CURRICULUM AND COURSE SPECIFICATIONS

For

NATIONAL INNOVATION DIPLOMA (NID)

IN

AUTOMOTIVE MECHATRONICS TECHNOLOGY

BY

NATIONAL BOARD FOR TECHNICAL EDUCATION
PLOT B, BIDA ROAD, P.M.B. 2239, KADUNA

NOVEMBER 2019

General Information

1.0 Title of the Programme

National Innovative Diploma in Automotive Mechatronics

1.1 Aim and Objectives of the Programme

The National Innovative Diploma 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 Innovative Diploma in Automotive Mechatronics programme is Post Basic Education Certificate (Post Junior Secondary School Certificate).

3.0 Structure of the programme

The National Innovative Diploma (NID) in Automotive Mechatronics Programme is in flexible modular form, and is structured to have three parts (i.e. NVC Part I, NID Part II, and NID 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 Innovative Diploma 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

NID 1 FIRST SEMESTER

Course Code	Course Title	L	P	CU	CH	Course Status
CSK 501	Basics of Communication Skills	1	1	2	2	GS
GNS	Citizen Education	1	1	2	2	GS
MTH 101	Algebra & Elementary Trigonometry	2	-	2	2	GS
MEC 102	Technical Drawing	1	2	3	3	Fundamental
COM 101	Introduction to Computer	1	2	3	3	Fundamental
MAT 111	Basic Electricity	1	2	3	3	Fundamental
MEC 111	Mechanical Engineering Science	1	2	3	3	Fundamental
EET 112	Electronics I	1	2	3	3	Core
AMT 112	Occupational Health, Safety and Environment	1	1	2	2	
	TOTAL	**10**	**13**	**23**	**23**	

NID 1 SECOND SEMESTER

Course Code	Course Title	L	P	CU	CH	Course Status
MTH 112	Logic and Linear Algebra	2	-	2	2	GS
COM 201	Computer Aided Design (CAD)	1	2	3	3	Fundamental
EET 123	Electronics II	1	2	3	3	Fundamental
MCE 111	Mechanical Workshop Technology & Practice	1	3	4	4	Core
AMT 121	Introduction to Automotive Systems	1	2	3	3	Core
AMT 122	Hydraulic & Pneumatics Systems	1	2	3	3	Core
AMT 123	Principles of Auto-Diagnosis	1	3	4	4	Core
	TOTAL	**8**	**14**	**22**	**22**	

NID 1 – THIRD SEMESTER

Course Code	Course Title	L	P	CU	CH	Course Status
EPD 201	Introduction to Entrepreneurship					
MTH 102	Calculus					
AMT 211	Practice of Auto-Diagnosis	1	3	4	4	Core
AMT 212	Principles of Automotive Systems	1	3	4	4	Core
AMT 213	Automobile Electrical Technology I	1	3	4	4	Core
AMT 214	Technical Report Writing	1	1	2	2	
AMT 215	Fundamental of Automation and Artificial Intelligence	1	1	2	2	Core
	TOTAL	**5**	**12**	**16**	**16**	

ND 1 FOURTH SEMESTER

Course Code	Course Title	L	P	CU	CH	Course Status
EPD 202	Practice of Entrepreneurship	1	3	3	3	
AMT 221	Practice of Automotive Systems	1	3	3	4	Core
AMT 222	Automotive Electrical Technology II	1	3	3	4	Core
AMT 223	Workshop Management and Organization	1	2	3	3	Core
AMT 224	Project	-	-	6	6	Core
		3	**8**	**15**	**18**	

BASIC OF COMMUNICATION SKILL
CSK 501

PROGRAMME: NID AUTOMOTIVE MECHATRONICS TECHNOLOGY

COURSE TITLE: CITIZENSHIP EDUCATION

COURSE CODE: GNS 1I1

CREDIT HOURS 2 HOURS

DURATION: Hours/Week: Theory: 2 hrs Practical: 0 hr

GOAL: This course is designed to enable students to acquire the necessary

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Understand Constitution of Nigeria
2.0 Understand the Federal System of Government in Nigeria
3.0 Know the Constitutional Rights and Obligations of Nigeria Citizens
4.0 Understand Citizenship
5.0 Fundamental Objectives and Directive of State Policy in Niger

PROGRAMME: **NID BUSINESS MANAGEMENT AND INFORMATION TECHNOLOGY**						
Course: CITIZENSHIP EDUCATION I		**Course Code: GNS 111**				**Contact Hours 2HRS/WEEK**
Year I	**Semester 1**	**Theoretical Content: 2 hrs**		**Practical Content: hrs**		
Goal: This course is designed to enable students to acquire the necessary						
General Objective: 1.0 Understand Constitution of Nigeria						
	Specific Learning Outcome:	Teacher Activities	Resources	Specific Learning Outcome:	Teacher Activities	Resources
	1.1 Explain the term constitution 1.2 Distinguish the different types of constitution 1.3 Highlight some provisions of an International Constitution 1.4 Explain the effectiveness of International Constitution 1.5 Explain the supremacy of the Nigerian Constitution to other laws with emphasis on the 1989 constitution 1.6 Evaluate the main parts of the Nigeria Constitution 1.7 Draft a constitution for an association 1.8 Trace the historical development of the Nigerian Constitution 1.9 Discuss the merits and demerits of each of the Nigerian constitutions	Ask the students: • what they understand by the term constitution and to distinguish the different rules of constitution known • Explain the effectiveness of International Constitution • Explain Nigerian Constitution to other laws. • Identify the main parts of the Nigerian Constitution. • Assess to the students by given the assignment to draft a constitution for an association	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			

