

NATIONAL VOCATIONAL CERTIFICATE

IN

AUTOMOTIVE MECHATRONICS

CURRICULUM AND COURSE SPECIFICATIONS

2009

NATIONAL BOARD FOR TECHNICAL EDUCATION

PLOT 'B' BIDA ROAD, P.M.B. 2239, KADUNA

General Information

1.0 Title of the Programme

National Vocational certificate in Automotive Mechatronics

1.1 Aim and Objectives of the Programme

The National Vocational Certificate in Automotive Mechatronics is aimed at providing solutions to the service maintenance problems of high technology motor vehicles through the production of competent craftsmen and women who will be enterprising and self reliant.

On completion of this programme, the Trainees should be able to:

- i. Function as technicians in automotive and related establishments
- ii. Carryout necessary general tests procedures, standard diagnosis and faults rectification in modern vehicles
- iii. Demonstrate the use of different sophisticated diagnostic equipment for fault detection and rectification in various modern vehicles brands
- iv. Observe relevant safety in Automotive Mechatronics Engineering practice
- v. Interpret wiring diagrams, fault codes, as well as technical reference materials.

2.0 Entry Qualification:

The minimum entry qualification into the National Vocational Certificate in Automotive Mechatronics programme is Post Basic Education Certificate (Post Junior Secondary School Certificate).

3.0 Structure of the programme

The National Vocational Certificate (NVC) in Automotive Mechatronics Programme is in flexible modular form, and is structured to have three parts (i.e. NVC Part I, NVC Part II, and NVC Final each taken in a span of one year. Each part shall have a cogent and flexible structure and content that would allow the trainee a practical working skill unit and the possibility to exit at that level. Each

part incorporates six months intensive training in the school and three months of supervised industrial work experience (SIWES). In a 14 weeks term, 12 weeks will be for academic activities while 2 weeks will be for registration and evaluation. For a 40hrs week, 6hrs will be for core theory courses; 2hrs General education courses and 32 hrs will be for practical.

4.0 Evaluation Scheme

The National Vocation Certificate Examination must be externally moderated. In grading the awards; theory shall constitute- 20%, practicals – 50% and SIWES - 30%. If there are group practical/projects, trainees must be assessed periodically on individual basis and records kept. Note that trainees are to be assessed on completion of every module.

The grading shall be Distinction (70 and above), credit (55 – 69), Pass (40 – 54), Fail (0 -39) kept.

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CURRICULUM TABLE

NVC Part I

TERM I					TERM II					TERM III
CODE	TITLE	T	P	CU	CODE	TITLE	T	P	CU	Industrial Training (Three months)
CSK 102	Speaking Skills in English	1	-	1	VMT 011	Number and Numeration	1	-	1	
VCS 111	Introduction to Computers	1	2	3	VCS 217	Fundamental of Internet Technology	1	2	3	
VAM 101	Technical Drawing	1	2	3	EDP 101	Element of Entrepreneurship I	1	2	3	
VAM 103	Basic Mechanics	1	2	3	VAM 102	Vehicle Routine Maintenance	1	2	3	
VAM 105	Workshop Safety Measures and Ethics	1	2	3	VAM 104	Conventional Coil Ignition System Maintenance	1	2	3	
VAM 107	Automotive Electricity /Electronics	1	2	3	VAM 106	Engine Maintenance	1	2	3	
VAM 109	Battery Maintenance	1	2	3	VAM 108	Auto-Electrical System Maintenance	1	2	3	
Total		7	12	19	Total		7	12	19	

NVC Part II

TERM I					TERM II					TERM III
CODE	TITLE	T	P	CU	CODE	TITLE	T	P	CU	Industrial Training (Three months)
VCS 221	Introduction to Computer Aided Design and Drafting	1	2	3	EDP 102	Element of Entrepreneurship II	1	-	1	
VAM 201	Basic Engineering Materials	1	-	1	VAM 202	Introduction to Engineering Measurement	1	2	3	
VAM 203	Automotive Sensor Technology	1	2	3	VAM 204	Alternator and Starter Motor Maintenance	1	2	3	
VAM 205	Automotive Lighting System	1	2	3	VAM 206	Electric Power-assisted Steering System	1	2	3	
VAM 207	Transistorised Ignition Sys. Maintenance	1	2	3	VAM 208	Fuel Injection System Maintenance (petrol)	1	2	3	
VAM 209	Modern Brake System	1	2	3	VAM 210	Diesel Engine Fuel System Maintenance	1	2	3	
Total		6	10	16	Total		6	10	16	

NVC Final

TERM I					TERM II					TERM III
CODE	TITLE	T	P	CU	CODE	TITLE	T	P	CU	Industrial Training (Three months)
VAM 301	Workshop Management and Organization	1	1	2	EDP 103	Element of Entrepreneurship III	1	-	1	
VAM 303	Safety and Comfort systems	1	2	3	VAM 302	Vehicle Communication System	1	2	3	
VAM 305	Automatic Gear Box Maintenance	1	2	3	VAM 304	Electronic Wheel Alignment	1	2	3	
VAM 307	Electronic Ignition System	1	2	3	VAM 306	Electronic Diesel Engine Maintenance	1	2	3	
VAM 309	Electronic Vehicle Diagnosis	1	2	3	VAM 308	Project	1	5	6	
Total		5	8	14	Total		5	11	16	

Programme: **National Vocational Certificate in Automotive Mechatronics**

Course: **Introduction to Computer**

Course Code: **VCS 111**

Contact Hours: **T:1hr/wk P:2hrs/wk**

General Objectives

- 1.0 Know computer and identify its classifications.
- 2.0 Understand the impact and role of computers in modern society.
- 3.0 Know computer hardware and software elements
- 4.0 Understand the EDP
- 5.0 Know importance of security within the computer environment
- 6.0 Know Data/File Security and control
- 7.0 Understand the basic principles of Data transmission
- 8.0 Know how to use keyboard

INTRODUCTION TO COMPUTER

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Introduction to Computer		Course Code: VCS 111		Contact Hours : T:1 hrs/wk P:2hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0: Know computer and identify its classifications.						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1	1.1 Define computer in relation to data and information. 1.2 Explain types of computer. 1.3 Classify computers according to: (a) usage and (b) size 1.4 Distinguish between analogue, digital and hybrid computers. 1.5 Identify the various types of microcomputers. 1.6 Operate the keyboard.	Explain the concept of computer in relation to data and information. Identify types of computers List and explain the classes of computers according to usage and sizes. Differentiate between the various types of computer listed in 1.4	1 Magic board 2 Charts/posters 3 Computer systems 4 Typing first course test book 5 Typing tutor software 6 Multimedia Projector. 7 External Storage Devices.	Start up and shut down the computer Identify and use the various icons on the menu bars and toolbars for specific appropriate functions	Supervise activity	board Charts/posters Computer systems Typing first course text book Typing tutor software Multimedia Projector External Storage Devices.
General Objective 2.0: understand the impact and role of computers in modern society.						
2	2.1 List the uses of	Drill learners	Magic board	Demonstrate	Drill	

	<p>computers in our society</p> <p>2.2 Explain the social implications of computers on society.</p> <p>2.3 List the characteristics and benefits to the society.</p> <p>2.4 Explain the various application of computer to the society.</p> <p>2.5 Operate the keyboard.</p>	<p>in keyboard mastering</p>	<p>Charts/posters</p> <p>Computer systems</p> <p>Typing first course test book</p> <p>Typing tutor software</p>	<p>how to operate the keyboard.</p>	<p>learners in keyboard mastering</p> <p>Assign Topics on Computer in modern society</p>	
General Objective 3.0: Know computer hardware and software elements						
3-4	<p>3.1 Identify parts of a computer system</p> <p>3.2 Explain and identify different hardware available and their functions</p> <p>3.3 Describe hardware configuration</p> <p>3.4 List some input and output units</p> <p>3.5 Describe the functions of the output units</p> <p>3.6 Explain the functions of CPU</p> <p>3.7 Describe the functions of some</p>	<p>Identify various hardware components and explain their functions.</p> <p>Identify and explain auxiliary functions</p> <p>Differentiate between system and application software</p> <p>Explain the difference between high and low level</p>	<p>Complete Computer systems</p>	<p>Demonstrate understanding of basic hardware and software elements</p> <p>Use MS office suite including MS-Word, MS Excel, MS PowerPoint, MS-Access</p> <p>Install software packages</p>	<p>Supervise activity</p>	<p>Complete Computer systems</p>

	<p>auxiliary memory units</p> <p>3.8 Define: nibbles, bites, words and storage size in terms of 'k'</p> <p>3.9 Define and list various types of software</p> <p>3.10 Distinguish between low and high level languages.</p> <p>3.11 Define source and object codes</p> <p>3.12 Define a translator</p> <p>3.13 Describe different types of translators: assembler, compiler and interpreters.</p> <p>3.14 Operate the keyboard.</p> <p>3.15 Define computer software</p> <p>3.16 Explain the following types of software namely: (i) Application software (ii) System software</p> <p>3.17 Describe operating system</p>	<p>languages.</p> <p>Identify source and object code</p> <p>Explain translator and show examples</p> <p>Identify different types of translators: assemblers, compilers and interpreters</p> <p>Drill learners in keyboard mastering</p>		<p>Use MS Window operating system (32-bit or above)</p>		
General Objective 4.0: Understand the EDP						
5-6	4.1 Describe organisational structure	Explain the Organogram	Pictures/Posters Computer system	Show how to master the use	Computer system	

	<p>of EDP environment 4.2 Define computer file 4.3 Explain the purpose of computer files 4.4 Describe the elements of a file 4.5 List types of files 4.6 Explain file organization and Access methods 4.7 Identify storage media devices 4.8 Describe processing activities 4.9 Explain vulnerability b of files i) Improper / fraudulent input ii) Software / programme abuse 4.10 Master the use of keyboard</p>	<p>of an EDP environment and describe their functions. Discuss the concept of computers Using question and answer technique, explain information and the concept of information technology. Define 'computer file' and explain the purpose; characteristics ; types and organisation Describe sequential, random and direct access methods</p>	<p>Magic board Lesson note, etc.</p>	<p>of keyboard</p>		
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		Describe storage media devices and state their functions Explain processing activities and give examples Discuss the vulnerability of files Ask questions and give note to student Drill students into keyboard mastering				
General Objective 5.0: Know importance of security within the computer environment						
7-8	5.1 Explain standard operating procedures of a computer centre 5.2 Explain the need for computer room security 5.3 Describe computer system auditing 5.4 Explain prevailing safety	List and explain standard operating procedures of a computer installation. State the need for computer security in the	Pictures/Posters Computer system Magic board Lesson note, etc	Demonstrate effect of insecurity in computer system	Supervise activity.	Computer system

	<p>regulations in computer centre</p> <p>5.5 Describe methods of preventing hazards (fire, flooding, sabotage, etc.)</p>	<p>computer room.</p> <p>Explain the various safety regulations applicable to computer centre.</p> <p>Enumerate methods whereby hazards could be prevented in computer room.</p>				
General Objective 6.0: Know Data/File Security and control						
9-10	<p>6.1 Explain data security and control, Manual Data preparation control, Validation checks.</p> <p>6.2 Explain file security and control.</p> <p>6.3 Describe file security methods in computer installations</p> <p>6.4 Explain the need for file security in computer installation.</p> <p>6.5 Explain the user</p>	<p>Use question and answer</p> <p>List methods of file security in computer installation and explain the need for file security in computer installation</p>	<p>Lesson note</p> <p>Magic board</p> <p>Deployment of anti-virus suite</p>	<p>Infect a computer with a virus.</p> <p>Clean virus from computer</p>		<p>Complete Computer system.</p>

	<p>password and user name. 6.6 Explain computer virus. 6.7 State the various sources of viruses 6.8 Describe ways of protecting file from infection and getting rid of computer virus.</p>	<p>Define 'user password' and 'user name' Describe computer virus and identify: i) Their possible sources ii) Ways of getting rid of them iii) Ways of preventing the computer from contaminating viruses iv) Ways of protecting file from virus infection Lesson note Magic board Deployment of anti-virus suite. Infect a computer with</p>				
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		a virus. Clean virus from computer. Complete Computer system.				
General Objective 7.0: Understand the basic principles of Data transmission						
11	7.1 Define data transmission 7.2 Explain the term telecommunication 7.3 State different methods of data transmission 7.4 Define computer Network 7.5 State types of Network 7.6 State advantages of Network 7.7 Identify equipment necessary for data transmission 7.8 Explain communication software	Explain data Transmission Explain the term 'telecommunication Define network Explain the differences between LAN and WAN Discuss the advantages of Network Describe modem, network cad etc. List some existing communication softwares such as Lab link, TCP/IP, etc.	Internal/External modem Example of Network cad, Network cables	Identify different methods of data transmission	Describe different methods of data transmission	
General Objective 8.0: Know how to use keyboard						
12	8.1 Operate the keyboard	Explain items	Computer	Carryout typing	Give	

	using: i) Function keys ii) Alpha-numeric keys iii) Numeric keys iv) Control keys 8.2 Carryout typing exercises on the Keyboard	in 8.1 Give a typing assignments to students Give proficient test on typing skills	software e.g. Typing tutor	exercises on the Keyboard	proficiency test on typing skills	
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PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS

Course Title: Fundamental of Internet

Course Code: VCS 217

Contact Hour: T:1 hr/wk P: 2 hrs/wk

General Objectives

- 1.0 Explain the concept of internet
- 2.0 Know the concept of computer network
- 3.0 Know various services on internet
- 4.0 Understand internet connectivity
- 5.0 Know obstacles to internet growth n Nigeria

FUNDAMENTAL OF INTERNET TECHNOLOGY

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Fundamental of Internet Technology		Course Code: VCS 217		Contact Hours: T: 1 hr/wk P: 2 hrs/wk		
Theoretical Content				Practical Content		
General Objective 1: Explain the concept of Internet						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-3	1.1 Define Internet 1.2 Narrate History of Internet 1.3 Distinguish between internet and intranet 1.4 Define Data transmission	Explain Internet concept Explain historical background of the Internet. Discuss Intranet and Extranet Distinguish between Internet, Intranet and Extranet. Discuss data transmission. Discuss the various transmission media	White Board PC loaded with Power point and connected OHP	Find organizations using Intranet and Extranet	Assist students to use Intranet and Extranet.	Networked PC's connected to the Internet
General Objective 2.0: Know the concept of computer network						
4-6	2.1 Explain simple computer Network techniques 2.2 Classify computer	Discuss computer networks such as APPANET, NUFNET AND MILNET	White Board PC loaded with Power	Search for documentation of APPANET,	Guide the students on how to obtain	

	<p>network by geographical coverage. 2.3 List some major networks. 2.4 List the benefits of Internet</p>	<p>Explain classifications of computer network. Distinguish between APPANET, NUFNET and MILNET Explain the economics, social, political educational and cultural benefits of Internet.</p>	<p>point and connected to OHP</p>	<p>NUFNET and MILNET from the Internet</p>	<p>materials from the Internet about the structure of the APPANET, NUFNET and MILNET</p>	
General Objective 3: 0 Know various services on the internet						
7-8	<p>3.1 Explain Internet Services 3.2 Explain the meaning of cyber-café 3.3 State general procedures in a Cybercafé</p>	<p>Discuss: Various Internet services like E-commerce, E-mail, file transfer protocol (FTP), Bulletin Board Service, Audio-Video Communication, Digital Library, world wide web, Telnet and</p>	<p>White Board PC loaded with Power point and connected to OHP</p>	<p>Use the various services available on the Internet.</p>	<p>Demonstrate how to use the various Internet services. Take the students to a cyber café</p>	

		<p>other services. The concept of cyber-café The steps involved in cybercafé operations. Personnel requirements of a cybercafé e.g. server/network administrator. Security devices in a cybercafé</p>				
General Objective 4: 0 Understand internet connectivity						
9-10	<p>4.1 State Basic Hardware requirements for Internet connectivity 4.2 Define a MODEM and state its functions. 4.3 State the functions of MODEM. 4.4 Explain the basic concept of wireless</p>	<p>List and explain the basic hardware required for Internet connectivity. Discuss MODEM and its functions Explain the data transfer rate of various modem.</p>	<p>White Board. PC loaded with PowerPoint and connected to the</p>	<p>Identify different types of Modem's Connect to the Internet Identify VSAT, Radio and Dial</p>	<p>Show different types of Modem's to students Demonstrate how to connect to</p>	<p>Networked PC's connected to the Internet.</p>
General Objective 5: Know obstacles to internet growth in Nigeria						
11-12	<p>5.1 Explain obstacles to Internet growth in</p>	<p>Discuss Problems of</p>	<p>Board PC loaded</p>	<p>Discuss possible</p>	<p>Guide students on</p>	

