
22.	Oil cans	10

23.	Grease guns	10
24.	Mole grip	10
25.	File card or cleaner	10
26.	Spark plug files	10
27.	Combination pliers	10
28.	Long nose pliers	10
29.	Wire cutter and stripper	10
30.	Tyre pressure gauges	10
31.	Metal scrappers	10
	DRILLING AND SCREW CUTTING	
1.	Electric Hand Drill	2
2.	Drill bits	3 sets
3.	Set of stock and dies - UNC, UNF and metric	2 sets
4.	Taps and wrenches - UNC, UNF and metric	2 sets
5.	Thread file	2
6.	Roller type thread restorer	2
7.	Screw (stud) extractor set	2
	MEASURING TOOLS	
1.	Vernier caliper	5
2.	Vernier calipers with clock	5
3.	Surface plates	2
4.	Vee blocks	8
5.	Vernier height gauge	2
6.	Vernier calipers (metric)	3
7.	Micrometer 0-25m 25-50mm, 50-75mm Internal & external 25-50mm; 75-100	3 3
8.	Dial indicator (gauge) with magnetic stand	2
	MACHINE TOOLS	
1.	Grinding machine with assorted wheels	1
2.	Bench grinder with wheels	1
3.	Workshop plain goggles	20
	JOINING METAL	
1.	Blow lamps	5

2.	Soldering iron	5
3.	Electric soldering iron	5
4.	Solder and flux	1pkt/tin
	LUB. BAY TYRE/WHEEL SERVICE	
1.	Compressor (3 phase motor driven type complete with spray gun, grease, horse reels)	1
2.	Wheel balance (rim 13-15)	1
3.	Air line gauge	2
4.	Portable tyre inflator	2
5.	Steam cleaner (complete) oil fired or electric	1
6.	High pressure washer	1
7.	Weld master vulcanizer	1
8.	Various sizes wheel braces	3 sets
9.	Tyre changer complete with bead breaker	1
10.	Heavy duty tyre changer (air separated type)	1
11.	Tyre repair kit comprising: rasp. Scissors, tyre knife, stitcher, spiral wound wire brush etc.	3 sets
12.	Wire brush set	3 sets
13.	Battery charger	1
14.	Service station set of tool kit plus special wrenches for removal of oil filter	2 sets
15.	Pipe wrench, clamp or vice	3 sets
16.	Pipe cutter	2
17.	Wheel alignment gauge	2
18.	Plug spanners (long and short)	2
19.	Battery service kit	2 each
20.	Adjustable wrench	3
21.	Clutch alignment gauge	5
22.	Clutch set-screw gauge	2
23.	Valve grinders	2
24.	Injector repair machine	1
25.	Injector needle service kit	1
26.	Hydrometers	4
27.	Vacuum tester	4
28.	Pullers (different sizes)	2

29.	Spark plug tester	4
30.	Work bench with vices	2
31.	Portable engine hoist	3
	GENERAL SERVICING & RECONDITIONING	
1.	Diesel phasing & calibration machine	1
2.	Electrical test bench	1
3.	Cylinder boring machine with accessories and assorted tools	1
4.	Honing machine with accessories and assorted cutters	1
5.	Bottle jack (hydraulic) light vehicle type	4
6.	Bottle jack (hydraulic) heavy vehicle type	2
7.	Ram up to 6 tonne capacity	1
8.	Trolley jacks	2
9.	Dynanometer	1
10.	Motor scope (engine analyzer)	2
11.	Timing light	4
12.	Tachometer	2
13.	Hydraulic press	1
14.	Inspection pits	2
15.	Dwell tester	2
16.	Armature growler	1
17.	Compression gauge	2
18.	Ammeter	2
19.	Voltmeter	2
20.	Ohmmeter	2
21.	Avometer (multimetre)	2
22.	Auto Electrical system instructional chassis	1
23.	Valve spring compressor kit	2
24.	Coil spring compressor	2
25.	Torque wrench pre-set type (metric graduation)	2
26.	Torque wrench dial type (metric)	2
27.	Hydraulic nipple forming tool	1
28.	Flaring tool for steel tubing	1

29.	**Small bore pipe bending tool**	**1**
30.	**Carburetor service kit**	**1**
31.	**Piston ring compressor**	**2**
32.	**Exahust gas analyzer**	**2**
33.	**Axle stands**	**8**
	OTHER UTILITIES	
1.	**Fire extinguishers**	**4**
2.	**Sand buckets**	**4**
3.	**Water buckets**	**4**
4.	**First aid box**	**1**
5	**Safety Charts/Posters**	**Lots**

LIST OF PARTICIPANTS:

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