	1.10 Explain the concept of "rule of law"					
Week	General Objective: **2.0 Understand the federal system of Government in Nigeria**					
5-7	2.1 Describe a federation 2.2 Distinguish a federation from a Confederation 2.3 Outline the basis for the federal system in Nigeria 2.4 Examine the evolution, structure and functions of the federal system in Nigeria. 2.5 Analyse the relationships among the three tiers of government in Nigeria 2.6 Evaluate the revenue allocation formula in operation in Nigeria 2.7 Compare and contrast other federation with Nigeria	Ask the students: • Describe a federation and the differentiate between a federation and a confederation • Define the functions of the federal system in Nigeria and the relationship among the three tiers of government • Evaluate the revenue allocation formula operation in Nigeria	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
Week	**General Objective: 3.0 Know the Constitutional Rights and obligations of Nigerian Citizens**					
8-9	3.1 Examine the significance of rights and obligations in Nigeria 3.2 Assess Government's protection of fundamental rights as contained in the Nigerian constitution 3.3 Evaluate the responsibilities and duties of Nigerian citizenships and the benefits for performing them 3.4 Assess the responsibilities and duties	Ask the students to • Identify the responsibilities and duties of Nigerian citizenship	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			

	of constituted authority to the people 3.5 Evaluate the responsibilities and duties of government to the People					
Week	**General Objective 4.0: Understand Citizenships**					
10-12	4.1 Discuss the significance of citizenship 4.2 Analyse the principles and benefits of citizenship 4.3 Explain the difference in the modes of acquiring citizenship 4.4 Evaluate the merits and demerits of each type of citizenship 4.4 Analyse the basis for the acquisition and withdrawal of Nigerian citizenship 4.5 Examine the benefits derivable from Nigeria citizenship	Ask the students: • Discuss and analyse the principles and benefits of citizenship • Analyse the basis for the acquisition and withdrawal of Nigerian citizenship	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			

Week	**General Objective 5.0: Fundamental Objectives and Directive Principles of State Policy in Nigeria**					
13-15	5.1 State the fundamental obligations of government as provided in the constitution 5.2 Explain the general provisions of the fundamental objectives and directive principles of state policy 5.3 Explain the political, economic, social and education policies of Nigeria 5.4 Explain the directive principles and policy of the Nigerian government on culture, the mass media, national ethics and duties of the citizen 5.5 Assess the conformity observance and application of the fundamental objectives and directive principles of state policy by governments and people of Nigeria. 5.6 Recommend improvements on the provision conformity, observance and application of the fundamental objectives and directive principles of state policy	Ask the students to • Explain the directive principles and policy of the Nigerian Government on cultures, the mass media, national ethnics and duties of the citizen	Instructional Manual. Recommended textbooks, e-books, lecture notes, Whiteboard, PowerPoint Projector, Screen, Magnetic Board, flip charts, etc.			
ASSESSMENT CRITERIA:						
	Course Work	Course Test 20%	Practical 20%	Examination/ Project/Portfolio 60%		

ALGEBRA AND ELEMENTARY TRIGONOMETRY
MTH 102

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY

COURSE TITLE: TECHNICAL DRAWING

COURSE CODE: MEC 102

DURATION: **3Hrs/Week**

GOAL: This course is designed to enable students acquire adequate knowledge and skills in the use of drawing instruments, graphical communication, construction of simple geometric figures and shapes, appreciation of isometric, oblique and single orthographic projections

GENERAL OBJECTIVES:

On completion this course, students should be able to:

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 isometric and oblique projections

5.0 Know simple orthographic projectors

6.0 Understand the intersection of regular solids

PROGRAMME: **NATIONAL INNOVATION DIPLOMA IN MECHATRONICS & AUTOMATION TECHNOLOGY**						
COURSE: **TECHNICAL DRAWING**	COURSE CODE: **MEC 102**		CONTACT HOURS: 3Hours/week			
COURSE SPECIFICATION: **Theoretical Course**			**Course Specification: Practical Content**			
General Objective 1.0: Know different Drawing Instruments, Equipment and Materials use in Technical drawing.						
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	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. 1.4 Use each of the items in 1.1 above. 1.5 Maintain various drawing instruments and equipment.	• Present to students all drawing instruments: a. Drawing set b. T-Square c. Drawing board d. Set squares e. Types of pencils (H to B) Explain the uses of all of the above. Explain how to take care various drawing instruments and equipment	•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 Students' drawing Set • Drawing table and Board			
	General Objective 1.0: Know different Drawing Instruments, Equipment and Materials use in Technical drawing.					
	2.1 Explain graphics and different types of graphic present	• Ask the students to	Black board ruler (1m)			