	<p>Nigeria. 5.2 Describe Internet Service Provider (ISP) concept. 5.3 Explain the concept of Domain Name System</p>	<p>telecommunication infrastructure in Nigeria. Technical know-how Economic factors in Nigeria poverty level of the people. Level of awareness. The government policies on internet access. Explain the concept of ISP and the need for it. Explain the economic effect of using local or foreign ISP. Describe domain name system (DNS) and its space Explain how to name servers in the DNS.</p>	<p>with PowerPoint and connected to Internet OHP A popular ISP</p>	<p>solutions to the problems of Internet connectivity in Nigeria</p>	<p>how to name servers in Domain Name System Take students to a popular ISP</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Introduction to Computer Design and Drafting**
Course code: **VCS 221**
Contact Hour: **T:1 hr/wk P: 2 hrs/wk**

General Objectives

- 1.0 Understand the principles of operation, capabilities and system requirements
- 2.0 Understand the use of OSNAP facility to select options.
- 3.0 Know how to save drawing and use the auto-save feature
- 4.0 Know how to use AutoCAD to draw

INTRODUCTION TO COMPUTER DESIGN AND DRAFTING

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Introduction to Computer Design and Drafting			Course Code: VCS 221	Contact Hours : T: 1hr/wk - P:2 hrs/wk		
Theoretical Content			Practical Content			
General Objective 1.0: Understand the principles of operation, capabilities and system requirements of AutoCAD						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-3	1.1 Explain the principles of operation, capabilities and system requirements of AutoCAD 1.2 Install the AutoCAD software correctly 1.3 Give commands in AutoCAD using the keyboard and mouse. 1.4 Explain how to use the help menu to solve problems when using the AutoCAD package	Explain the advantages of Computer Aided Drafting List all known CAD softwares. Guide students on how to use snap point to construct lines. Give assignments to Students.	Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display screen	Install the AutoCAD software Show commands in AutoCAD	Supervise activity	Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display screen
General Objective 2: Understand the use of OSNAP facility to select options						

4-6	Change the layers in a drawing using the Layer Control. 2.2 Draw lines using Cartesian and Polar co-ordinate. 2.3 Prepare and change the size of the drawing zone 2.4 Save drawings on demand and set up the auto-save feature	Explain the difference between Cartesian and polar co-ordinates systems. Show how to construct lines at set lengths and angles using Cartesian and Polar co-ordinates.	Computer systems	Construct lines at set lengths and angles using Cartesian and Polar coordinates		Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display screen
General Objective 3: Know how to save drawings and use the auto-save feature						
5-9	3.1 Save drawings on demand 3.2 Set up the auto-save feature	Show students how to save drawings and set up auto save feature.	Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display screen.	Save drawings on demand Set up the auto-save feature.	Supervise students on tasks	Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display screen
General Objective 4: Know how to use the AutoCAD to draw						
10-12	Produce a simple drawing 4.2 Use the Mesh System to produce drawings. 4.3 Change the drawing	Produce a simple drawing with all necessary	Latest version of AutoCAD software Packages, computer systems, projector, whiteboard, display	Produce a simple drawing. Use the Mesh System.	Guide students on activities	Latest version of AutoCAD software Packages, computer

	<p>scale</p> <p>4.4 Draw a line using the command line</p> <p>4.5 Create the title block for a drawing</p> <p>4.6 Write letters and numbers on drawing</p> <p>4.7 Draw circles and be able to erase parts of lines or circles.</p> <p>4.8 Produce a simple drawing with Corel detail in terms of title block.</p>	<p>details for students to see.</p> <p>Guide students to produce similar simple drawing to specification.</p> <p>Give further exercises on drawings. e.g. drawing of a complete building project.</p> <p>Give drawing assignments to student.</p>	<p>screen.</p>	<p>Change the drawing scale</p> <p>Draw a line using the command line.</p> <p>Create the title block for a drawing</p> <p>Write letters and numbers on drawing.</p> <p>Draw circles and be able to erase parts of lines or circles.</p> <p>Produce a simple drawing with Corel detail in terms of title block.</p>		<p>systems, projector, whiteboard, display screen</p>
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Programme:	National Vocational Certificate in Automotive Mechatronics
Course Title:	Technical Drawing
Course Code:	VAM 101
Contact Hour:	T:1 hr/wk P: 2 hrs/wk

General Objectives

- 1.0 Know different drawing instruments, equipment and materials used in technical drawing.
- 2.0 Know graphical communication
- 3.0 Know the construction of simple geometrical figures and shapes
- 4.0 Know the construction of simple geometrical figures and shapes.
- 5.0 Know isometric and oblique projections
- 6.0 Know the single orthographic projections

TECHNICAL DRAWING

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Technical Drawing		COURSE CODE: VAM 101		CONTACT HOURS: T: 1hr/wk - P: 2hrs/wk		
Course Specification: Theoretical Content			Course Specification: Practical Content			
General Objective 1.0: Know different drawing instruments, equipment and materials used in technical drawing.						
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
1	1.1 Identify the different types of drawing instruments, equipment and materials. 1.2 Outline the uses of the various instruments, equipment and materials. 1.3 State the precautions necessary to preserve items 1.1 above.	• Present the students all drawing instruments: a. Drawing set b. T-Square c. Drawing board d. Set squares e. Types of pencils (H to B) f. Show to demonstrate and explain the uses of all of the above.	• Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table	1.1 Use each of the items in 1.1 above. 1.2 Maintain the various instruments and equipment.	Guide the students on the maintenance of the instruments.	• Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table
General Objective 2.0: Know Graphical Communication						

Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
2 - 3	<p>2.1 Explain graphics and the different types of graphic present.</p> <p>2.2 Illustrate the various convention present in graphical productions of construction lines, finished lines, hidden and overhead details projections, centre lines, break lines, dimensioning of plane, elevation and sections of objects.</p> <p>2.3 Layout of drawing sheets with the following : (a) Margins (b) Title block etc.</p> <p>2.4 State the various standards of drawing sheets.</p> <p>2.5 Print letters and figures of various forms and characters.</p> <p>2.6 Illustrate conventional signs, symbols and appropriate lettering characters.</p>	<p>Ask the students to illustrate in a drawing the various types of lines based on BS 308 1972 Part 2. and assess.</p> <p>Ask the students to set drawing area on A1 paper with a title block and the boarder lines and assess.</p> <p>Ask students to illustrate technical lettering in capital and small letters, using, free hand and using letter stencils and assess.</p> <p>Ask students to identify the various standard sheets Ao -A4</p>	<p>Black board ruler (1m)</p> <ul style="list-style-type: none"> • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table <p>Black board ruler (1m)</p> <ul style="list-style-type: none"> • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square 	<p>2.1 Print letters and figures of various forms and characters.</p> <p>2.2 Illustrate conventional signs, symbols and appropriate lettering characters.</p>	<p>Give assignment to students on geometrical constructions of circles.</p>	<ul style="list-style-type: none"> • Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table

		and assess Ask students to draw conventional signs and symbols and assess.	<ul style="list-style-type: none"> • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table 			
General Objective: 3.0 Know the construction of simple geometrical figures and shapes.						
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
4-6	<p>3.1 Explain the purpose of geometrical construction in drawing parallel.</p> <p>3.2 Discuss the construction of parallel and perpendicular lines</p> <p>3.3 Explain how to construct and bisect lines, angles and areas.</p> <p>3.4 Explain how to divide a straight line into given number of equal parts.</p> <p>3.5 Identify polygons (regular or irregular)</p> <p>3.6 Discuss the construction of regular</p>	<p>Ask students to illustrate the construction of simple geometrical figures and shapes and assess.</p> <p>Ask students to construct parallel and perpendicular lines and assess.</p> <p>Ask students to construct and bisect lines, angles and areas and assess.</p> <p>Ask students to divide a straight</p>	<p>Black board ruler (1m)</p> <ul style="list-style-type: none"> • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete 	<p>3.2 Construct parallel and perpendicular lines</p> <p>3.3 Construct and bisect lines, angles and areas</p> <p>3.4 Divide a straight line into given number of equal parts.</p> <p>3.5 Identify polygons (regular or irregular)</p> <p>3.6 Construct regular polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners</p>	<p>Give assignment to students on geometrical constructions of circles.</p>	<p>Black board ruler (1m)</p> <ul style="list-style-type: none"> • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster

	<p>polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners 3.7 Define a circle 3.8 Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.</p>	<p>line into a graph number of equal parts using the compasses and assess. Ask students to differentiate between regular and irregular polygons and assess. Ask students to construct regular polygon with N side and assess.</p>	<p>drawing table</p>			<ul style="list-style-type: none"> • Chalk • Complete drawing table
<p>General Objective 4.0: Know the construction of simple geometrical figures and shapes.</p>						
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
7-8	<p>4.1 Explain simple geometrical constructions on circles e.g. (a) diameter of a circle of a given circumference. (b) the circumference to a circle of a given diameter (c) a circle to pass</p>	<p>Ask students to explain the various properties of a circle and assess.. Ask students to differentiate the different methods of constructing ellipses and</p>	<p>Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square</p>	<p>4.1 Carry out simple geometrical constructions on circles e.g. (a) diameter of a circle of a given circumference. (b) the circumference to a circle of a given diameter</p>	<p>Give assignment to students on geometrical constructions of circles.</p>	

	<p>through 3 points (d) a circle to pass through 2 points and touch a given line (e) a circle to touch a given smaller circle and a given line (f) tangents to circles at various points (g) an arc of radius tangent to two lines at an angle to less than and more than 90. (h) an area externally tangent to two circles (i) inscribing and circumscribing circles 4.2 Define an ellipse. 4.3 Explain the following draughting techniques (a) Projection method (b) Measurement method (c) Transposition method.</p>	<p>assess. • Ask students to construct an ellipse using the various methods and assess. Ask students to explain the various draughting techniques and assess. Ask students to construct plane and diagonal scales and assess.</p>	<ul style="list-style-type: none"> • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table 	<p>(c) a circle to pass through 3 points (d) a circle to pass through 2 points and touch a given line (e) a circle to touch a given smaller circle and a given line (f) tangents to circles at various points (g) an arc of radius tangent to two lines at an angle to less than and more than 90. (h) an area externally tangent to two circles (i) inscribing and circumscribing circles 4.2 Construct ellipse by using (a) trammal Method (b) concentric circle method. 4.3 Explain the following draughting techniques (a) Projection method</p>		
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				(b) Measurement method (c) Transposition method. 4.4 Construct plane scales and diagonal scales, using appropriate instruments.		
General Objective 5.0: Know Isometric and Oblique Projections.						
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
9-10	5.1 Explain isometric and oblique projections. 5.2 Explain the drawing of a square in isometric and oblique forms. 5.3 Explain how to draw a circle in Isometric and oblique Forms. 5.4 Discuss the drawing of an ellipse in Isometric and oblique forms. 5.5 Explain how to draw a polygon with minimum of eight sides in Discuss the Isometric and oblique forms.	Ask students to differentiate between Isometric and oblique projections and assess. Ask students to construct a square and circle in isometric and oblique projections and assess. Ask students to draw a polygon in isometric and oblique projections and assess.	Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete drawing table	5.1 Draw a square in isometric and oblique forms. 5.2 Draw a circle in Isometric and oblique Forms. 5.3 Draw an ellipse in Isometric and oblique forms. 5.4 Draw a polygon with minimum of eight sides in Isometric and oblique forms. 5.5 Dimension holes, circles, arcs and angles correctly on isometric and oblique views. 5.6 Use appropriate convention symbols	Show the students isometric and oblique projections of various engine parts. Give assignment to students.	Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete

		Ask students to construct and dimension holes circles, arcs and angles in isometric and oblique projection and label with appropriate conventional symbols and abbreviations and assess.		and abbreviations.		drawing table
General Objective 6.0: Know single orthographic projections.						
Week	Specific Learning Outcome	Teacher Activities	Resources	Specific Learning Outcome	Teacher Activities	Resources
11 - 12	6.1 Explain the principle of orthographic projection. 6.2 Illustrate the principle planes of projection (a) Vertical plane (b) Horizontal plane . 6.3 Explain why the first and third angles are used and the second and fourth angles not used.	Ask students to differentiate between first and third angle orthographic projection and assess. Ask students to explain the vertical and horizontal planes in orthographic projection and assess.	Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates	6.1 Project views of three- dimensional objects on to the basic planes of projection in both first and third angle to obtain (a) the front view or elevation (b) the top view or plan.	Ask students to construct orthographic projections of simple objects in first and third angle orthographic projections and assess.	Black board ruler (1m) • Black board Tee-Square • Black board compass • Blackboard protector • Adjustable set-square • 60 set square • 45 set square • French curve

Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Vehicle Routine Maintenance**
Course Code: **VAM 102**
Contact Hours: **T:1hr/Wk - P:2hrs/Wk**

General Objectives

- 1.0 Understand the procedures to service a vehicle engine
- 2.0 Understand the vehicle lubrication service

VEHICLE ROUTINE MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Vehicle Routine Maintenance		Course Code: VAM 102		CONTACT HOURS: T: 1hr/wk - P: 2hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0: Understand the procedures to service a vehicle engine						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1 – 2	1.1 Explain the functions of an engine. 1.2 Discuss the principles of operation of a four stroke cycle engine. 1.3 Discuss the basic engine components and their functions namely: <ul style="list-style-type: none"> - Crankshaft - Pistons - Camshaft - Top cylinder - Oil pump - Fuel pump - Fuel filter - Oil filter - Air filter - Spark pluck 1.4 Mention the reasons for routine engine	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.	Using the four stroke engine model to demonstrate the principle of operation listed in 1.3.	Show the students the components of the engine	Live engine components.

	<p>service.</p> <p>1.5 Explain the application of manufacturer's specifications to carry out the following:</p> <ul style="list-style-type: none"> - Service interval - Grade of oil - Service components parts - Engine oil selection <p>1.6 Highlight the engine service procedures such as:</p> <ul style="list-style-type: none"> - Safety measures - Tool selection - Replacement of service parts - Engine oil selection 					
General Objective: 2.0 Understand the vehicle lubrication service						
3 -4	<p>2.1 Explain the following purposes of vehicle service lubrication that include:</p> <ul style="list-style-type: none"> - Reduction of friction - Heat dissipation in wear and tear - Improved service 	<p>Explain in details the principles and effects of friction and the law governing it. Guide the students to</p>	<p>Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.</p>	<p>2.1 Carry out lubrication of a vehicle.</p>	<p>Demonstrate how to lubricate a vehicle. Assign the students into group to carry out lubrication.</p>	<p>Lubrication bay, grease gum, grease,</p>

	<p>life</p> <p>2.2 Discuss identification of Lubrication points on components such as: Gear box, rear axle, propeller shafts, universal joints, tie rod ends, bearing etc</p> <p>2.3 Discuss the types , characteristics and applications of lubricants.</p> <p>2.4 State the following lubrication service procedures such as:</p> <ul style="list-style-type: none"> - Tools & lubricant selections - Location of lubrication points - Safety measures 	<p>solve problems relating to friction.</p>				
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Programme:	National Vocational Certificate in Automotive Mechatronics
Course Title:	Basic Mechanics
Course Code:	VAM 103
Contact Hour:	T:1 hr/wk P: 2 hrs/wk

General Objectives

- 1.0 Understand the concept and effect of forces and their moments.
- 2.0 Understand the effect of friction and law governing it.
- 3.0 Understand linear and angular motion of bodies.
- 4.0 Determine curvilinear motion of bodies.
- 5.0 Understand momentum of bodies
- 6.0 Understand the concept of work, energy and power
- 7.0 Understand general principle of operation of simple machines
- 8.0 Know simple harmonic motions

BASIC MECHANICS

	PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS					
	COURSE: Basic Mechanics		Course Code: VAM 103		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
	Theoretical Content			Practical Content		
	General Objective 1.0: Understand the concept and effect of forces and their moments.					
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1 – 2	1.1 Define force 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	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 force. 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.

	related to 1.1 to 1.9 above.					
General Objective: 2.0 Understand the effect of Friction and the law governing it.						
3 -4	2.1 Define friction 2.2 State advantages and disadvantages of friction. 2.3 Define coefficient of Friction.	Explain in details the principles and effects of friction and the law governing it. Guide the students to solve problems relating to friction.	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.	2.1 Determine the co-efficient of friction by means of an inclined plane.	Demonstrate activity 3.1 for the students to learn and ask them to carry out the activity.	Specimens of mosses and inclined plain set-up. Protractor, etc.
General Objective 3.0: Understand Linear and Angular motions of bodies.						
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. 3.4 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,	Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, Graph sheets, etc.			