	2.2 Illustrate 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. 2.3 Layout of drawing sheets with the following: (a) Margins (b) Title block etc. 2.4 State the various standards of drawing sheets. 2.5 Print letters and figures of various forms and characters. 2.6 Illustrate conventional signs, symbols and appropriate lettering characters.	illustrate in a drawing the various types of lines based on BS 308 1972 Part 2. and assess. • Ask the students to set drawing area on A1 paper with a title block and the boarder lines and assess. • Ask students to illustrate technical lettering in capital and small letters, using, free hand and using letter stencils and assess. •Ask students to identify the various standard sheets Ao -A4 and assess. Print letters and figures of various forms and characters. Ask students to draw conventional signs and symbols and assess.	• 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 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			
	General Objective 3.0: Know different Drawing Instruments, Equipment and Materials use in Technical drawing.					
	3.1 Explain the purpose of geo-metrical construction in drawing parallel.	• Ask students to illustrate the construction of simple geometrical figures	• Black board ruler (1cm) • Black board Tee-Square			

	3.2 Construct parallel and perpendicular lines 3.3 Construct and bisect lines, angles and areas 3.4 Divide a straight line into given number of equal parts. 3.5 Identify polygons (regular or irregular) 3.6 Construct regular 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.	• Ask students to construct parallel and perpendicular lines • Ask students to construct and bisect lines, angles and areas. • Ask student to divide a straight line into a given number of equal parts using the compasses. • Ask students to differentiate between regular polygon. • Construct regular polygons with N sides in a given circle, given (a) distance across flats (b) distance across corners Give the definition of a circle Explain the properties of a circle, e.g. radius, diameter, normal, tangent, circumference etc.	• Black board compass • Black board projector • Adjustable set-square • 60 set square • 45 set square • French curve set • Templates • Duster • Chalk • Complete • Drawing table and polygons and assess • Ask students to conduct regular polygon with N side and assess			
	General Objective 4: 0 Know how to construct of simple geometrical figures and shapes					
	4.1 Carry out simple geometrical constructions on circles e.g: a. Diameter of a circle of	• Show how to construct plane and diagonal scales. \	• Black board ruler (1m) • Black board			

	given circumference b. The circumference to circle of given diameter. c. A circle to touch a given smaller circle and a given line. 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 tangent to two circles h. An area externally tangent to two circles i. Inscribing and circumscribing circles. 4.2 Define an ellipse 4.3 Construct ellipse by using (a) trammel method	• Explain the various properties of a circle. • Illustrate simple geometrical constructions on circles listed in 4.1 • Show the different methods of constructing ellipses. • Explain the meaning of an ellipse. • Show how to construct an ellipse using the various methods.	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 • Black board ruler (1m) • Black board • Tee-Square • Black board compass			

	(b) concentric circle method 4.4 Explain the following draughting techniques : (a) Projection method (b) Measurement method (c) Transposition method 4.5 Construct plane scales and diagonal scales, using appropriate instruments	• Explain the various draughting techniques listed in 4.4. • Illustrate how to construct plane shapes and diagonals scales using appropriate instruments.				
	General Objective 5: 0 Know the Isometric and Oblique Projects					
	5.1 Differentiate between isometric and oblique projections. 5.2 Draw a square in isometric and oblique forms. 5.3 Draw a circle in Isometric and oblique Forms. 5.4 Draw an ellipse in Isometric and oblique forms. 5.5 Draw a polygon with a minimum of eight sides in Isometric and oblique forms. 5.6 Dimension holes, circles, arcs and angles	• Explain isometric and oblique projections. • Illustrate how to construct a square in isometric and oblique projections. • Illustrate how to construct a circle in Isomeric and Oblique forms • Illustrate how to draw an ellipse in Isometric and Oblique forms • Illustrate how to draw a polygon in isometric and oblique projections	• 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			

	correctly on isometric and oblique forms. 5.7 Use appropriate convention symbols and abbreviations.	• Illustrate how to dimension holes circles, arcs and angles in isometric and oblique projection and label with appropriate conventional symbols and abbreviations	• Complete drawing table			
	General Objective 6: 0 Know Single Othographic Projects					
	6.1 Explain the principle of orthographic projection. 6.2 Explain 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. 6.4 Project views of three-dimensional objects on to the basic planes of projection in both first and third angle to obtain: -	• Ask students to differentiate between first and third angle orthographic projection. • Explain the vertical and horizontal planes in orthographic projection. • Show students how to construct orthographic projections of simple objects in first and third angle orthographic projections. • Show students how to 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	• Black board ruler (1m) • Black board Tee-Square • 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			

	(a) the front view or elevation (b) the top view or plan.	(b)the top view or plan				
	General Objective 7.0 Understand the Intersections of Regular Solids					
	7.1 Explain interpretation or inter-sections of solids. 7.2 Draw the lines of intersections of the following regular solids and planes in both first and third angles. a. Two square-prisms meeting at right angles. b. Two dissimilar square prisms meeting at and angle. c. Two dissimilar square prisms meeting to an angle. d. A hexagonal prism meeting a square prism at right angles. e. Two dissimilar cylinders meeting at an angle. f. Two dissimilar cylinders meeting at right angle, their centres not being in the same vertical plane.	• Give examples of intersection of solids • Illustrate how to construct: a. Two square-prisms meeting at right angles a. Two dissimilar square prisms merely b. Two dissimilar square prisms meeting 60 c. An hexagonal prism meeting a square prism d. Two dissimilar cylinders meeting at an angle e. Two dismal cylinders meeting at right angle, then centres at long in the same vertical place as in 6.2.	• Blackboard ruler (1m) • Blackboard 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			

PROGRAMME: **NID AUTOMOTIVE MECHATRONICS TECHNOLOGY**

COURSE TITLE: **INTRODUCTION TO COMPUTING**

COURSE CODE: **COM 101**

CREDIT HOURS **3 HOURS**

DURATION: Hours/Week Theory: 1 hr Practical: 2 hrs

GOAL: This course is designed to acquaint students with basic knowledge of Computer

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0. Understand the roles of Computers in Modern Society
2.0. Understand computer Hardware Components
3.0. Know the concept of software
4.0. Know the various types of computer data processing Techniques
5.0. Know the basic procedures for operating computer systems
6.0. Understand security and safety procedures within a computer environment.
7.0. Understand the concept of a computer Networks
8.0. Understand the use of the Internet

PROGRAMME: **NID AUTOMOTIVE MECHTRONICS TECHNOLOGY**						
COURSE: INTRODUCTION TO COMPUTING				**COURSE CODE: COM 101**		**CREDIT HOURS: 3**
YEAR: 1	**SEMESTER: 1**	**PRE-REQUISITE**		**Theoretical: 1hr Practical : 2 hrs**		
GOAL: This course is designed to acquaint students with the basic knowledge of Computer						
Theoretical Content				**Practical Content**		
General Objective: 1.0 Understand the role of the computer in modern society						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Objectives	Teachers Activities	Learning Resources
1-3	1.1. Define the computer 1.2. Describe the development of computers in particular. Abacus, Pascal, Babbage, Hollerath and the ENIAC 1.3. Classify computers according to generation from the 1st to 5th generations (and any subsequent generations) 1.4. Distinguish between analog, digital and hybrid computers 1.5. Explain the social implications on society, in particular privacies and quality of life 1.6. List the benefits of computers to the society	• Define computer • Trace the history of computer. • Classify the computer according to generations • Distinguish between types and classes of computers. • Highlight the implications of computers to the society. • Outline the benefit of computer to the society.	White Board and Marker. PC loaded with Power point and connected to multimedia projector	Identify different types of computers Classify computer system	Guide students to identify and classify computer systems	Networked PCs loaded with software packages. Computer charts PC loaded with computer images

		• Distinguish between types and classes of computers. • Highlight the implications of computers to the society. • Outline the benefit of computer to the society.				
	General Objective : 2.0 Understand Computer Hardware Components					
4-5	2.1. Describe computer hardware components 2.2. List some input and output devices 2.3. Describe the functions of The input and output devices 2.4. Describe the functions of the CPU 2.5. List some auxiliary units 2.6. Describe the functions of the auxiliary memory 2.7. Define bits, nibbles, bytes, word and storage size 2.8 Describe the computer hardware configuration	• Discuss the basic Hardware components. • Discuss the various components and functions. • Discuss the configuration of typical computer system.	White Board and Marker. PC loaded with Power point and connect to Multimedia Projector	Identify the various components of a computer system Identify the various components of a computer system	Guide the students on how to identify the various components of a computer system	A DEMO PC showing its components

	General Objective: 3.0 Know the concept of Software					
6-7	3.1 Define Software 3.2 Classify computer software 3.3 Describe types of programming languages: • Machine • Curve • High-level 3.2 Explain source and object code 3.5 Define a translator 3.6 Describe types of translators: assembles, compiler, interpreter 3.7 Explain the use of package programmes	• Discuss software and its various types. • Explain computer packages and its various types • Explain safety software and its various types.	White Board and Marker . PC loaded with Power point and connected to multimedia projector	Identify computer packages on computer system Identify system software on computer system	Guide students to identify computer packages on computer systems Guide students to identify system software on computer system	PCs loaded with different computer softwares
	General Objective: 4.0 Know the various types of computers data processing Techniques					
8	4.1 Define Batch processing, Real time processing, Time sharing and distributed processing 4.2 Differentiate between Batch processing, Real time processing, Time sharing and Distributed processing systems	• Explain offline and online concepts • Describe batch processing, real time, time sharing and distributed processing • Differentiate between batch processing, real	White Board. Marker PC loaded with Application packages and connected to multi-media projector	Solve life problems requiring the application of the various modes	Guide the students on how to identify real life problems requiring the various data processing techniques	Networked PCs loaded with different computer packages

	4.3 Explain multi-tasking, multi programming, multi processing	time processing, time-sharing and distributed processing system. • Describe multi-tasking and multi processing				
	General Objective: 5.0 Know the basic procedures for operating Computer System					
10-11	5.1 Explain basic computer operations setting up, start up, shot down, etc. how to operate a computer system 5.2 Explain storage initialization and formatting.	• Discuss the principles and procedures of operating the computer system, the setting up, start up and shut-down systems • Discuss initialization and formatting of storage devices such as disks and diskettes	White Board. Marker PC loaded with multi-media projector CDs External Hard-drives, Flash drives	Be able to boot and shut down computer system Format Storage media	Guide the students on how to operate the computer. Guide students on how to format storage media	Networked PCs and storage media such as diskettes, flash, CDs
	General Objective: 6.0 Understand security and safety procedures within a computer environment**.**					
11-12	6.1 Define Computer Security 6.2 Explain Data Control Techniques 6.3 Understand security methods in computer installation and the need for users passwords, anti-viruses 6.4 Explain methods of preventing hazards such as fire floating and sabotage	• Explain data control techniques. • Describe standard operating procedures of a computer installation. • Explain the need for computer room security. • Explain computer system auditing	White Board and Marker PC loaded with Relevant software packages and connected to multi media projector	Create password on computer system Installation of computer anti-viruses	Guide students on how to create simple password that they could easily remember Guide students on how to install anti viruses	Networked PCs Anti-virus software