	<p>3.7 Solve simple problem related to 3.1 to 3.6above.</p> <p>3.8 Define angular motion of a body in a circle.</p> <p>3.9 Derive the relationship between angular velocity and acceleration.</p> <p>3.10 Draw angular velocity- time graph.</p>	<p>velocity and acceleration.</p> <p>Assess students' assignments.</p>				
General Objective 4.0: Determine Curvilinear motion of bodies						
7	<p>4.1 Develop the relationship between angular and linear motions.</p> <p>4.2 Define circular motion.</p> <p>4.3 Explain centrifugal acceleration and centrifugal force.</p> <p>4.4 Develop expressions for centripetal and centrifugal forces.</p> <p>4.5 Give examples of centrifugal effects e.g. Planetary motion, Conical pendulum, etc.</p>	<p>Explain in details the concept of curvilinear motion of bodies.</p> <p>Guide students to develop expressions for centripetal and centrifugal forces and solve problems on them.</p>	<p>Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, etc.</p>	<p>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.</p> <p>4.2 Verify the equation of motion using Fletcher's trolley.</p>	<p>Illustrate 4.1 to 4.2 and ask the students to perform experiments.</p> <p>Assess the students' reports.</p>	<p>Practical guide, Centrifugal apparatus. Fletcher's trolley Weights</p>

General Objective 5.0: Understand Momentum of Bodies.						
8	<p>5.1 Define Mass and Weight of a body.</p> <p>5.2 State Newton’s Laws of motion.</p> <p>5.3 Define Impulse and Momentum.</p> <p>5.4 State the Law of Conservation of Momentum.</p> <p>5.5 Define Angular Momentum.</p>	<p>Describe in details the concepts and principles of momentum.</p> <p>Guide the students to solve problems relating to momentum.</p> <p>Assess students’ assignments.</p>	<p>Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, etc.</p>			
General Objective 6.0: Understand the concept of Work, Energy and Power						
9	<p>6.1 Define Work, Energy and Power.</p> <p>6.2 State the units of work, energy and power.</p> <p>6.3 Develop expressions for Work, Energy and Power.</p> <p>6.4 Differentiate between Kinetic Energy and Potential Energy.</p> <p>6.5 Explain Kinetic Energy of rotating bodies.</p>	<p>Explain in details with the concepts of work, energy, torque and power.</p> <p>Guide the students to solve problems on work, energy, power and torque.</p> <p>Assess the</p>	<p>Chalk, Chalkboard duster, Recommended textbooks, Lecture notes, etc. Chalk, Blackboard.</p>	<p>6.1 Determine tractive force and driving torque of a system.</p> <p>6.2 Determine kinetic energy of rotation.</p>	<p>Demonstrate to the students the activities in 6.1 to 6.2 and ask the students to perform the experiments.</p> <p>Assess the students’ reports.</p>	

		students' graded assignments.				
General Objective 7.0: Understand general principle of operation of simple machines.						
10	<p>7.1 Define simple machine.</p> <p>7.2 Give examples e.g. Lever, Pulley, Screw Jack, etc.</p> <p>7.3 Explain the operations of 3.2 above.</p> <p>7.4 Define</p> <p>(i) Mechanical Advantage</p> <p>(ii) Velocity Ratio</p> <p>(iii) Mechanical Efficiency</p> <p>7.5 Develop the relationship for Mechanical Advantage, Velocity Ratio and Efficiency of a wheel, pulley and screw jack</p> <p>Solve simple problems related to 7.1 to 7.5 above.</p>	<p>Explain in details the features, types and principle of operation of simple machines.</p> <p>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.</p>	<p>Chalk, Chalkboard, Duster, Recommended textbooks, Lecture notes, etc.</p>	<p>7.1 Determine the velocity ratio, mechanical advantage and mechanical efficiency of a screw jack.</p> <p>7.2 Determine the velocity ratio and efficiency of simple pulley system.</p>	<p>Demonstrate the activities in 1.1 and 1.2, and ask the students to perform the experiments.</p>	<p>Practical guide, screw jack and pulley system.</p>
General Objective 8.0: Know simple harmonic motion.						
11-12	<p>8.1 Describe periodic motion</p> <p>8.2 Describe period,</p>	<p>Explain in details the features and</p>	<p>Chalk, Blackboard, Duster, Recommended</p>	<p>8.1 Determine experimentally the period and</p>	<p>Demonstrate the activity in 8.1 and ask the</p>	<p>Simple Pendulum</p>

	<p>frequency and amplitude in simple harmonic motion. 8.3 Develop expressions for 6.3 above. 8.4 Analyse the motion of a simple pendulum. 8.5 Solve problems related to the above.</p>	<p>principles of Simple Harmonic Motion (SHM). Guide the students to derive expression for period, frequency and amplitude of SHM and solve problems on them. Assess the students' assignments.</p>	<p>textbooks, Lecture notes, etc.</p>	<p>frequency of a simple harmonic motion.</p>	<p>students to carry out experiment.. Assess the students' reports.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Conventional Coil Ignition System Maintenance**
Course code: **VAM 104**
Contact Hour: **T:1 hr/wk P: 2 hrs/wk**

General objectives

- 1.0 Distinguish between conventional coil and transistorized ignition system
- 2.0 Identify faults on a conventional coil ignition system
- 3.0 Rectify faults on conventional coil ignition systems

CONVENTIONAL COIL IGNITION SYSTEM MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Conventional Coil Ignition System Maintenance			Course Code: VAM 104	Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0: Distinguish between conventional coil and transistorized ignition system.						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-2	<p>1.1 Explain coil ignition system.</p> <p>1.2 Describe the differences between conventional and transistorized ignition system.</p> <p>1.3 Compose the operating principles of conventional and transistorized ignition systems.</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Demonstrate by physical inspection the different features of conventional and transistorized ignition systems.</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>Live vehicles with conventional and transistorized ignition systems</p>
General Objective 2.0: Identify faults on a conventional coil ignition system						

3-8	<p>2.1 Describe the functions of a coil ignition system.</p> <p>2.2 Describe the operating principles of a conventional coil ignition system.</p> <p>2.3 Identify the different components of a conventional coil ignition system and their functions.</p> <p>2.4 Illustrate a conventional coil ignition circuit and the functions of components on the circuit.</p> <p>2.5 Describe the principles of electromagnetism and electromagnetic induction and their applications in conventional coil ignition systems.</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Rectify common faults on coil ignition systems.</p> <p>2.2 Demonstrate the use of tools and equipment in servicing conventional coil ignition system.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Complete tool box, multimeter, test lamp, feeler gauge, capacitor, wire brush ignition coil tester, stroboscopic lamp</p>
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	2.6	State the common faults on coil ignition systems, their causes and effects.					
	2.7	Demonstrate the use of tools and equipment in serving conventional coil ignition system.					
	2.8	Apply procedures for identifying faults on coil ignition systems.					
General Objective 3.0: Rectify faults on conventional coil ignition systems.							
7-12	3.1	State the different methods used to rectify different faults on conventional coil ignition systems.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	3.1 Check for continuity of high tension leads. 3.2 Replace and adjust spark plugs. 3.3 Replace and adjust contact breaker point. 3.4 Replace capacitor. 3.5 Replace high tension leads.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.	Complete tool box, multimeter, test lamp, feeler gauge, capacitor, wire brush ignition coil tester, stroboscopic lamp
	3.2	Read and interpret manufacturer's specifications relating to fault diagnosis and rectification.	Solve as many problems as possible for				
	3.3	Apply procedures for rectifying faults.					

	<p>3.4 Explain how to check for continuity of high tension leads.</p> <p>3.5 Discuss replacement and adjustment of spark plugs.</p> <p>3.6 Discuss replacement and adjustment of contact breaker point.</p> <p>3.7 Explain replacement of capacitor.</p> <p>3.8 Explain replacement of high tension leads.</p>	<p>the students during tutorial classes.</p>			<p>Demonstrate the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Workshop Safety Measures and Ethics**

Course Code: **VAM 105**

Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Observe workshop safety measures
- 2.0 Understand basic fire fighting procedures
- 3.0 Know basic first aid

WORKSHOP SAFETY MEASURES AND ETHICS

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Workshop Safety Measures and Ethics		Course Code: VAM 105		Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0 Observe workshop safety measures						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-3	<p>1.1 State the different safety measures.</p> <p>1.2 State procedures for the safe use, maintenance and storage of tools.</p> <p>1.3 List procedures and techniques for lifting.</p> <p>1.4 Identify the different hazards, their causes and remedies to include fire, electricity and mechanical.</p> <p>1.5 Identify the different protective wears and equipment and their uses.</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Apply correct procedures and techniques for lifting.</p> <p>1.2 Demonstrate correct use of different protective wears and equipment.</p> <p>1.3 Observe workshop safety rules and regulations.</p> <p>1.4 Apply correct support method on</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>Safety shoes, safety godless, hand glove, Aprons, Shields, Overall, fire extinguisher, sand buckets, axle stands, Hoist</p>

	<p>1.6 Identify and interpret workshop safety rules and regulations including the provisions and requirements of the factory ordinance of 1973.</p> <p>1.7 State the importance of supporting a vehicle before working on it.</p> <p>1.8 Apply safety measures.</p>			<p>vehicle before working on it.</p>		
General Objective 2.0: Understand basic fire fighting procedures						
4-6	<p>2.1 Identify the different types of fire, their causes and remedies.</p> <p>2.2 Identify the different types of fire fighting tools, equipment, materials and their different application.</p> <p>2.3 Discuss demonstration of basic fire fighting procedures.</p> <p>2.4 Explain how to</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Demonstrate the correct use of different types of fire fighting tools, equipment, and materials.</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as</p>	<p>Safety shoes, safety godless, hand glove, Aprons, Shields, Overall, fire extinguisher, sand buckets, axle stands, Hoist</p>

	perform fire drills.	problems as possible for the students during tutorial classes.			references to students. Demonstrate the procedure to perform these practical works.	
General Objective 3.0 : Know basic First Aid						
7-9	<p>3.1 State the importance of first aid.</p> <p>3.2 Outline the procedures to be followed in the treatment of minor burns, cuts, and lacerations.</p> <p>3.3 Identify the contents of a first aid kit and their uses.</p> <p>3.4 Explain basic first aid procedures.</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	3.1 Apply basic first aid procedures.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	First Aid boxes
General Objectives 4.0 : Observe workshop ethics						
10-12	4.1 Identify the different	Assess the students'	<ul style="list-style-type: none"> - Whiteboard - marker 	4.1 Observe the different	Engage the students in	Practical manuals, safety boards &

	<p>workshop ethics.</p> <p>4.2 Discuss different workshop ethics.</p> <p>4.3 Explain environmental issues such as waste disposal, air pollution, noise, exhaust gas extractor etc.</p> <p>4.4 Discuss interpersonal relationship in the workplace.</p> <p>4.5 Explain professional ethics.</p>	<p>performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>workshop ethics.</p>	<p>group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>posters</p>
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Engine Maintenance**
Course Code: **VAM 106**
Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Discuss engine overhauling.
- 2.0 Understand engine performance test
- 3.0 Understand the general maintenance of cylinder head
- 4.0: Set valve clearance

ENGINE MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE : Engine Maintenance			Course Code: VAM 106	Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Contents				Practical Contents		
General Objective 1.0: Discuss engine overhauling.						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-3	1.1 Explain the following reasons for engine overhaul such as: Loss of engine power Excessive engine oil consumptions Engine knock Prolonged engine use 1.2 Discuss the Working principles of four stroke cycle 1.3 Describe the following engine components and their functions: Crankshaft; camshaft; pistons; connecting rods; rods; oil	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	1.1 Detect an engine that is due to be overhauled. 1.2 identify engine components	Assess the students' performances. Use manuals to guide the students during the practical session.	Live vehicles due for overhauling and not due for hauling, engine compression tester, tool boxes

	<p>pump; cylinder head etc.</p> <p>1.4 Define the following terms: Engine knock Stroke Top dead centre (TDC) Bottom Dead Centre (BDC) Honinng etc Clearance and swept volume Compression ratio</p>					
General Objective 2.0 Understand engine performance test						
4-6	<p>2.1 Discuss reasons and functions of engine testing</p> <p>2.2 Explain the following types of engine testing: - Compression test - Cylinder leak test - Radiator pressure test</p> <p>2.3 Describe the procedures for engine overhauling such as: - Tool selection; - Manufacturer's data, - Dismantling and assembling - Taking measurements</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	2.1 Carry out compression test.	Demonstrate various test listed in 2.2.	Live vehicles due for overhauling and not due for hauling, engine compression tester, tool boxes

	of components e.g crankshaft, pistons, journals, examination of components for wear and tears & Parts replacements					
General Objective 3.0 Understand the general maintenance of cylinder head						
7-9	<p>3.1 Identify the constructional features and functions of a cylinder head.</p> <p>3.2 Identify the component parts of a cylinder head and their functions.</p> <p>3.3 Explain the reasons and process of decarbonising a cylinder head.</p> <p>3.4 Identify the tools, equipment and materials used in de-carbonising and their uses.</p> <p>3.5 Demonstrate the tightening sequence of cylinder head bolts.</p> <p>3.6 State the causes and effects of worn</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Identify the component parts of a cylinder head and their functions.</p> <p>1.2 Use appropriate tools, equipment and materials to de-carbonise in cylinder head.</p> <p>1.3 Demonstrate the tightening sequence of cylinder head bolts.</p> <p>1.4 Change</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	

	<p>cylinder head gaskets and valve oil seals.</p> <p>3.7 Apply procedures for decarbonising cylinder head.</p> <p>3.8 Change cylinder head gasket.</p> <p>3.9 Replace valve oil seal.</p>			<p>cylinder head gasket.</p> <p>1.5 Replace valve oil seal.</p>		
General Objective 4.0: Set valve clearance						
10-12	<p>4.1 State the importance of having correct valve clearance.</p> <p>4.2 Outline the sequence of valve timing.</p> <p>4.3 Define key terms relating to valve clearance.</p> <p>4.4 Explain how to re-surface valve seats.</p> <p>4.5 Discuss procedures for setting valve clearance.</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Demonstrate use of tools and equipment for correct valve clearance.</p> <p>2.2 Re-surface valve seats.</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	

Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Automotive Electricity and Electronics**
Course Code: **VAM 107**
Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Understand fundamentals of automotive electronics
- 2.0 Know sensors and actuator
- 3.0 Know typical digital engine control
- 4.0 Understand typical electronic vehicle motion control systems
- 5.0 Know modern automotive instrumentations
- 6.0 Know trends in automotive electronics

AUTOMOTIVE ELECTRICITY/ELECTRONICS

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Automotive Electricity/Electronics			Course code: VAM 107		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
WEEKS	COURSE SPECIFICATION: THEORETICAL CONTENTS			PRACTICAL CONTENTS		
	General objective: 1.0 Understand fundamentals of Automotive electronics			General objective:		
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
1	1.1 Define d.c. current. 1.2 Describe basic d.c circuits 1.3 Explain Ohm's law. 1.4 Define resistivity and conductivity of a conductor. 1.5 State the relationship between resistance of a conductor, its resistivity, length and area. 1.6 Differentiate between series and parallel circuits. 1.7 Explain Kirchoff's	Describe and explain operations of diodes, rectifier circuits, transistors, amplifiers, operational amplifiers indicating their uses in digital circuits. Explain binary number system and its use in digital electronics. Discuss logic circuits and their use in digital computers.	White board, markers, recommended text books, etc.	1.1 Produce simple functional electronic circuits.	Explain and build simple electronic devices, such as timers and pulse triggers (loud speaker) using operational amplifiers, capacitors and resistors	White board, markers, boards

	laws. 1.8 Define and explain operations of semi conductor devices.	Define ICs and summarize their manufacturing process.				
General objectives 2.0: Know sensors and actuators						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
2-4	2.1 Define a sensor and actuator. 2.2 State the main differences between them. 2.3 Explain the Principle of operation of sensors and actuators. 2.4 State the criteria for selection of sensors and actuators for automotive applications.	Discuss the automotive control applications of sensors and actuators. Explain electronic ignition MAPPING. Explain the use in electronic fuel injection, electronic carburetor and throttle body fuel injection (TBFi) Discuss ignition and exhaust gas	White board, markers, recommended text books, etc.	2.1 Perform experiments with each of the following sensors : i. Temperature sensors ii. Flow sensor iii. Air flow iv. Speed sensor v. Crankshaft position sensor vi. Camshaft position sensor 2.2 Carry out practical with the following actuators for automotive use.: i. Fuel injector	Describe and use sensors and actuators for automotive applications.	White board, markers, recommended text books, etc, models/ samples.

		recirculator (EGR) actuators.		pump ii. Fuel injector nozzles iii. Engine starting relay.		
General objectives 3.0: Know Typical Digital Engine Control System						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
5-6	3.1 Explain control system input and output signals. 3.2 State control system specifications. 3.3 Explain fuel EGR, electronic spark and integrated engine control systems.	Discuss control system signals and specifications. Discuss all sub-systems of the electronic engine control.	White board, markers, recommended text books, etc.	Identify component parts of an engine electronic control system.	Locate all parts and components of the electronic control system of an engine. Remove and replace such components.	White board, markers, recommended text books, live engine etc.
General objectives 4.0: Understand typical electronic vehicle motion control systems						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
7 - 9	4.1 Describe typical automotive motion control systems.	Explain and identify vehicle motion control systems for cruise, brake	White board, markers, recommended text books, models etc.	4.1 Identify motion control mechanisms on vehicles	Locate, remove and replace control devices.	White board, markers, recommended text books, live vehicle and

		skid, tyre-slip, idle-speed, engine governor and transmission control.				manuals.
General objectives 5.0: Know modern automotive instrumentations						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
10	5.1 Explain modern vehicle instrumentation Signal processing, sampling and sample period. 5.2 Describe instrumentation for fuel quantity, coolant temperature oil, pressure and vehicle speed measurements. 5.3 Discuss instrumentation for electronic display devices for trip information and engine diagnosis.	Describe current automotive electronic instrumentation practice.	White board, markers, recommended text books, life vehicle etc.	Explain vehicle instrumentation.	Describe, identify, locate, remove and replace (where possible) modern vehicle instrumentation.	White board, markers, recommended text books, manuals and life vehicles.
General objectives 6.0: Know trends in automotive						

electronics						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
11-12	6.1 Explain trends in automotive electronics. 6.2 Discuss multiplexing system.	Discuss trends in motor vehicle electronics illustrating with distributor –less ignition system, vehicle occupant protection, collision avoidance radar warning, low tyre pressure warning system, CRT display, electronic automatic transmission, speed synthesis and multiplexing.	White board, markers, recommended text books, live vehicles etc.	Carry out maintenance activities on the vehicle electronics: i. distributor – less ignition system vehicle occupant protection, ii. collision avoidance radar warning, iii. low tyre pressure warning system, iv. CRT display, v. electronic automatic transmission, vi. speed synthesis and multiplexing.	Explain and identify latest automotive electronic components on a life modern vehicle.	White board, markers, recommended text books, live vehicle, manuals.

Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Auto-Electrical System Maintenance**

Course Code: **VAM 108**

Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Know the requirements, designs and operations of automotive starter batteries
- 2.0 Know the requirements, construction, types and operational principles of modern automotive charging system.
- 3.0 Understand the general operational principles of the starting system.
- 4.0 Understand the lighting system principle of the motor vehicle.

AUTO-ELECTRICAL SYSTEM MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Auto-Electric al System Maintenance			Course Code: VAM 108		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Week	General Objective 1.0: Know the Requirements, Designs and Operations of Automotive Starters Batteries					
	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
1 – 2	1.1 State the function and purpose of a battery. 1.2 Explain the construction of a lead-acid cell. 1.3 Discuss the chemistry of charging and discharging processes. 1.4 Explain the process of electrolyte preparation. 1.5 Discuss battery charging process. 1.6 State and explain factors which affect battery life. 1.7 Discuss general safety precautions when handling automotive batteries. 1.8 Explain modern procedures for	Explain in details the features, functions, chemistry of charging/ discharging, principle .of operations of a battery. Illustrate the procedures for connecting and disconnecting batteries to and from modern vehicles to avoid loss of stored systems codes and information.	Recommended textbooks, lecture notes, white board, marker, duster, charts etc.	1.1 Carry out battery charging process. 1.2 Carry out battery capacity and functionality test. 1.3 Demonstrate modern procedures for connecting and disconnecting batteries to and from modern vehicles to avoid loss of stored system codes and information.	Demonstrate activities 1.1 t0 1.3 for the students to learn and allow them to practice till they become competent. Grade students’ reports, practical works, sketches and drawing.	Batteries, battery charging, equipment, manuals, etc.

	connecting batteries and disconnecting batteries to and from modern vehicles to avoid loss of stored system codes and information.	Ask the students to illustrate the procedures indicated above. Mark students graded assignments.				
General Objective 2.0: Know the Requirements, Construction, Types and Operational .principles of Modern Automotive Charging System.						
	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
3– 5	2.1 State the purpose of the charging system and list components that make up the system. 2.2 Outline common types used in vehicles. 2.3 Discuss principles of generator operation. 2.4 Differentiate between generators and alternators. 2.5 Highlight the limitations of the dynamo. 2.6 Explain the	Explain in details the features, circuits, components, types, functions and principles of operations of charging system and its accessories. Illustrate the methods of carrying out functionality test of charging system. Assess students graded	Recommended textbooks, lecture notes, chalkboard, chalk, duster, charts, etc.	2.1 Identify a typical charging system of a modern vehicle, its components and Functions 2.2 Carry out functionality test of the system. 2.3 Dismantle, service and reassemble a modern alternator and test for functionality.	Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carry out all the activities. Grade students' reports, practical works, sketches and drawings.	Complete tool box, Manuals

	methods of carrying out functionality test of the system. 2.7 Explain a typical charging system circuit diagram.	assignments.				
General Objective 3.0: Understand the General Operational principles of the Starting System.						
	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
6-8	3.1 State the function of the starting system and list the components that make up the system. 3.2 Discuss the D.C motor principles of operation. 3.3 Explain power, torque and current requirements for starting. 3.4 Mention types of starter motors in use. 3.5 State common faults associated with the starting. 3.6 Discuss the duration and frequency of use the	Explain in details the features, functions, principle of operations and frequency of use of starting system. Illustrate common faults associated with the starting system and possible remedies. Assess students graded assignments.	Recommended textbooks, lecture notes, chalkboard, duster, charts etc.	3.1 Identify the starting system, its components and functions. 3.2 Dismantle, service, reassemble and test a typical starter motor for functionality.	Demonstrate activities 3.1 to 3.2 for the students to learn and allow them to practice till they become competent.	Complete tool box. Starting system equipment Manuals

	starting circuit.					
General Objective 4.0: Understand the Lighting System Principle of the Motor Vehicle.						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
9– 12	<p>4.1 Explain the need for the lighting system in vehicles.</p> <p>4.2 Discuss the legal requirements for an ideal lamp and their effects.</p> <p>4.3 Give reasons for the following:- - Wiring of lamps in parallel. Anti-dazzle controls. - Use of dipped and main beams.</p> <p>4.4 Discuss the need for: a. Overload protection. b. Fuses, their uses and Sizes. c. Headlamp relays.</p> <p>4.5 Explain the principle of direction indicating devices e.g. the flasher unit.</p>	<p>Explain in details the features, need, legal requirements, types and principles of operation of lighting system.</p> <p>Illustrate the need for overload protection, fuses and headlamp relays.</p> <p>Assess the students graded assignments.</p>	<p>Recommended textbooks, lecture notes, chalkboard, chalk, duster, charts etc.</p>	<p>4.1 Identify a typical lighting system circuits, its components and functions.</p> <p>4.2 Demonstrate fault tracing on lamp circuits.</p>	<p>Demonstrate activities 4.1 and 4.2 for the students to learn and allow them to practice till they become competent.</p> <p>Grade students' reports, practical works, sketches and drawings.</p>	<p>Complete tool box, adjustment beam, multimeters, test lamps, practical Manuals</p>

Programme: **National Vocational Certificate in Automotive Mechatronics**

Course: **Battery Maintenance**

Course Code: **VAM 109**

Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand the procedure to test battery
- 2.0 Understand maintenance of battery Electrolyte
- 3.0 Understand charging battery
- 4.0 Know the Installation of battery

BATTERY MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Battery Maintenance		Course Code: VAM 109		Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0 Understand the procedure to test battery						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-3	<p>1.1 Explain the functions of a battery of an automotive.</p> <p>1.2 Distinguish between dry cell and wet cell batteries in relation to their characteristics, operating principles and applications.</p> <p>1.3 Describe the operating principles of a lead – acid battery.</p> <p>1.4 Identify the constructional features and</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Demonstrate the external and internal components of a lead – acid battery.</p> <p>1.2 Testing the following parameters of a battery:</p> <ul style="list-style-type: none"> - Nominal voltage - Amperage per hour - Voltage loss <p>1.3 Carry out tests to resolve cold start</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Hydrometers, battery chargers, Battery service kits, Emery cloths, brushes, Digital multimeters, Test lamps</p>

	<p>components of a lead – acid battery and their uses.</p> <p>1.5 Define the following:</p> <ul style="list-style-type: none"> • Battery rating • Battery capacity • Voltage • Amperage <p>1.6 Outline the procedure for testing the following:</p> <ul style="list-style-type: none"> • Nominal voltage • Amperage per hour • Voltage loss • Cold start <p>1.7 Identify the safety precautions to observing when conducting battery tests.</p> <p>1.8 State how the battery problems identified above can be resolved.</p>			problem in a battery.		
General Objective 2.0 : Understand maintenance of battery Electrolyte						
4-6	2.1 Define specific	Assess the	- Whiteboard	2.1 Test the	Engage the	Hydrometers,

	<p>gravity and the composition of electrolyte.</p> <p>2.2 State the procedure for the preparation of electrolyte.</p> <p>2.3 Identify the tools and materials used for the preparation and testing of electrolyte.</p> <p>2.4 Identify the safety hazard relating to the preparation and testing of electrolyte.</p> <p>2.5 Discuss testing of the specific gravity of electrolyte.</p> <p>2.6 Explain how to check electrolyte level in battery.</p> <p>2.7 Remedy identified faults.</p>	<p>students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>specific gravity of electrolyte.</p> <p>2.2 Check electrolyte level in battery.</p> <p>2.3 Remedy identified faults.</p>	<p>students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>battery chargers, Battery service kits, Emery cloths, brushes, Digital multimeters, Test lamps</p>
General Objective 3.0 : Understand charging battery						
7-9	<p>3.1 Outline the principles and purpose of charging battery.</p>	<p>Assess the students' performances. Give relevant</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional 	<p>3.1 Carry out safety measures on the use of a</p>	<p>Engage the students in group work. Assess the</p>	<p>Hydrometers, battery chargers, Battery service</p>

	3.2	Outline the procedure of charging a battery.	printed and non printed academic materials, websites and manuals as references to students.	drawing - Text books - Journals - Lecture notes	charger and the charging process. 3.2 Demonstrate correct and safe procedures of charging a battery.	students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	kits, Emery cloths, brushes, Digital multimeters, Test lamps
	3.3	Distinguish the different types charges, their working principles and applications.	Solve as many problems as possible for the students during tutorial classes.				
	3.4	Differentiate different charging processes.					
	3.5	Observe safety measures on the use of a charger and the charging process.					
	3.6	Explain correct and safe procedures of charging a battery.					
General Objective 4.0 : know the Installation of battery							
10-12	4.1	Differentiate positive and negative terminal.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	4.1 Identify positive and negative terminal. 4.2 Remove and install a battery. 4.3 Clean battery terminals	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic	Hydrometers, battery chargers, Battery service kits, Emery cloths, brushes, Digital multimeters, Test lamps
	4.2	Outline the procedure of removing and installing a battery.					
	4.3	Identify and					

	<p>demonstrate correct and safe use of tools and equipment.</p> <p>4.4 Explain the procedure of cleaning battery terminals and the different materials used and their applications.</p> <p>4.5 Observe safety precautions relating to partial contacts sparks, connection of wrong terminals and electrolyte.</p> <p>4.6 Connect battery terminals.</p> <p>4.7 Install and secure battery.</p>	<p>references to students. Solve as many problems as possible for the students during tutorial classes.</p>		<p>and the different materials used and their applications.</p> <p>4.4 Carry out practical tests on partial contacts sparks, connection of wrong terminals and electrolyte.</p> <p>4.5 Connect battery terminals.</p> <p>Install and secure battery.</p>	<p>materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course: **Basic Engineering Materials**
Course Code: **VAM 201**
Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0: Understand the Structural Arrangement of atoms and their influence on the properties of materials.
- 2.0: Understand the structural arrangements of atoms of non-metals.
- 3.0: Understand the process of obtaining metals from ores.
- 4.0: Understand the common types of non-ferrous metals and their alloys.

BASIC ENGINEERING MATERIALS

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Basic Engineering Materials			Course Code: VAM 201		Contact Hours: T:1hr/wk – P: 0 hrs/wk	
Theoretical Content				Practical Content		
Week	General Objective 1.0: Understand the Structural Arrangement of atoms and their influence on the properties of materials.					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
1-3	1.1 Distinguish between the various types of atomic bonding in materials such as covalent, ionic, metallic, etc. 1.2 Explain the structural arrangement of materials in 1.1 above.	Explain in details the features and structural arrangement of atoms and their influence on the properties of materials.	Recommended textbooks, Lecture notes, Chalkboard, Chalk, Models, Charts, etc			
Week	General Objective 2.0: Understand the structural arrangements of atoms of non-metals.					
	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
4-6	2.1 Describe non-crystalline atomic structure. 2.2 Explain the structure of: clay, glass & plastics. 2.3 List the properties and applications of the non-metals in 5.2 above.	Explain in details the features and structural arrangements of atoms of non-metals. Assess the students' graded assignments.	Recommended text book, Lecture notes, Chalkboard, Chalk, Duster, Charts, etc.			