		• Explain methods of preventing hazards fire, floating and sabotage etc. • Describe file security methods in computer installations. • Explain the need for file security in computer installation. • Explain the user passwords and user name.				
	General Objective: 7.0 Understand the concept of a computer networks					
12 - 13	7.1 Define and explain Network. 7.2 Describe different types of network topologies such as star, ring and bus. 7.3 Explain LAN, MAN and WAN. 7.4 Explain the benefits of networks in an organization	• Define computer network. • Explain different types of network organization such as star, ring, bus etc. • Describe different types of network: LAN, WAN • Discuss the benefits of networks in an organization	White Board Marker PC loaded with power point and connected to OHP	Identify various computer topologies Find out different organizations using the different topologies.	Guide the students on how to identify various network topologies	Networked PCs
	General Objective: 8.0 Understand the use of the internet					
14 - 15	8.1 Define internet and describe its resources	• Define internet • Describe resources of	White Board and Marker.	Search for materials on the internet.	Guide students on how to search for materials on	Networked PCs connected to the internet.

	8.2 Explain the processes involved in searching the internet for materials 8.3 Explain the concept of E-Mail 8.4 Explain cybersecurity	internet • Explain the processes involved in browsing and searching the internet. • Explain the meaning of ISP. • Explain the concept of email address. • Describe the processes of acquiring an e-mail address. • Describe the process of sending and receiving an email. • Discuss cyber security and preventing measures	PC loaded with power point and internet browser and connected to OHP	Compose and send Email.	the internet Demonstrate how to compose and send Email.	
	Assessment Criteria					
	Course Work	Course Test 20%	Practical 20%	Examination/ Project/Portfolio 60%		

PROGRAMME: **NID TECHNOLOGY**				
COURSE: INTRODUCTION TO COMPUTING			**COURSE CODE: COM 101**	**CREDIT HOURS: 3**
YEAR: 1	**SEMESTER: 1**	**PRE-REQUISITE**	**Theoretical: 1hr Practical : 2 hrs**	
GOAL: This course is designed to acquaint students with the basic knowledge of Computer				

Theoretical Content				Practical Content		
General Objective: 1.0 Understand the role of the computer in modern society						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning Objectives	Teachers Activities	Learning Resources
1-3	1.7. Define the computer 1.8. Describe the development of computers in particular. Abacus, Pascal, Babbage, Hollerath and the ENIAC 1.9. Classify computers according to generation from the 1st to 5th generations (and any subsequent generations) 1.10. Distinguish between analog, digital and hybrid computers 1.11. Explain the social implications on society, in particular privacies and quality of life 1.12. List the benefits of computers to the society	• Define computer • Trace the history of computer. • Classify the computer according to generations • Distinguish between types and classes of computers. • Highlight the implications of computers to the society. • Outline the benefit of computer to the society. • Distinguish between types and classes of computers. • Highlight the implications of computers to the society.	White Board and Marker. PC loaded with Power point and connected to multimedia projector	Identify different types of computers Classify computer system	Guide students to identify and classify computer systems	Networked PCs loaded with software packages. Computer charts PC loaded with computer images

		• Outline the benefit of computer to the society.				
	General Objective : 2.0 Understand Computer Hardware Components					
4-5	2.1. Describe computer hardware components 2.2. List some input and output devices 2.3. Describe the functions of The input and output devices 2.4. Describe the functions of the CPU 2.5. List some auxiliary units 2.6. Describe the functions of the auxiliary memory 2.7. Define bits, nibbles, bytes, word and storage size 2.8 Describe the computer hardware configuration	• Discuss the basic Hardware components. • Discuss the various components and functions. • Discuss the configuration of typical computer system.	White Board and Marker. PC loaded with Power point and connect to Multimedia Projector	Identify the various components of a computer system Identify the various components of a computer system	Guide the students on how to identify the various components of a computer system	A DEMO PC showing its components
	General Objective: 3.0 Know the concept of Software					
6-7	3.1 Define Software 3.3 Classify computer software 3.3 Describe types of	• Discuss software and its various types.	White Board and Marker . PC loaded with	Identify computer packages on computer system	Guide students to identify computer packages on computer	PCs loaded with different computer softwares

	programming languages: • Machine • Curve • High-level 3.3 Explain source and object code 3.5 Define a translator 3.6 Describe types of translators: assembles, compiler, interpreter 3.7 Explain the use of package programmes	• Explain computer packages and its various types • Explain safety software and its various types.	Power point and connected to multimedia projector	Identify system software on computer system	systems Guide students to identify system software on computer system	
	General Objective: 4.0 Know the various types of computers data processing Techniques					
8	4.1 Define Batch processing, Real time processing, Time sharing and distributed processing 4.2 Differentiate between Batch processing, Real time processing, Time sharing and Distributed processing systems 4.3 Explain multi-tasking, multi programming, multi processing	• Explain offline and online concepts • Describe batch processing, real time, time sharing and distributed processing • Differentiate between batch processing, real time processing, time-sharing and distributed processing system. • Describe multi-tasking and multi processing	White Board. Marker PC loaded with Application packages and connected to multi-media projector	Solve life problems requiring the application of the various modes	Guide the students on how to identify real life problems requiring the various data processing techniques	Networked PCs loaded with different computer packages
	General Objective: 5.0 Know the basic procedures for operating Computer System					