General Objective 3.0: Understand the process of obtaining metals from ores.						
Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
7-9	3.1 Classify various ores. 3.2 Explain the crushing and grinding of ores.	Explain in details the processes of obtaining metals from ores.	Recommended text book, Lecture notes, Chalkboard, Chalk, Duster, Charts, etc			
General Objective 4.0: Understand the common types of non-ferrous metals and their alloys.						
Week	Specific Learning Outcome	Teachers Activities	Resources	Specific Learning Outcome	Teachers Activities	Resources
10-12	4.1 Explain the basic properties and uses of common non-ferrous metals like tin, nickel, titanium magnesium, zinc, copper, aluminum and their alloys.	Explain in details the basic properties of non-ferrous metals and their alloys.	Recommended text book, Lecture notes, Chalkboard, Chalk, Duster, Charts, etc			

Programme: **National Vocational Certificate in Automotive Mechatronics**
Course: **Introduction to Engineering Measurement**
Course Code: **VAM 202**
Contact Hours: **T: 1hr/wk – P: 2hrs/wk**

General Objectives

- 1.0 Know the fundamentals of measurement.
- 2.0 Understand the types and sources of errors.
- 3.0 Know strain gauges, load cells and piezoelectric devices and their uses.
- 4.0 Understand temperature measurement
- 5.0 Know displacement measurement
- 6.0 Understand Pressure Transducer
- 7.0 Know Flow Measurement
- 8.0 Understand Electrical Measurement
- 9.0 Understand mechanical measuring instruments

INTRODUCTION TO ENGINEERING MEASUREMENT

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Introduction to Engineering Measurement			Course Code: VAM 202		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Content				Practical Content		
General Objective 1.0: Know the fundamentals of measurement.						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1	1.1 Describe workshop standards of length. 1.2 List the sub-divisions of standard of length. 1.3 Discuss the sub-divisions in 1.2.	Explain in details the concepts and fundamentals of measurement.	Recommended textbooks, charts, Chalkboard, chalk, etc.			Metrology laboratory, Practical manuals, Practical reports, relevant textbooks
General Objective 2.0: Understand the types and sources of errors.						
2	2.1 Describe the types of errors commonly found in engineering measurement. 2.2 Explain sources of errors in measurement such as: equipment errors; operational interference; and installation. 2.3 Explain means of over-	Explain in details the types, sources and means of overcoming errors.	Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.	Demonstrate the activity in 2.1 and ask the students to identify the sources of error and suggest ways of overcoming them. Assess students' reports.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and	Metrology laboratory, Practical manuals, Practical reports

	coming errors mentioned in 2.1 above.				manuals as references to students. Demonstrate the procedure to perform these practical works.	
General Objective 3.0: Know strain gauges, load cells and Piezoelectric devices and their uses.						
3-4	3.1 Describe various forms of strain gauges for measuring strains in radial, axial and biaxial directions 3.2 Describe load cells and piezoelectric devices in measurement. 3.3 Discuss the effect of heat and other environmental factors in the use of strain gauges.	Explain in details the principle of operation and application of strain gauges. Assess the students.	Recommended textbooks, charts, lecture notes, Chalkboard, chalk, etc,	3.1 Use the strain gauges for measuring strains in radial, axial and biaxial directions 3.2 Use load cells and piezoelectric devices in measurement.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Metrology laboratory, Practical manuals, Practical reports
General Objective 4.0: Understand temperature measurement						
5-6	4.1 Explain the	Give assignment	Chalk,	4.1 Perform	Engage the	Metrology

	<p>classification of temperature measuring instruments as follows:</p> <ul style="list-style-type: none"> i. Expansion Thermometer ii. Change of state iii. Thermometer iv. Electrical transduction thermometer. <p>4.2 Discuss the examples of each class mentioned above.</p> <p>4.3 Explain the operational principle of the following temperature measuring instruments:</p> <ul style="list-style-type: none"> i. Bimetallic thermometer ii. Thermocouples iii. Resistance thermometers 	<p>and continuous assessment to students.</p> <p>With the aid of charts, power point, slides etc , illustrate the fundamental principles in the modules.</p> <p>Engage the students in syndicate group discussion and projects.</p>	<p>Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.</p>	<p>temperature measurement using the following instruments:</p> <ul style="list-style-type: none"> i. Mercury in glass thermometer ii. Bimetallic thermometer iii. Thermocouples iv. Resistance thermometers 	<p>students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>laboratory, Practical manuals, Practical reports, relevant textbooks</p>
General Objective 5.0: Know displacement measurement						
7-8	<p>5.1 Explain the principle of operation of potentiometer</p> <p>5.2 Describe the following different types of potentiometer namely:</p> <ul style="list-style-type: none"> i. Servo ii. Rectilinear iii. Rotary 	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as</p>	<p>Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.</p>	<p>5.1 Take displacement measurements using each of the potentiometers listed below:</p> <ul style="list-style-type: none"> i. Servo ii. Rectilinear 	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed</p>	<p>Metrology laboratory, Practical manuals, Practical reports, relevant textbooks</p>

	5.3 Discuss the application of potentiometers 5.4 Explain the merit and demerits of potentiometer.	references to students. Solve as many problems as possible for the students during tutorial classes.		iii. Rotary	academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	
General Objective 6.0: Understand Pressure Transducer						
9	6.1 Explain the operational principle of the following pressure measuring instruments: i. Manometers ii. Bourdon Tubes iii. Bellows iv. Diaphragms 6.2 Discuss the advantages and disadvantages of each instruments listed in .1 above.	Give assignment and continuous assessment to students. With the aid of charts, power point, slides etc , illustrate the fundamental principles in the modules. Engage the students in syndicate group discussion and projects.	Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.	6.1 Carry out pressure measurements using the following instruments: i. Manometers ii. Bourdon Tubes iii. Bellows iv. diaphragms	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical	Metrology laboratory, Practical manuals, Practical reports, relevant textbooks

					works.	
General Objective 7.0: Know Flow Measurement						
9-10	<p>7.1 Discuss the physical properties used for measuring the flow of fluids.</p> <p>7.2 Explain the working principle of the following flow rate measurement devices namely:</p> <ol style="list-style-type: none"> i. Orifice ii. Venturi iii. Dall tube iv. Nozzle <p>7.3 Mention the applications of each type of flowmeters.</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<p>Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.</p>	<p>6.1 Carry out flow measurements using the following instruments:</p> <ol style="list-style-type: none"> i. Orifice ii. Ventri iii. Dial tube iv. Nozzle 	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Metrology laboratory, Practical manuals, Practical reports, relevant textbooks</p>
General Objective 8.0: Understand Electrical Measurement						
11	<p>8.1 State the uses of the following types of measuring Instruments used in Electrical signals:</p> <ol style="list-style-type: none"> i. Digital Analyzers ii. Spectrum Analyzers iii. Voltmeter iv. Ammeter 	<p>Give assignment and continuous assessment to students. With the aid of charts, power point, slides etc , illustrate the</p>	<p>Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.</p>	<p>8.1 Measure Electrical signals using :</p> <ol style="list-style-type: none"> i. Digital Analyzers ii. Spectrum Analyzers iii. Voltmeter 	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non</p>	<p>Metrology laboratory, Practical manuals, Practical reports, relevant textbooks</p>

	<p>v. Oscilloscope (C.R.O.) vi. Wheatstone bridge vii. Power meter viii. Digital Voltmeter ix. Frequency Counters x. Capacitance meter xi. Inductance bridge xii. Impedance meter 8.2 State when each of the above is used.</p>	<p>fundamental principles in the modules. Engage the students in syndicate group discussion and projects.</p>		<p>iv. Ammeter v. Oscilloscope (C.R.O.) vi. Wheatstone bridge vii. Power meter viii. Digital Voltmeter ix. Frequency Counters x. Capacitance meter xi. Inductance bridge xii. Impedance meter 8.2 State when each of the above is used.</p>	<p>printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	
General Objective 9.0 Understand mechanical measuring instruments						
12	<p>9.1 Explain the uses of the following measuring instruments: i. Vernier caliper ii. Inside caliper iii. Outside caliper iv. Divider caliper v. Oddleg caliper vi. Dial caliper vii. Digital caliper viii. Micrometer caliper</p>	<p>Give assignment and continuous assessment to students. With the aid of charts, power point, slides etc , illustrate the fundamental principles in the modules.</p>	<p>Chalk, Chalkboard, Recommended textbooks, Posters showing sources of errors, etc.</p>	<p>9.1 Apply the following instruments to take measurements: i. Vernier caliper ii. Inside caliper iii. Outside caliper iv. Divider caliper xv. Dial caliper xvi. Digital caliper</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials,</p>	<p>Metrology laboratory, Practical manuals, Practical reports, relevant textbooks</p>

	<ul style="list-style-type: none"> ix. Dial indicator x. Feeler guage xi. Bore gauge xii. Micrometer xiii. Surface guage 	<p>Engage the students in syndicate group discussion and projects.</p>		<ul style="list-style-type: none"> xvii. Micrometer caliper xviii. Dial indicator xix. Feeler guage xx. Bore gauge xxi. Micrometer xxii. Surface guage 	<p>websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course: **Automotive Sensor Technology**

Course Code: **VAM 203**

Contact Hours: **T:1hr/wk – P:2 hrs/wk**

General Objectives

- 1.0 Understand Mechatronics Systems
- 2.0 Understand Mechatronics Systems
- 3.0 Know sensor and Transducer Principles
- 4.0 Understand Drive Technology

AUTOMOTIVE SENSOR TECHNOLOGY

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Automotive Sensor Technology			Course Code: VAM 203		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Course Specification: Theoretical Content: Know the meaning of Mechatronics				Practical Content:		
General Objectives 1.0: Understand Mechatronics Systems						
Week	Specific Learning Outcomes	Teacher’s activities	Learning Resources	Specific Learning Outcomes	Teacher’s activities	Learning Resources
1 - 3	1.1 Define Mechatronics. 1.2 State the types of Mechatronics. 1.3 Discuss the significant differences between the different types of Mechatronics. 1.4 State the advantages and disadvantages of each of the types. 1.5 Discuss its relevance to contemporary engineering design. 1.6 Mention Mechatronics system and its primary elements.	Explain the concept of Mechatronics Identify its differences Distinguish between the types identified. Explain the relevance to engineering design.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	1.1 Identify household items that can be characterized as mechatronic system. What components do they contain that help you identify them as mechatronic Systems. If an item contains a micro-processor, describe the function that are performed by the micro-processor.	Guide the students to identify the various components of mechatronic systems. Demonstrate the use of the various components of the training board.	<ul style="list-style-type: none"> - Instrumental diagrams - Training board - Plug-in-cables - Dc power source - Washing machine - Bread toaster and hand drilling Machine. - Live vehicle with inbuilt technology
General Objective 2.0: Understand Mechatronics Systems						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources

4 - 6	<p>2.1 Define mechatronic system.</p> <p>2.2 State the different types of systems.</p> <p>2.3 State the function of each type.</p> <p>2.4 Discuss system measurement.</p> <p>2.5 Discuss system control.</p> <p>2.6 Discuss microprocessor.</p>	<p>Explain systems.</p> <p>Explain system measurement.</p> <p>Explain control system.</p> <p>Explain the steps in sequential control.</p> <p>Explain the applications of mechatronic system.</p>		<p>Carry out system measurement</p>	<p>Demonstrate the use of measurement equipment.</p> <p>Demonstrate how systems are controlled.</p> <p>Guide the students to identify controlled systems.</p> <p>Demonstrate system measurement and ask the students to practice same.</p>	<p>- measuring tools</p>
General Objective 3.0: Know sensor and Transducer Principles						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
7-10	<p>3.1 Define sensor.</p> <p>3.2 Mention the different types of sensors.</p> <p>3.3 Define transducer.</p> <p>3.4 Mention the different types of transducers.</p> <p>3.5 Differentiate between a sensor and</p>	<p>Explain sensors and transducers.</p> <p>Guide the students to identify different types of sensors and transducers.</p> <p>Explain the uses and applications of sensors and</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 			

	a transducer. 3.6 Discuss calibration and signal conditioning.	transducers; Performance, classification, static & dynamic characteristics of calibration and signal conditioning.				
General Objective 4.0: Understand Drive Technology						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Learning Resources
11 - 12	4.1 Define actuators. 4.2 Mention the different types of actuators. 4.3 Define valves. 4.4 Mention the different types of valves.	Explain the physical principles of solenoid-type devices, valves, dc machines, ac machines & stepper motor etc. Guide the students to identify the different items mentioned above.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	7.1 Carry out identification of different drives	Guide the students to identify the drives.	Actuators, valves ac & dc motors, solenoid, etc.

Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Alternator and Starter Motor Maintenance**
Course Code: **VAM 204**
Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand the procedure to Service Starter Motor
- 2.0 Know the procedure to service an alternator
- 3.0 Identify faults on a charging system.
- 4.0 Rectify faults on a charging system

ALTERNATOR AND STARTER MOTOR MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Alternator and Starter Motor Maintenance			Course Code: VAM 204	Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Contents				Practical Contents		
General Objective 1.0: Understand the procedure to Service Starter Motor						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-3	1.1 State the function of the starter motor. 1.2 Name types of starter motor. 1.3 Identify the components of a starter motor. 1.4 Explain the operating principles of a starter motor. 1.5 Identify common faults of a starter motor. 1.6 Explain the use of tools and equipment for starter motor servicing. 1.7 Observe safety in starter motor servicing.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	1.1 Detect common faults in a starter motor. 1.2 Select tools and equipment for starter motor servicing. 1.3 Dismantle and assemble a starter motor. 1.4 Rectify faults. 1.5 Carry out performanc	Engage the students in group work. Assess the students' performances . Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these	Complete tool box, Starter motor service bench, starter motor, multimeters, Manufacturer's special tools

				e test.	practical works.	
General Objective: 2.0 Know the procedure to service an alternator						
4-6	2.1 State the function of an alternator. 2.2 Differentiate between an alternator and a dynamo. 2.3 Identify alternator components and their functions. 2.4 Explain the principles of operation of an alternator.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	2.1 Select tools and equipment for alternator servicing. 2.2 Carry out safety measures. 2.3 Demonstrate compliance to manufacturers specifications. 2.4 Demonstrate the procedure for dismantling and assembling an alternator. 2.5 Rectify faults. 2.6 Carry out alternator performance test.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Complete tool box, Starter motor bench, multimeters, Manufacturer's special tools
General Objective 3.0 : Identify faults on a charging system.						
7-9	3.1 Identify faults on a charging system. 3.2 Describe the functions of a charging system. 3.3 Describe the operating principles of an alternator.	Assess the students' performances. Give relevant printed and non printed academic	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals 	3.1 Detect faults in a charging system. 3.2 Carry out identification of the different parts of alternator	Engage the students in group work. Assess the students' performances. Give relevant	Complete tool box, charging system, test lamp

	<p>3.4 Identify the different parts of an alternator and their uses.</p> <p>3.5 Identify the charge indicator, its uses and operating principles.</p> <p>3.6 State the functions of a voltage regulator.</p> <p>3.7 Identify common faults on a charging system, their causes and remedies.</p> <p>3.8 State reasons for decarbonising armature.</p> <p>3.9 Illustrate how drive is transmitted from crankshaft to alternator through fan belt.</p>	<p>materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<p>- Lecture notes</p>	<p>3.3 Use charge indicator.</p> <p>3.4 State the functions of a voltage regulator.</p> <p>3.5 Rectify common faults in a charging system.</p>	<p>printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	
General Objective 4.0: Rectify faults on a charging system						
10-12	<p>4.1 State effects of inadequate tension of fan belt.</p> <p>4.2 Observe safety precautions relating to the maintenance of a charging system.</p> <p>4.3 De-carbonise armature.</p> <p>4.4 Replace different</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as</p>	<p>- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes</p>	<p>4.1 Detect faults in a charging system.</p> <p>4.2 Carry out identification of the different parts of alternator</p> <p>4.6 Use charge indicator.</p> <p>4.7 State the functions of a</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic</p>	<p>Complete tool box, charging system, test lamp</p>

	components of charging system.	references to students. Solve as many problems as possible for the students during tutorial classes.		voltage regulator. 4.8 Rectify common faults in a charging system.	materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Automotive Lighting S8ystem**

Course Code: **VAM 205**

Contact hour: **T:1hr/wk – P:2hrs/wk**

General Objectives

- 1.0 Understand headlamp setting
- 2.0 Understand the procedures for clearing faults in lighting systems.
- 3.0 Know the construction of simple lighting system

AUTOMOTIVE LIGHTING SYSTEM

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Automotive Lighting System		Course Code: VAM 205		Contact Hours: T:1hr/wk – P:2hrs/wk		
General Objective 1.0 Understand headlamp setting.						
Theoretical Contents				Practical Contents		
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	<p>1.1 Explain the purpose and function of automotive lighting system namely.</p> <ul style="list-style-type: none"> - Better visibility during night and bad weather driving. - Traffic safety - Vehicle identification - Safety <p>1.2 Discuss the types of lighting systems, their functions and applications as follows:</p> <ul style="list-style-type: none"> - Headlamp - Pear light - Direction Indication Lamps (Trafficators) - Parking light 	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Use the following lighting system, tools and equipment:</p> <ul style="list-style-type: none"> - Headlamp Adjustment Beam - Multimeters - Test lamps etc. <p>1.2 Test different types of circuits used in auto lighting systems.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p>	<p>Headlamp adjustment beam, multimeter, test lamps, test cables, lighting system simulation bench, lighting system wiring boards , charts for lighting system, automobile wiring diagram</p>

	<ul style="list-style-type: none"> - Hazard light - Plate number light - Interior/Door lights - Brake & Reverse lights - Front and rear fog light <p>1.3 Explain the Lighting System Legislation with respect to National & International Laws.</p> <p>1.4 Discuss the following lighting system tools and equipment, their uses and applications:</p> <ul style="list-style-type: none"> - Headlamp Adjustment Beam - Multimeters - Test lamps etc. <p>1.5 Explain the types of bulbs, features, ratings uses and applications.</p> <p>1.6 Discuss the purpose, types and implication of anti-dazzling devices in use.</p>			<p>1.3 Carry out wire Identification using :</p> <ul style="list-style-type: none"> - Colour Code - Thickness (mm) - Etc 	<p>Demonstrate the procedure to perform these practical works.</p>	<p>Headlamp adjustment beam, multimeter, test lamps, test cables, lighting system simulation bench, lighting system wiring boards , charts for lighting system, automobile wiring diagram</p>
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	<p>1.7 Discuss Modern Headlamps Operations, viz:</p> <ul style="list-style-type: none"> - Self adjustment and - Self operating system <p>1.8 Explain different types of circuits used in auto lighting systems, and their applications.</p> <ul style="list-style-type: none"> - series and parallel connections. <p>1.9 Explain the Wire Identification Methods:</p> <ul style="list-style-type: none"> - Colour Code - Thickness (mm) - Etc 					
General Objective 2.0: Understand the procedures for clearing faults in lighting system.						
7-12	<p>2.1 Discuss common Lighting System Faults, Symptoms</p> <ul style="list-style-type: none"> - Short circuit - Open circuit - Defective bulb - Fault Switch <p>2.2 Explain the purpose and function of fuses</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Rectify common lighting System faults such as:</p> <ul style="list-style-type: none"> - Short circuit - Open circuit - Defective bulb - Fault Switch <p>2.1 Carry out</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic</p>	<p>Headlamp adjustment beam, multimeter, test lamps, test cables, lighting system simulation bench, lighting system wiring</p>

	<p>and relays in the lighting system.</p> <p>2.3 Discuss the fuse ratings and applications.</p> <p>2.4 Explain the following lighting system service and maintenance procedures:</p> <ul style="list-style-type: none"> - National Laws - Manufacturer's Data - Tools & Equipment Selection and Set-up. - Wiring diagram interpretation - Components/ Circuit testing - Component replacement - Relay testing procedures 	<p>references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>		<p>practical works on fuses and relays in the lighting system.</p> <p>Equipment</p> <p>2.3 Read and interpret wiring diagram interpretation</p> <p>2.4 Test components/circuit</p> <p>2.5 Carry out replacement of components.</p>	<p>materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>boards , charts for lighting system, automobile wiring diagram</p>
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Electric Power-Assisted Steering**

Course Code: **VAM 206**

Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand operating principle of power assisted steering
- 2.0 Understand the principles of operation of electric assisted power steering
- 3.0 Understand the general mechanical functioning

Electric Power assisted Steering

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Electric Power assisted Steering			Course Code: VAM 207	Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Contents			Practical Contents			
General Objective 1.0 : Understand operating principle of power assisted steering						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-4	1.1 State the function and purpose of power assisted steering. 1.2 Discuss the types if power assisted steering systems such as: - Hydraulic system - Electric system 1.3 Explain the following components of power steering and their functions: - Steering box - Rack and Pinion - Push rod and its screw - Linkage and ball joints.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	1.1 Demonstrate the operation of the following steering system: i. Hydraulic power steering ii. Electric power steering 1.3 Detect safely systems faults and remedies such as: - Stiff operation - Noisy system	Engage the students in groups work . Assess their performances. Give relevant printed and non printed academic material to students. Demonstrate the procedure to perform these practical	Live vehicles with hydraulic and electric power assisted steering, complete steering box, special tool diagnostic equipment, printed materials.
General Objective 2.0: Understand the principles of operation of electric assisted power steering						
5-8	2.1 Explain the steering box providing assistance. 2.2 Discuss the under	Assess the students' performances.	- Whiteboard - marker - Duster			

	<p>listed components such as:</p> <ul style="list-style-type: none"> - Electrical motor (DC) - A reduction gear comprising a wormless screw and a wheel. - Torque sensor - Electric board - Electronic control unit. 	<p>Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Instructional drawing - Text books - Journals - Lecture notes 			
General Objective 3.0: Understand the general mechanical functioning						
9-12	<p>3.1 Discuss motion transmission pinion linked to the steering column drives a rack. 3.2 Explain power assisted force</p> <ul style="list-style-type: none"> - wheel and worm gear system - link between the drive wheel and the pinion. <p>3.3 Discuss the following components :</p> <ul style="list-style-type: none"> -Torque sensing components - Input shafts - Output shafts 	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>3.1 Detect faults, symptoms of electric power assisted steering. 3.2 Rectify faults in electric power assisted steering. 3.3 Set up tools for fault detection and clearing</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these</p>	<p>Live vehicles with hydraulic and electric power assisted steering, complete steering box, special tool diagnostic equipment, printed materials.</p>

	3.4 Explain the faults: Symptoms and remedies of electric assisted sheering 3.5 Discuss tools set- up for fault detection and clearing 3.6 State safety requirements.	tutorial classes.			practical works.	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Transistorized Ignition System Maintenance**

Course Code: **VAM 207**

Contact hour: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Set ignition system maintenance
- 2.0 Rectify faults on transistorized ignition systems

TRANSISTORIZED IGNITION SYSTEM MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Transistorized Ignition System Maintenance			Course Code: VAM 207		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Contents			Practical Contents			
General Objective: 1.0 Set Ignition Timing						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	1.1 Define ignition timing. 1.2 State the purpose of ignition timing. 1.3 Explain the consequences of wrong ignition timing. 1.4 Distinguish between various types of transistorized ignition, systems and their applications. 1.5 Illustrate transistorized ignition system circuit. 1.6 Observe safety relating to transistorized ignition systems service. 1.7 Identify ignition timing tools and equipment.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	1.1 Use ignition timing tools and equipment. 1.2 Apply the procedures for ignition timing. 1.3 Select manufacturer's specifications for different vehicles. 1.4 Apply procedures for ignition timing.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Complete toolbox, multimeter, Stroboscopic lamp, Dwell angle tester, ignition coil tester

	<p>1.8 Outline procedures for ignition timing.</p> <p>1.9 Select manufacturer's specifications for different vehicles.</p> <p>b. Apply procedures for ignition timing.</p>					
General Objective 2.0: Rectify faults on transistorized ignition systems						
7-12	<p>2.1 Explain common faults on transistorized ignition systems, their symptoms and remedies.</p> <p>2.2 List tools and equipment used in identifying faults on transistorized ignition systems.</p> <p>2.3 State the different methods used to rectify faults on transistorized ignition system.</p> <p>2.4 Discuss how to read and interpret manufacturer's specifications relating to fault diagnosis and rectification.</p> <p>2.5 Observe related safety.</p> <p>2.6 Apply procedures for rectifying faults.</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Detect common faults on transistorized ignition systems, their symptoms and remedies.</p> <p>2.2 Use tools and equipment for identifying faults on transistorized ignition systems.</p> <p>2.3 Read and interpret manufacturer's specifications relating to fault diagnosis and rectification.</p> <p>2.4 Apply procedures for rectifying faults.</p> <p>2.5 Test ignition System.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	

Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Fuel Injection System Maintenance**

Course Code: **VAM 208**

Contact hour: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand fuel injection system service.
- 2.0 Know how to Set Idling Speed

FUEL INJECTION SYSTEM MAINTENANCE (PETROL)

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Fuel Injection System Maintenance			Course Code: VAM 208		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Contents				Practical Contents		
General Objective: 1.0 Service fuel injection system.						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	1.1 State the functions of the fuel injection system. 1.2 Distinguish the difference types of injection systems and their applications. 1.3 Identify the various components of the injection system, their locations and functions. 1.4 Illustrate the fuel circuit of a typical fuel injection system. 1.5 Explain the operating principles of the fuel injection system. 1.6 State the causes	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	1.1 Demonstrate procedures for the assembling and disassembling of fuel injections system including cleaning of parts. 1.2 Rectify fuel injection faults. 1.3 Carry out functionality test.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Complete toolbox, injection system testing machines, digital multimeters, Injection system service kit, Injection nozzle tester

	<p>and remedies of faults including checking fuel pump pressure and fuel leakage.</p> <p>1.7 Outline the procedures for fuel injection system service.</p> <p>1.8 Demonstrate procedures for the assembling and disassembling of fuel injections system including cleaning of parts.</p> <p>1.9 Rectify fuel injection faults. b. Carry out functionality test.</p>					
General Objective: 2.0 Know how to set Idling Speed						
7-12	<p>2.1 Define the term “Idling Speed” and “RPM”</p> <p>2.2 Distinguish between idling speed and RPM.</p> <p>2.3 State the importance of having correct idling speed.</p>	<p>Assess the students’ performances. Give relevant printed and non printed academic materials, websites and manuals as</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Use tools and instrument for setting idling speed.</p> <p>2.2 Apply procedures for setting idling speed.</p>	<p>Engage the students in group work. Assess the students’ performances. Give relevant printed and non printed academic materials, websites</p>	<p>Complete toolbox, injection system testing machines, digital multimeters, Injection system service kit, Injection nozzle tester</p>

	<p>2.4 Select idling speed from manufacturer's specifications.</p> <p>2.5 Identify tools and instrument used in setting idling speed.</p> <p>2.6 State the procedures for setting idling speed.</p> <p>2.7 Apply procedures for setting idling speed.</p>	<p>references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>			<p>and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Modern Brake System**

Course Code: **VAM 209**

Contact Hour: **T: 1hr/wk – P: 2 hrs/wk**

Course Objectives

- 1.0 Understand brake systems
- 2.0 Classification of brake systems
- 3.0 Know the legal requirements of the brake system
- 4.0 Know the operating principles of various brake system
- 5.0 Understand the purpose of antilock brake system

Modern Brake System

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
COURSE: Modern Brake System			Course Code: VAM 209		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Course Specification: Theoretical content				Course Specification: Practical content		
General Objective 1.0: Understand Brake Systems						
WEEK	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Resources
1-3	1.1 Explain the purpose of brake systems in automobile. 1.2 Define pressure, friction and Pascal’s principles in relation to brake system. 1.3 Explain the types of brake fluid e.g. Dot 3 and Dot 4. 1.4 Analyse the characteristic of brake fluid.	Describe the features of brake system in automobile. Explain the use of the Duo check equipment. Illustrate pressure, friction and Pascal’s principles in relation to brake system.	Recommended textbook, lecture notes, whiteboard, marker, duster, Duo check equipment etc.	1.1 Identify the different component parts of the brake system in a motor vehicle. 1.2 Trace faults in brake system. 1.3 Dismantle, service and Reassemble master cylinder. 1.4 Dismantle, service and Reassemble disc and drum brake systems. 1.5 Carry out bleeding of the hydraulic brake system. 1.6 Adjust relevant brake components.	Demonstrate activities 1.1 to 1.5 for the students to learn and allow them to practice till they become competent. Grade students’ reports, practical works, drawings and sketches.	Complete brake system of a motor vehicle. Brake fluid Hand tools
General Objective 2.0: Classify of Brake Systems						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Resources
4-6	2.1 Classify the various	Explain in details	Recommended	-	-	-

	Brake systems in automobile. 2.2 State the uses/ applications of each type in 2.1. 2.3 Emphasize the importance of braking system.	the various types and applications of brake system. Explain the application of the various braking system Assess students graded assignments.	textbook, lecture notes, whiteboard, marker, duster, etc.			
General Objective 3.0: Know the Legal Requirements of the Brake System						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Resources
7-8	3.1 List the safety rules (acts) affecting brake systems. 3.2 Explain the performance of braking effort on different surfaces and weather.	Explain the safety act affecting brake systems and the performance of braking effort on different surfaces and weather.	Recommended textbook, lecture notes, whiteboard, marker, duster, simulation board etc.	-	-	
General Objective 4.0: Know the Operating Principles of Various Brake System						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Resources
9-10	4.1 Explain the working principles of: Exhaust braking system. 4.2 Explain the working	Guide the students to understand the working	Recommended textbook, lecture notes, whiteboard,			

	<p>principles of Fixed and floating cam.</p> <p>4.3 Explain the working principles of: Single and multi-piston master cylinders.</p> <p>4.4 Explain the working principles of: Single and multi-piston types of hydraulic wheel.</p>	<p>principles of Brake system in 4.1 – 4.4.</p>	<p>marker, duster, simulation boards etc.</p>			
General Objective: 5.0 Understand the purpose of Antilock brake system						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Outcome	Teachers Activities	Resources
11-12	<p>5.1 Explain antilock brake system.</p> <p>5.2 Highlight the Purposes of ABS.</p> <p>5.3 Explain different types of ABS system.</p> <p>5.4 List major ABS component and explain the functions.</p> <p>5.5 Explain the principles of operation of the ABS.</p> <p>5.6 Explain the relationship</p>	<p>Explain the purpose of ABS.</p> <p>Discuss different types of ABS.</p> <p>Identify major components of ABS and their functions.</p> <p>Discuss the principles of ABS operation.</p>	<p>Recommended text book.</p> <p>Lecture notes</p> <p>White Board</p> <p>Marker</p> <p>Duster</p> <p>Live component for demonstration.</p>	<p>5.1 Identify components of an ABS system.</p> <p>5.2 Dismantled, inspect and reassemble ABS system.</p> <p>Trace and rectify fault in an ABS system.</p>	<p>Demonstrate activities 5.0 to 5.2 for the students to learn and allow them to practice till they become competent.</p>	<p>Live vehicle with ABS system.</p> <p>Or</p> <p>ABS training model</p>

	between the ABS and normal brake System.					
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Diesel Engine Fuel System Maintenance**
Course Code: **VAM 210**
Contact Hours: **T: 1hr/wk – P: 2hrs/wk**

General Objectives

- 1.0 Maintain Diesel Fuel Injection Pump
- 2.0 Understand the process of Phasing and calibrating Diesel Injection Pump.
- 3.0 Know how to service diesel fuel injector nozzles.

DIESEL ENGINE FUEL SYSTEM MAINTENANCE

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Diesel Engine Fuel System Maintenance			Course Code: VAM 210		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Contents				Practical Contents		
General Objective 1.0: Maintain Diesel Fuel Injection Pump						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-4	1.1 State the purpose of the diesels fuel system. 1.2 Distinguish between the diesel fuel system and the petrol fuel system, and their application. 1.3 Illustrate the diesel fuel circuit. 1.4 State the characteristics of the diesel fuel and its safety precaution. 1.5 Describe the functions of a diesel injection pump. 1.6 Identify various types in use. 1.7 Identify diesel injection pump components and their functions.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	1.1 Test the functionality of a diesel injection pump. 1.2 Dismantle and assemble an injection pump. 1.3 Carry out injection pump timing. 1.4 Demonstrate injection pump servicing and timing.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Complete tool box, injector pump phasing and calibrating machine, injector pump and nozzle service kits, manufacturers' special tools.

	1.8 Outline procedures for dismantling and assembling of the injection pump. 1.9 State causes and remedies of faults.					
General Objective 2.0 : Understand the process of Phasing and calibrating Diesel Injection Pump.						
5-8	2.1 Define “Phasing” and “Calibration” and state their importance. 2.2 Distinguish between phasing and calibration. 2.3 Identify the procedure for phasing and calibrating the various types of injection pumps. 2.4 State safety measures to be observed while phasing and calibrating the pump. 2.5 Select appropriate tools and equipment for phasing and calibration. 2.6 Determine manufacturer’s specifications for the various types of	Assess the students’ performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	2.1 Use appropriate tools and equipment for phasing and calibration. 2.2 Apply manufacturer’s specifications to determine various types of pump. 2.3 Phase the injection pump. 2.4 Calibrate the injection pump. 2.5 Perform functionality test.	Engage the students in group work. Assess the students’ performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Complete tool box, injector pump phasing and calibrating machine, injector pump and nozzle service kits, manufacturers’ special tools.

	pump.					
	General Objective 3.0 : Know how to service diesel fuel injector nozzles.					
9-12	<p>3.1 State the functions of the injector nozzles.</p> <p>3.2 Identify the various types and their applications.</p> <p>3.3 State the components of diesel injector nozzles and their functions.</p> <p>3.4 Observe safety precautions relating to nozzles servicing.</p> <p>3.5 Determining manufacturer's specifications on the various nozzles types.</p> <p>3.6 Select appropriate tools and equipment for nozzles services.</p> <p>3.7 Outline the procedures injector nozzles servicing.</p> <p>3.8 Outline the procedure for dismantling and assembling injector nozzles.</p> <p>3.9 Demonstrate injector</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>3.1 Use appropriate tools and equipment for nozzles services.</p> <p>3.2 Dismantle and assemble injector nozzles.</p> <p>3.3 Demonstrate injector nozzle service according to specification.</p> <p>3.4 Carry out tests on injector nozzles.</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>Complete tool box, injector pump phasing and calibrating machine, injector pump and nozzle service kits, manufacturers' special tools.</p>

	nozzle service according to specification. b. Test injector nozzles.					
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Workshop Management and Organization**

Course Code: **VAM 301**

Contact Hours: **T:1hr/wk – P: 1hrs/wk**

General Objectives

- 1.0 Understand workshop financial records.
- 2.0 Maintain workshop job related records.
- 3.0 Procedure tools, materials and equipment.