10-11	5.1 Explain basic computer operations setting up, start up, shot down, etc. how to operate a computer system 5.2 Explain storage initialization and formatting.	• Discuss the principles and procedures of operating the computer system, the setting up, start up and shut-down systems • Discuss initialization and formatting of storage devices such as disks and diskettes	White Board. Marker PC loaded with multi-media projector CDs External Hard-drives, Flash drives	Be able to boot and shut down computer system Format Storage media	Guide the students on how to operate the computer. Guide students on how to format storage media	Networked PCs and storage media such as diskettes, flash, CDs
	General Objective: 6.0 Understand security and safety procedures within a computer environment**.**					
11-12	6.1 Define Computer Security 6.2 Explain Data Control Techniques 6.3 Understand security methods in computer installation and the need for users passwords, anti-viruses 6.5 Explain methods of preventing hazards such as fire floating and sabotage	• Explain data control techniques. • Describe standard operating procedures of a computer installation. • Explain the need for computer room security. • Explain computer system auditing • Explain methods of preventing hazards fire, floating and sabotage etc. • Describe file security methods in computer installations.	White Board and Marker PC loaded with Relevant software packages and connected to multi media projector	Create password on computer system Installation of computer anti-viruses	Guide students on how to create simple password that they could easily remember Guide students on how to install anti viruses	Networked PCs Anti-virus software

		• Explain the need for file security in computer installation. • Explain the user passwords and user name.				
	General Objective: 7.0 Understand the concept of a computer networks					
12 - 13	7.1 Define and explain Network. 7.2 Describe different types of network topologies such as star, ring and bus. 7.3 Explain LAN, MAN and WAN. 7.4 Explain the benefits of networks in an organization	• Define computer network. • Explain different types of network organization such as star, ring, bus etc. • Describe different types of network: LAN, WAN • Discuss the benefits of networks in an organization	White Board Marker PC loaded with power point and connected to OHP	Identify various computer topologies Find out different organizations using the different topologies.	Guide the students on how to identify various network topologies	Networked PCs
	General Objective: 8.0 Understand the use of the internet					
14 - 15	8.1 Define internet and describe its resources 8.2 Explain the processes involved in searching the internet for materials 8.3 Explain the concept of E-Mail 8.4 Explain cybersecurity	• Define internet • Describe resources of internet • Explain the processes involved in browsing and searching the internet. • Explain the meaning of ISP.	White Board and Marker. PC loaded with power point and internet browser and connected to OHP	Search for materials on the internet. Compose and send Email.	Guide students on how to search for materials on the internet Demonstrate how to compose and send Email.	Networked PCs connected to the internet.

		• Explain the concept of email address. • Describe the processes of acquiring an e-mail address. • Describe the process of sending and receiving an email. • Discuss cyber security and preventing measures				
	Assessment Criteria					
	Course Work	Course Test 20%	Practical 20%	Examination/ Project/Portfolio 60%		

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHTRONICS

COURSE TITLE: BASIC ELECTRICITY

COURSE CODE: MAT 111

DURATION: 3hrs/ 3 Credit Units

GOAL: This course is designed to afford students the ability to explain basic principles of electricity, connect simple electronics circuits, and hands-on working experience on electrical measuring instruments.

GENERAL OBJECTIVES:

On completion of this course, the student should be able to::

1.0 Understand the terms conductor and insulator and give examples of each.
2.0 Understand resistance, voltage and current and their units of measurement
3.0 Know how to calculate the equivalent resistance, current and voltage based on Ohm's Law
4.0 Understand the factors that affect the resistance of a conductor
5.0 Know how to calculate power and energy consumed in electrical circuits
6.0 Know the applications of ammeter, voltmeter, ohmmeter and insulation resistance meter.
7.0 Understand how electricity is generated and supplied to the consumer.
8.0 Understand the single-phase distribution system
9.0 Understand the essential requirements of protection in standard circuit.
10.0 Understand the types of conductor and insulator used on cables.
11.0 Know earth fault situations
12.0 Understand the essential requirement on earthen
13.0 Understand the terms associated with earth leakage and protection
14.0 Understand the function and application of the Residual Current-operated Circuit Breaker (RCCB) and earth fault relay

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: Basic Electricity			**COURSE CODE:** MAT 111		**CONTACT HOURS: 3**	
GOAL: This course is designed to afford students the ability to explain basic principles of electricity, connect simple electronics circuits, and hands-on working experience on electrical measuring instruments						
COURSE SPECIFICATION: Theoretical Content: 1				**Practical Content:** 1		
	General Objective: 1.0Understand the terms conductor and insulator and give examples of each of them					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
	1.1 Distinguish between positive and negative ions in an atom 1.2 State how the movement of electrons constitutes an electric current 1.3 Distinguish between conventional current flow and electron flow 1.4. Define the terms "conductor" and "insulator" 1.5. Explain the meanings of good conductor and bad conductor 1.6 List examples of materials used as conductors. 1.7. Explain the meaning of	• Draw an Atom • Explain the concept of an atom. • Illustrate the atomic structure of an atom • Explain conventional current flow and electron flow and their differences • Explain the term conductor and insulator. • Explain the meanings of good conductor and bad conductor with examples. • Give examples of materials used as good	• Whiteboard • Projector • Laptop • Markers • Charts • Training Notes	1.1 Draw an atomic structure of an atom. 1.2 Identify the following materials – Conductor - Insulator - Semi-conductor 1.3 Identify the following materials: ➢ Conductors ➢ Insulators ➢ Semi-Conductor	• Show an atomic structure of an atom • Show the following materials and their uses: ➢ Conductor ➢ Insulator ➢ Semi-conductor • Show the following materials and their uses: ➢ Conductors ➢ Insulators ➢ Semi-Conductor	• Whiteboard • Projector • Laptop • Markers • Charts • Training Notes • Flip charts • Real objects