WORKSHOP MANAGEMENT AND ORGANISATION

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Workshop Management and Organisation			Course Code: VAM 301		Contact Hours: T:1hr/wk – P: 1hrs/wk	
General Objective1.0: Understand the Workshop Financial Records						
Theoretical Contents				Practical Contents		
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-3	1.1 State reasons for keeping workshop financial records. 1.2 Identify different financial records in a workshop. 1.3 Differentiate the difference between receipts and invoices and their applications. 1.4 Discuss the preparation and use of receipts and invoices. 1.5 Explain safe and proper records keeping techniques.	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes - Computer systems - Samples of job related and financial records	1.1 Demonstrate the preparation and use of receipts and invoices. 1.2 Demonstrate safe and proper records keeping techniques.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Receipts, invoices, records, computer systems, ledger
General Objective: 2.0 Maintain Workshop Job Related Records.						

4-7	<p>2.1 State workshop job related records.</p> <p>2.2 Explain reasons for keeping workshop job related records.</p> <p>2.3 Differentiate between workshop job related records and workshop financial records and their applications.</p> <p>2.4 Explain the procedure for the preparation of workshop job related records and their uses.</p> <p>2.5 Discuss safe and proper records keeping.</p> <p>2.6 Highlight the importance of workshop job related records.</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Demonstrate the procedure for the preparation of workshop job related records and their uses.</p> <p>2.2 Demonstrate safe and proper records keeping.</p> <p>2.3 Maintain workshop job related records.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Job cards, vehicle reception card.</p>
General Objective: 3.0 Procure tools, materials and equipment.						
9-12	<p>3.1 State the various procurement methods used in the workshop, their reasons and applications.</p> <p>3.2 Interpret manuals and reference materials.</p> <p>3.3 Describe basic procurement</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>3.1 Determine appropriate stock-level in the workshop.</p> <p>3.2 Procure tools, materials and equipment.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic</p>	<p>Manufacturer data, suppliers inventory records, requisition cards, computer with internet</p>

	<p>procedures.</p> <p>3.4 Explain the determination of appropriate stock-level in the workshop.</p> <p>3.5 Identify the various storage techniques, their advantages and disadvantages.</p>	<p>manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>			<p>materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>connectivity.</p>
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Vehicle Communication Systems**

Course Code: **VAM 302**

Contact Hours: **T:1hr/wk – P: 1hrs/wk**

General Objectives

- 1.0 Identify faults on vehicle communications
- 2.0 Maintain vehicle communication systems

VEHICLE COMMUNICATION SYSTEMS

PROGRAMME : NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Vehicle Communication Systems			Course Code: VAM 302	Contact Hours: T:1hr/wk – P: 2 hrs/wk		
General Objective: 1.0 Identify Faults on Vehicle Communication						
Theoretical Contents				Practical Contents		
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	1.1 Explain the purpose and function of modern vehicle communication systems. 1.2 Discuss the types of communication systems: <ul style="list-style-type: none"> - Car Radio/Sound System/DVD - Car Telephone - Car Television - Electronic Dash Boards - Navigation Systems 1.3 Explain the principles, operations and applications of the above communication systems in modern	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	1.1 Identify the following types of communication systems: <ul style="list-style-type: none"> - Car Radio/Sound System - Car Telephone - Car Television - Electronic Dash Boards - Navigation Systems 1.2 Observe legal and safety requirements in vehicle communication system applications.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Live vehicle with modern communication systems, Local Safety codes and regulations.

	automobiles. 1.4 Explain the legal and safety requirements in vehicle communication system applications.					
General Objective 2.0 Maintain Vehicle Communication Systems.						
7-12	<p>2.1 Discuss the common communication system faults such as:</p> <ul style="list-style-type: none"> - wrong signals - sound distribution - system failure <p>2.2 Explain the interpretation of communication symbols on Digital Dash Boards with respect to:</p> <ul style="list-style-type: none"> - Engine Malfunction - Service Interval Indication - Safety system status e.g seat belts, brakes, door locks, tyre pressure e.t.c <p>2.3 State the vehicle communication system service maintenance tasks</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Detect common communication system faults such as:</p> <ul style="list-style-type: none"> - wrong signals - sound distribution - system failure <p>2.2 Interpret communication symbols on Digital Dash Boards with respect to:</p> <ul style="list-style-type: none"> - Engine Malfunction - Service Interval Indication - Safety system status e. g seat belts, brakes, door locks, tyre 	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Computerised diagnostic tools, digital multimeter , electrical toolbox, manufacturer data</p>

	<p>namely:</p> <ul style="list-style-type: none"> - Removal and installation of radio/sound systems. - Installation of vehicle telephone system. - Removal and installation of vehicle television system. - Coding and programming of radio, sound systems, car phones, navigation systems etc. - Electronic dash board removal and installation. <p>2.4 State the following service maintenance procedures:</p> <ul style="list-style-type: none"> - Adherence to legal requirements - Adherence to Manufacturer specifications. - Adherence to safety standards 			<p>pressure e.t.c</p> <p>2.3 Carry out the following vehicle communication system service maintenance tasks namely:</p> <ul style="list-style-type: none"> - Removal and installation of radio/sound systems. - Installation of vehicle telephone system. - Removal and installation of vehicle television system. - Coding and programming of radio, sound systems, car phones, navigation systems etc. - Electronic dash board removal and 		
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	<p>and requirements.</p> <ul style="list-style-type: none"> - Tools/requirement selection and set-up. - Fault tracing and rectifications. 			<p>installation.</p> <p>2.4 Observe the following service maintenance procedures when carry out 2.3 above:</p> <ul style="list-style-type: none"> - Adherence to legal requirements - Adherence to Manufacturer specifications. - Adherence to safety standards and requirements. - Tools/requirement selection and set-up. - Fault tracing and rectifications. 		
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Safety and Comfort Systems**

Course Code: **VAM 303**

Contact Hours: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand automotive safety systems
- 2.0 Understand the operational principle of comfort system

SAFETY & COMFORT SYSTEMS

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Safety & Comfort Systems			Course Code: VAM 303		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
General Objective 1.0: Understand Automotive Safety Systems						
Theoretical Contents				Practical Contents		
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	<p>1.1 Explain purpose and function of auto-safety and comfort systems.</p> <ul style="list-style-type: none"> - Vehicle Safety - Occupants Safety and Comfort - Luggage Safety - Traffic <p>1.2 Discuss the types of safety systems and their functions and applications.</p> <ul style="list-style-type: none"> - Seat Belt - Air Bag (SRS) - Cruise Control - Parktronic System (PTS) - Central Lock System (CTL) - Drive Authorization <p>1.3 Explain the following</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<p>- Whiteboard</p> <ul style="list-style-type: none"> - marker - Duster <p>- Instructional drawing</p> <ul style="list-style-type: none"> - Text books - Journals - Lecture notes 	<p>1.1 Demonstrate the use of the following types of safety systems:</p> <ul style="list-style-type: none"> - Seat Belt - Air Bag (SRS) - Cruise Control - Parktronic System (PTS) - Central Lock System (CTL) - Drive Authorization <p>1.2 Detect safety systems faults and remedies namely:</p> <ul style="list-style-type: none"> - Inactive Air Bag - Cruise Control Failure - PTS Sensor Malfunction 	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>Live vehicles with safety & comfort system, complete tools box, diagnostic equipment, multimeters, test lamps, simulation boards, CBTs, CD-ROM, manufacturers' specification manuals & auto data</p>

	<p>common safety systems faults symptoms and remedies:</p> <ul style="list-style-type: none"> - Inactive Air Bag - Cruise Control Failure - PTS Sensor Malfunction - ISTR Sensor Malfunction - Failed or Incorrect Central Lock Operation. - Irregular Drive Authorization <p>1.4 Identify Safety Systems Components that includes:</p> <ul style="list-style-type: none"> - Sensors - Control Units - Etc <p>1.5 Explain Safety Systems Service and Maintenance procedures listed below:</p> <ul style="list-style-type: none"> - Manufacturer's Data - Tools and equipment 			<ul style="list-style-type: none"> - DTR Sensor Malfunction - Failed or Incorrect Central Lock Operation. - Irregular Drive Authorization <p>1.3 Carry out the following safety Systems Service and Maintenance procedures:</p> <ul style="list-style-type: none"> - Manufacturer's Data - Tools and equipment selection - Sensors and control unit testing. - System programming - Components replacement - Service safety requirement - Faults tracing and rectification procedures. 		
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	<ul style="list-style-type: none"> selection - Sensors and control unit testing. - System programming - Components replacement - Service safety requirement - Faults tracing and rectification procedures. 					
General Objective 2.0 Understand the operational principle of comfort system.						
7-12	<p>2.1 Explain the following types of comfort systems, their operational principles, functions and applications:</p> <ul style="list-style-type: none"> - Vehicle Air Condition System - Vehicle Interior Heating Systems - Seat heaters - Windscreen/mirror heaters - Keyless Go System - Seat adjustment mechanisms 	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Carry out tests on the following comfort system components.</p> <ul style="list-style-type: none"> - Air condition components : - Sensors and control Units <p>2.2 Perform comfort system service and maintenance</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate</p>	<p>A/c gas recirculation plant</p>

	<p>2.2 Discuss the underlisted comfort system components.</p> <ul style="list-style-type: none"> - Air condition components: <ul style="list-style-type: none"> • Compressors • Dryers • Evaporators • Thermostat etc • Types of air-conditioner gases - Sensors and control Units <p>2.3 Explain the comfort system service and maintenance procedures; namely:</p> <ul style="list-style-type: none"> - Tools and equipment selection. - Manufacturer's Data - Air condition servicing procedures - Safety requirement - Adjustment and programming - Fault tracing and rectification procedures. - Sensors and control units testing and replacement. 	<p>problems as possible for the students during tutorial classes.</p>		<p>procedures namely:</p> <ul style="list-style-type: none"> - Tools and equipment selection. - Manufacturer's Data - Air condition servicing procedures - Safety requirement - Adjustment and programming - Fault tracing and rectification procedures. - Sensors and control units testing and replacement 	<p>the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Electronic Wheel Alignment**

Course Code: **VAM 304**

Contact Hour: **T:1hr/wk – P: 2 hrs/wk**

General Objectives

- 1.0 Understand wheels, tyres and tube specifications
- 2.0 Understand wheel tyres and tube maintenance procedures
- 3.0 Understand wheel balancing procedures
- 4.0 Understand the concept of wheel alignment

ELECTRONIC WHEEL ALIGNMENT

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Electronic Wheel Alignment		Course Code: VAM 304			Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Content				Practical Content		
General Objective 1.0: Understand wheels, tyres and tube specifications						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-3	1.1 Define pressure. 1.2 State the units of measurement of length and pressure. 1.3 Convert SI and imperial unit of measurement of length and pressure. 1.4 Identify the different types of tyres and applications. 1.5 State the effects of temperature and other weather conditions on tyres. 1.6 Identify the recommendation tyres depth gauge and pressure from manufacturers specifications. 1.7 State tyres rotation	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	1.1 Identify tyres specifications from manufacturer's manuals.	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Tyre changing machines, vulcanizing kit, sizeable wheel spanners, tyre pressure gauge, tyre depth gauge, water, soap.

	<p>principles and their importance</p> <p>1.8 Differentiate between tubeless and tubes tyres, their advantages and disadvantages.</p> <p>1.9 Differentiate between tyres ad shapes of wheels, their advantages</p>					
General Objective 2.0: Understand wheels, tyres ad tubes maintenance procedures						
4-6	<p>2.1 State safety precautions to be observed when replacing tyres, wheels and tubes.</p> <p>2.2 Explain tools and equipment used to replace tyres, wheels to include tyre bead removal and tubes.</p> <p>2.3 Describe the procedure for replacing tyres, wheels and tubes.</p> <p>2.4 outline the procedures for identifying faults' of tyres and tubes.</p> <p>2.5 State the different method used to repair tyres and tubes.</p> <p>2.6 Explain the procedure</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Observe safety precautions when replacing tyres, wheels and tubes.</p> <p>2.2 Select tools and equipment used to replace tyres, wheels to include tyre bead removal and tubes.</p> <p>2.3 Demonstrate the procedure for replacing tyres, wheels and tubes.</p> <p>2.5 Detect</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical</p>	<p>Tyre changing machines, vulcanizing kit, sizeable wheel spanners, tyre pressure gauge, tyre depth gauge, water, soap.</p>

	of identifying faults and repair tyres and tubes.			faults' in tyres and tubes. 2.5 Use different method to repair tyres and tubes.	works.	
General Objective 3.0 Understand wheel balancing procedure						
7-9	3.1 State the meaning purpose and importance of wheel balancing. 3.2 Describe different methods of wheel balancing namely: - Static - dynamic 3.3 Explain principles of wheel balancing. 3.4 Discuss the procedures for wheel balancing	Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	3.1 Carry out the following procedures: - Equipment set-up - Adjustment - Adherence to manufacturer's specifications - Safety measures - Functionality test	Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	Tyre changing machines, vulcanizing kit, sizeable wheel spanners, tyre pressure gauge, tyre depth gauge, water, soap, wheel balancing machine, complete tool box
4.0 Understand the concept of wheel alignment						
10-12	4.1 State the meaning of wheel alignment.	Assess the students'	- Whiteboard - marker	4.1 Carry out wheel alignment	Engage the students in	Tyre changing machines,

	<p>4.2 Explain the importance and function of wheel alignment</p> <p>4.3 Describe different methods of wheel alignment namely:</p> <ul style="list-style-type: none"> - Microscopic (optical) - Computerized <p>4.4 Define the following terms used in wheel alignments:</p> <ol style="list-style-type: none"> i. Castor angle ii. Camber angle iii. King-pi inclination iv. Toe in and toe out <p>4.5 Explain tools and equipment that are used in wheel alignment.</p> <p>4.6 Describe common faults associated with wheel alignment, their causes and effects.</p> <p>4.7 State safety precautions related wheel alignment.</p>	<p>performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>using the following methods:</p> <ul style="list-style-type: none"> - Microscopic (optical) - Computerized <p>4.2 Select tools and equipment that are used in wheel alignment.</p> <p>4.3 Rectify wheel alignment faults</p> <p>4.4 Observe safety precautions related to wheel alignment.</p>	<p>group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>vulcanizing kit, sizeable wheel spanners, tyre pressure gauge, tyre depth gauge, water, soap, complete tool box, wheel balancing machine</p>
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Automatic Gear Box System**

Course Code: **VAM 305**

Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Identify faults on gear box systems
- 2.0 Service manual and automatic gear box systems

AUTOMATIC GEAR BOX SYSTEM

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Automatic Gear box system		Course Code: VAM 305		Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Contents				Practical Contents		
General Objective 1.0: Identify faults on gear box systems						
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	<p>1.1 Define key terms used in manual and automatic gear box systems.</p> <p>1.2 State the functions of a gear box system.</p> <p>1.3 Distinguish between manual and automatic systems, their advantages and disadvantages.</p> <p>1.4 Describe the operating principles of a manual gear box systems.</p> <p>1.5 Describe the operating principles of an</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Identify common faults on manual and automatic gear box systems, their causes and effects.</p> <p>1.2 Identify the different types of automatic transmission fluids, their properties, characteristics and applications</p>	<p>Engage the students in group work.</p> <p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	<p>Complete tool box, Gear box special tools and parts cleaning trays, live vehicle with automatic gear box and complete automatic gear box</p>

	<p>automatic gear box system.</p> <p>1.6 Identify the components of manual and automatic gear box systems and their functions.</p> <p>1.7 Identify common faults on manual and automatic gear box systems, their causes and effects.</p> <p>1.8 Explain the flow system of automatic transmission fluid in automatic gear system.</p> <p>1.9 State the functions of automatic transmission fluid.</p> <p>1.10 Identify the different types of automatic transmission fluids, their properties, characteristics and applications.</p> <p>1.11 State the functions of gear</p>	<p>Assess the students' performances.</p> <p>Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 			
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	<p>oil in manual box systems.</p> <p>1.12 Identify the different gear box oils, their properties, characteristics advantages and disadvantages.</p> <p>1.13 State the importance of having adequate transmission fluid and gear box oil.</p>					
General Objective 2.0: Service Manual and Automatic gear box system						
7-12	<p>2.1 Outline the routine procedures for the servicing of gear box systems in accordance with manufactures' specifications.</p> <p>2.2 Demonstrate the use of tools and equipment used in servicing manual and automatic gear box systems.</p> <p>2.3 Discuss how to dismantle and assemble manual</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Use manufactures' specifications to service a gear box system.</p> <p>2.2 Demonstrate the use of tools and equipment used in servicing manual and automatic gear box systems.</p> <p>2.3 Dismantle and assemble</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate</p>	<p>Complete tool box, Gear box special tools and parts cleaning trays, live vehicle with automatic gear box and complete automatic gear box</p>

	<p>and automatic gear box systems.</p> <p>2.4 Explain adjustment of gear selector mechanism.</p> <p>2.5 Discuss how to replace components of gear box systems.</p>			<p>manual and automatic gear box systems.</p> <p>2.4 Adjust gear selector mechanism.</p> <p>2.5 Replace components of gear box systems.</p> <p>2.6 Test drive vehicle</p>	<p>the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Electronic Diesel Engine Maintenance**

Course Code: **VAM 306**

Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Service electronic diesel engines.
- 2.0 Rectify faults on Electronic diesel engines.

ELECTRONIC DIESEL ENGINE MAINTENANCE

PROGRAMME : NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course: Electronic Diesel Engine Maintenance			Course Code: VAM 306		Contact Hours: T:1hr/wk – P: 2 hrs/wk	
General Objective 1.0: Service Electronic Diesel Engines						
Theoretical Contents				Practical Contents		
Week	Specific Learning Objectives	Teachers Activities	Resources	Specific Learning Objectives	Teachers Activities	Resources
1-6	<p>1.1 Explain the justifications of the need for electronic diesel engine operations with respect to:</p> <ul style="list-style-type: none"> - improved performance - better emission control - wider applications <p>1.2 State the difference between conventional diesel engine and electronic diesel engine operations.</p> <ul style="list-style-type: none"> - Limitation of the former over the later. <p>1.3 Discuss the functions and application of electronically controlled diesel fuel</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Identify by visual inspection different features of conventional diesel engine and electronic diesel engine.</p> <p>1.2 Identify by visual inspection electronically controlled diesel fuel injection pumps and mechanical pump</p> <p>1.3 Identify the constructional features of the following types of Electronic Diesel Control systems (EDC) such as:</p> <ul style="list-style-type: none"> - Common rail Diesel 	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Live diesel electronic engines with following EDC applications: CDI, UPS, UIS, manufacturer manuals, CBTs</p>

	<p>injection pumps their functions and applications namely:</p> <ul style="list-style-type: none"> - In line pump - Distributor pump <p>Etc</p> <p>1.4 Discuss the following types of Electronic Diesel Control systems (EDC) in use, their operations, functions and applications.</p> <ul style="list-style-type: none"> - Common rail Diesel Injection (CDI) - Unit Pump System (UPS) - Unit Injector System (UIS) 			<p>Injection (CDI)</p> <ul style="list-style-type: none"> - Unit Pump System (UPS) - Unit Injector System (UIS) 		
General Objective 2.0: Rectify faults on Electronic Diesel Engines.						
7-12	<p>2.1 Explain the faults, symptoms and remedies of Common rail diesel Injector (CDI) namely:</p> <ul style="list-style-type: none"> - Low rail pressure - High rail pressure <p>2.2 Discuss Unit System (UPS) faults, symptoms and remedies.</p> <p>2.3 Explain the Unit</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Detect the following faults and symptoms on a CDI engine:</p> <ul style="list-style-type: none"> - Low rail pressure - High rail pressure <p>2.2 Detect fault and symptoms in Unit Pump System (UPS).</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to</p>	<p>Computerized diagnostic equipment, autoscan tools, digital multimeter, manufacturer special tools, standard toolbox and manufacturer data.</p>

	<p>Injector System (UIS) faults, systems and remedies</p> <p>2.4 Discuss the following electronic diesel engine service maintenance procedures:</p> <ul style="list-style-type: none"> - Tools and equipment selection and set up. - Manufacturer's Data - Safety Requirements - Sensors and Actuator Testing - Control Units Testing - Component replacements and adaptations. - Fault Deleting Procedures 	<p>Solve as many problems as possible for the students during tutorial classes.</p>		<p>2.3 Detect fault and symptoms in Unit Injector System (UIS) .</p> <p>2.4 Perform the following electronic diesel engine service maintenance procedures:</p> <ul style="list-style-type: none"> - Tools and equipment selection and set up. - Manufacturer's Data - Sensors and Actuator Testing - Control Units Testing - Component replacements and adaptations. - Fault Deleting Procedures <p>2.5 Observe Safety Requirements when carrying out 2.4 above.</p>	<p>students.</p> <p>Demonstrate the procedure to perform these practical works.</p>	
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Programme: **National Vocational Certificate in Automotive Mechatronics**
Course Title: **Electronic Ignition System**
Course Code: **VAM 307**
Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Understand the principles of operation of electronic ignition system.
- 2.0 Know how to set system parameter.

ELECTRONIC IGNITION SYSTEM

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Electronic Ignition System		Course Code: VAM 307		Contact Hours: T:1hr/wk – P: 2 hrs/wk		
Theoretical Content				Practical Content		
General Objective 1.0: Understand the principles of operation of electronic ignition system						
WEEK	Specific Learning Outcomes	Teacher's activities	Resources	Specific Learning Outcomes	Teacher's activities	Resources
1-6	<p>1.1 Discuss the justification for the electronic system in modern vehicles.</p> <p>1.2 Explain the limitations of coil ignition systems.</p> <p>1.3 Describe the transistorized ignition system</p> <p>1.4 Describe the constructional features of the following electronic ignition systems and their applications, namely: static and dynamic.</p> <p>1.5 Discuss the electronic ignition</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students.</p> <p>Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>1.1 Identify vehicles fitted with the static and dynamic ignition coil.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Complete tool box, Scan tools/diagnostic equipments, computer printers, live vehicle with electronic ignition system, simulation/demonstration board</p>

	components, their functions and operating principles.					
General Objective 2.0 Know how to set system parameter						
7-12	<p>2.1 Highlight common, electronic ignition system faults, causes, symptoms and remedies.</p> <p>2.2 Explain safety requirements in faults diagnosis and rectification.</p> <p>2.3 Describe different types the electronic ignition maintenance and diagnostic tools.</p> <p>2.4 Discuss service maintenance procedures such as:</p> <ul style="list-style-type: none"> - Right selection of tools - Adherence to manufacturers' specifications - testing and replacement where necessary. 	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Detect faults in electronic ignition system.</p> <p>2.2 Carry out maintenance of electronic ignition systems using appropriate diagnostic tools.</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical works.</p>	<p>Complete toolbox, Scan tools/diagnostic equipment, multimeters, computer printers</p>

Programme: **National Vocational Certificate in Automotive Mechatronics**

Course Title: **Electronic Vehicle diagnosis**

Course Code: **VAM 309**

Contact Hour: **T:1 hr/wk - P: 2 hrs/wk**

General Objectives

- 1.0 Understand operational principles of computerized vehicle diagnosis
- 2.0 Know how to configure system parameters

ELECTRONIC VEHICLE DIAGNOSIS

PROGRAMME: NATIONAL VOCATIONAL CERTIFICATE IN AUTOMOTIVE MECHATRONICS						
Course : Electronic Vehicle Diagnosis		Course Code: VAM 309			Contact Hours: T:1hr/wk – P: 2 hrs/wk	
Theoretical Content				Practical Content		
General Objective 1.0 Understand operational principles of electronics vehicle diagnosis						
WEEK	Specific Learning Outcomes	Teacher’s activities	Resources	Specific Learning Outcomes	Teacher’s activities	Resources
1-6	1.1 State the reasons for computerized diagnosis 1.2 List the advantages of computerized diagnosis 1.3 Identify various diagnostic equipment, their applications, advantages and disadvantages. 1.4 Locate the on-board diagnostic socket on the vehicle. 1.5 Observe safely precaution relating to computerized vehicle diagnosis	Assess the students’ performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Solve as many problems as possible for the students during tutorial classes.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	1.1 Locate the on-board diagnostic socket on the vehicle. 1.2 Use various diagnostic equipment and computerized vehicle diagnosis system 1.2 Demonstrate ability to use computer 1.3 Perform vehicle self check. 1.4 Retrieve vehicle data	Engage the students in group work. Assess the students’ performances. Give relevant printed and non printed academic materials, websites and manuals as references to students. Demonstrate the procedure to perform these practical	Complete tool box, Scan tools/diagnostics equipments, computer printers

	<p>1.6 Outline the procedure for computerized vehicle diagnosis</p> <p>1.7 Demonstrate ability to use computer</p> <p>1.8 Perform vehicle self check.</p> <p>1.9 Interpret results of self check test.</p> <p>1.10 Analyze test results</p> <p>1.11 Delete and rectify stored faults in the ECU</p> <p>1.12 Identify various electronics components, their function and locations in vehicles</p>			<p>electronically from diagnosis equipment.</p> <p>1.5 Erase stored fault on vehicle OBD.</p>	works.	
General Objective 2.0 Know how to configure system parameters						
7-12	<p>2.1 Identify manufacturer's specifications of various systems.</p> <p>2.2 State the procedures for retrieving manufacturer's information via the computer.</p> <p>2.3 Explain parameter</p>	<p>Assess the students' performances. Give relevant printed and non printed academic materials, websites and manuals as references to</p>	<ul style="list-style-type: none"> - Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes 	<p>2.1 Carry out parameter measurement according to manufacturer's specifications</p>	<p>Engage the students in group work. Assess the students' performances. Give relevant printed and non printed academic materials,</p>	<p>Complete toolbox, Scan tools/diagnostic equipment, multimeters, computer printers</p>

	measurement according to manufacturer's specifications	students. Solve as many problems as possible for the students during tutorial classes.			websites and manuals as references to students. Demonstrate the procedure to perform these practical works.	
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LIST OF MINIMUM RESOURCES

A. List of Equipment for Automotive Mechatronics Laboratory

S/No.	Description	Quantity
1.	Digital Multimeter (DMM)	5
2.	Potentiometer	5
3.	Ohmmeter	5
4.	Oscilloscope	5
5.	Independent Power supply panel	5
6.	Personal Computers	20
7.	Printers	2
8.	Scanner	1
9.	Function Generator (a.c.)	5
10.	Function Generator (d.c.)	5
11.	Multimedia Data acquisition & Control board	2
12.	Lab View Software (data acquisition & process control)	1 packet
13.	MATLAB software	1
14.	Bench link software (HP, LG, IBM, etc.)	1
15.	Engine analysis, Part sourcing & assembling techniques tools	1
16.	Training board (Auto-electric)	1
17.	Plug-in-cables	1
18.	Pneumatic training unit	1
19.	Hydraulic board	1
20.	Bearing and Precision assembly kit	1
21.		

B. List of Equipment for Automotive Mechatronic Workshop

S/No.	Description	Quantity
1.	Automatic crane	1
2.	Digital alignment unit	1
3.	Fuel Injection testing unit	1
4.	Live vehicles	various models
5.	Model diesel & petrol engines	1 each
6.	Manual transmission units	1
7.	Automatic transmission units	1
8.	Assorted motor parts models	various
9.	Digital wheel balancing machines	1
10.	Mobile cranes	1
11.	Vulcanizing units	1
12.	D.C. charging kits	1
13.	Welding machines (MIG, Arc, Gas, etc.)	1 each
14.	Mobile tool boxes	10
15.	Bench vices	10
16.	Column drilling machine	1
17.	Student Lathes	1
18.	Power saw	1
19.	Floor grinding machine	1
20.	Table grinding machines	1
21.	Table drilling machine	1
22.	Measuring and marking out tables	1
23.	Work benches with a.c. plug-in facilities	6
24.	Hydraulic brake testing unit	1
25.	Hydraulic jacks	2
26.	Hydraulic stands	2
27.	Floor jacks (6 ton capacity)	2

28.	Cable stands (mobile and stationary)	2 each
29.	Headlight alignment unit	1
30.	Modern training facilities (multimedia & overhead projectors, mobile board, board fax)	1 each
31.	Fuel pressure gauge	2
32.	Engine stand	2
33.	Diagonostic equiptment	2

C. DRAWING ROOM/STUDIO

1	Drawing table complete with drafting machine/stools	30
2	Drawing set complete with pens for ink work	2
3	45° set squares	2
4	60° set squares	2
5	Blue printing machine	1
6	Adjustable set squares	5
7	Desk sharpener	5
8	Triangular scale rule (30 mm)	5
9	Flat scale rule (300 mm)	5
10	Blackboard ruler (1m)	4-1
11	Blackboard Tee squares	4-1
12	Blackboard set square (45° 60°)	2 each
13	Blackboard compasses	4-1
14	Blackboard protractor	4-1
15	French curve set	5
16	Letter stencils (3 mm, 6 mm, 7 mm and 10 mm)	5 each
17	Rubber stencils (3 mm, 6 mm, 7 mm, 6 mm and 10 mm)	5 each

18	Erasing stencils	5 each
19	Drawing rack/shelves for 30 students	
20	Personal computers	2
21	Plotter	1
22	Printer to handle A3 size	1

D. METROLOGY LABORATORY

1	Comparator (Mechanical)	1
2	Universal measuring microscope	1
3	Bench testing centers	1
4	Angle gauge	1
5	Set of slip gauge	1
6	Sine bars with centers	1
7	Engineers level	1
8	Micrometers (assorted denomination)	2 each
9	Vee blocks (assorted sizes)	2 each
10	Magnetic vee block	1
11	Vernier calipers	3
12	Vernier height gauge	2
13	Angle plate	1
14	Limit gauges for holes, shafts, and threads	3 each
15	Surface plate	1
16	Marking out table	1
17	Parallel strips	4 pairs
18	Bevel protractor	2

19	Dial gauges and magnetic stand	2
20	Engineers' square	2
21	Thread gauge	2
22	Radius gauge	2
23	Feeler gauge	2
24	Steel rule	4
25	Combination set	2

LIST OF PARTICIPANTS

Expert Group Meeting between 9th and 13th February 2009

1. Mr. F.C. Udeh
Training Manager,
Anammco Training Centre, Enugu
2. Engr. O.O. Bello
National Board for Technical Education, Kaduna
3. Engr. S.M. Yusuf
National Board for Technical Education, Kaduna
4. Engr. A D K Muhammad
Desk Officer (VEI/IEI)
National Board for Technical Education, Kaduna
5. Engr. J.O. Falade
Ag. Deputy Director,
National Board for Technical Education, Kaduna
6. Dr. M. S. Abubakar
Director of Programmes,
National Board for Technical Education, Kaduna
7. Engr. Dr. Nuru A Yakubu, OON
Executive Secretary,
National Board for Technical Education, Kaduna

National Critique Workshop between 10th and 13th March 2009

1. Mr. F.C. Udeh
Anammco Training Centre, Enugu
2. Mr. Pakshar J. Yakubu
Peugeot Automobile Nig. Ltd, Kaduna
3. Engr. Awunde Peter
Council for Regulation of Engineering in Nigeria (COREN), Abuja
4. Engr. O.O. Bello
National Board for Technical Education, Kaduna
5. Engr. S.M. Yusuf
National Board for Technical Education, Kaduna
6. Engr. A D K Muhammad
Desk Officer (VEI/IEI)
National Board for Technical Education, Kaduna
7. Engr. J.O. Falade
Ag. Deputy Director,
National Board for Technical Education, Kaduna

8. Dr. M. S. Abubakar
Director of Programmes,
National Board for Technical Education, Kaduna
9. Engr. Dr. Nuru A Yakubu, OON
Executive Secretary,
National Board for Technical Education, Kaduna