	good insulator and bad insulator 1.8 Mention examples of materials used as insulators. 1.9. Explain the meaning of semi conductor 1.10 List examples of materials used as semi-conductor	conductor and bad conductor • Explain the terms good and bad insulators with examples of each. • Explain the terms good and bad insulators with examples of each.				
	General Objective: 2.0 - Understand resistance, voltage and current and their units of measurement					
	2.1 State the International System (IS) of units of the following dimensions ➢ Length ➢ Mass ➢ Current ➢ Time ➢ Temperature 2.2. Define the terms resistance, voltage and current 2.3 State the S.I units of the following:	• Explain International System (IS) of units of dimensions in 2.1 • Explain the following mathematical conversion of measurement: ➢ micro (μ) ➢ milli (m) ➢ kilo(k) ➢ mega (m) • Explain the terms resistance, voltage and current	• Whiteboard • Projector • Training Notes • Laptop • Markers • Charts			

	➢ Resistance ➢ Voltage ➢ Current 2.4 Define Ohm's Law 2.5 Explain the concept of resistance as an opposition to current flow. 2.6. Relate between multiples of the following prefixes: • micro (μ) • milli (m) • kilo(k) • mega (m)	• Explain the S.I units of the following: ➢ Resistance ➢ Voltage ➢ Current • Explain the concept of ohm's law. • Explain the concept of resistance as an opposition to current flow. • Explain the relationship between multiples of the following prefixes: • micro (μ) • milli (m) • kilo(k) • mega (m)				
	General Objective 3.0: – Know how to calculate the equivalents resistance, current and voltage based on Ohm's Law for a maximum of 3 resistors in series, parallel and series-parallel connection					
	3.1 State Ohm's Law in terms of proportionality of current to potential	• Explain Ohm's Law in respect to it proportionality of current to potential	• Whiteboard • Projector • Laptop	3.1 Calculate the current, voltage and resistance in a series and parallel	• Show the procedures to take measurements of voltage, current and	• *Various components* • *Resistors*

	difference 3.2 Use Ohm's Law to solve for current, voltage and resistance 3.3 Differentiate between Series and Parallel Connected Resistors 3.4 Calculate the current flow in a series/ parallel circuit 3.5 Calculate the sum of the voltage in a series/ parallel circuit 3.6 Calculate the equivalent resistance of resistors connected in series/ parallel	difference. • Use Ohm's Law to solve for current, voltage and resistance • Explain the difference between series and parallel connected resistors. • Calculate the current flow in a series/ parallel circuit • State the sum of voltage in a series/ parallel circuit • Illustrate all calculations on resistors connected in series/ parallel listed in 3.6 - 3.7	• Markers • Training Notes • Charts	circuits	resistance on resistors connected in series and parallel circuits.	• *Capacitors* • *Digital/ Analog multi meter* • *Breadboard* • *wires*

	3.7 Use Ohm's law to solve simple problem involving resistors connected in series/ parallel 3.8 Solve simple problems involving resistors connected in series-parallel					
	General Objective 4.0: Understand the factors that affect the resistance of a conductor					
	4.1 Relate the resistance of a material (R) as follows: ➢ R varies directly with its length ➢ R varies inversely with its cross-sectional area ➢ R depends on the type of material 4.2 Explain the specific resistance of resistivity of a material and its unit of measurement (ohm-metre) 4.3 Calculate the resistance of	• Explain the resistance of a material (R) as follows: ➢ R varies directly with its length ➢ R varies inversely with its cross-sectional area ➢ R depends on the type of material • Explain the specific resistance of resistivity of a material and its unit of measurement (ohm-metre) • Solve examples on	• Whiteboard • Projector • Laptop • Markers • Training Notes Charts	4.1 Measure resistance with respect to: ➢ Length ➢ Cross-sectional area ➢ Type of material	• Determine the resistance of given materials with respect to: ➢ Length ➢ Cross-sectional area ➢ Type of material	• Whiteboard • Projector • Laptop • Markers • Training • Resistor • Digital/ analogue Multimeter • Breadboard • Wires

	a given material using the formula, R=þ l/a 4.4 Explain that temperature affects the resistance of a material. 4.5 State the temperature coefficient of resistance of a material and its unit of measurement (/^{0}C) 4.6 Explain positive temperature coefficient of resistance of a material 4.7 List examples of materials that have positive temperature coefficient. 4.8 Explain negative temperature coefficient of resistance of material	calculation of resistance of a given material using the formula, R=þ l/a • Explain how temperature affects the resistance of a material. • Explain the temperature coefficient of resistance of a material and its unit of measurement (/^{0}C) • Explain positive and negative temperature coefficient of resistance of a material. • Give examples of materials that have positive temperature Coefficient • Give examples of				

	4.8 List examples of materials that have negative temperature	materials that have negative temperature coefficient.				
	General Objective: 5.0: Know how to calculate power and energy consumed in electrical circui					
WEEK	5.1 Define Energy 5.2 State the law of conservation of energy: • Mechanical • Electrical • Thermal 5.3 Define power 5.4 State the units of power (watt) and energy(joule) 5.5 Calculate power using the following formulae: • P = VI	• Explain the concept of Energy and efficiency • State the law of conservation of energy: • Mechanical • Electrical • Thermal • Define power • Derive the formula to calculate power, energy and efficiency and their units of measurement • Explain the law of conservation of energy		5.1 Connect circuit correctly 5.2 Calculate power in a circuit	• Demonstrate how to connect circuit • • Demonstrate how to power in the circuit	• AC Power supply • -Resistors • -Capacitors • -Wires • Analog/Digital multi meter • -Ammeter

	• $P = I^2R$ • $P = V^2/R$ 5.6 Calculate power loss in a cable using I^2R 5.7 Explain unit of e electrical energy in kilowatt-hour 5.8 Compute the energy used by a consumer given the estimated daily loading. 5.9 Calculate efficiency using the formula: • Efficiency = Power Output / Power Input × 100% 5.10 Calculate current and energy given the rated voltage and power.	• Illustrate the calculation of power, energy and efficiency in a circuit.				

	General Objective: 6.0: Know and state the applications of ammeter, voltmeter, ohmmeter and insulation resistance meter.					
WEEK	6.1 Explain the use electrical instruments: ➢ Analogue types ➢ Digital types 6.2 State the advantages and disadvantages of analogue and digital instrument 6.4 Explain the full-scale deflection of an ammeter and voltmeter 6.5 State the applications of the following instruments: • Ohmmeter • Multimeter • Ammeter • Voltmeter • 6.6 Describe the methods of connecting ammeter and voltmeter 6.7 Describe the methods of extending the ranges of an ammeter and a	• Explain the applications of ammeter, voltmeter, ohmmeter and insulation resistance meter. • Explain the effect of parallel error in measurement	• Whiteboard • Projector • Laptop • Markers • Training Notes Charts	6.1 Read the scales of an analogue instrument 6.2 Read Digital multimeter 6.3 Connect Ammeter and Voltameter taking note of readings.	• Show the proper way of taking reading using analog multi meter • Demonstrate the effect the parallel error. • Demonstrate how to take reading using digital multiment • Demonstrate the method of connecting Ammeter and Voltameter	Measuring instruments -Analog multi meter -Ammeter -Voltmeter

	voltmeter					
	General Objective 7.0: Understand how electricity is generated and supplied to the consumer.					
	7.1 List the methods of electricity generation process 7.2 Explain the process of energy conversion from coal, oil, hydropower and nuclear power to electricity 7.3 State the voltages used for generation, transmission and distribution of electricity 7.4 Explain the functions of transmission lines, distribution lines, feeders and services cables 7.5 State the reason for transmission of electricity at high voltages. 7.6 Sketch the diagram of a 3-phase/4-phase	• Explain how electricity is generated and supplied to the consumer. • Explain the voltages used for generation, transmission and distribution of electricity • • Explain the reason for transmission of electricity at	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts			-

	Wiring system from supply authority to the consumer's terminal 7.7 State the supply voltages used for distribution in Nigeria 7.8 State the permissible variation in supply voltage (±6%) and frequency (±0.5%) of the supply authority in Nigeria. 7.9 Define the following terms as stated in NESIS: ➢ Extra low voltage ➢ Low voltage ➢ Neutral conductor ➢ Phase conductor ➢ Protective conductor ➢ System	high voltages. • Explain with the aid of a diagram a 3-phase/4-phase wiring system from supply authority to the consumer's terminal • Explain the permissible variation in supply voltage (±6%) and frequency (±0.5%) of the supply authority in Nigeria • Explain the terms associated to NESIS as listed in 7.9				
	General Objective: 8.0: Understand the single-phase distribution system					

	8.1 State how single-phase systems are obtained from a 3-phase 4-wire distribution 8.2 Explain the importance of balancing the three phases in the single-phase distribution 8.3 Sketch the single-phase, two-wire supply system to the consumer 8.4 Explain the function of isolation as a means of maintenance 8.5 Explain the function of protection as a safety precaution against electric shook and fire risk 8.6 State the importance of metering for registering energy consumption on a given period.	• Explain the how single-phase systems are obtained from a 3-phase 4-wire distribution	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts	8.1 State how single-phase systems are obtained from a 3-phase 4-wire distribution	• Demonstrate how single-phase systems are obtained from a 3-phase 4-wire distribution	• Wires • Lamb • Single phase AC power supply • Switches

	General Objective: 9.0: Understand the essential requirements of isolation, switching protection and standard circuit arrangements for socket outlets					
.	9.1 Explain the following terms: ➢ Electrical installation ➢ Distribution board ➢ Consumer's control unit ➢ Final circuit ➢ Isolator ➢ Maximum demand ➢ Diversity factor ➢ Radial final circuit ➢ Ring final circuit ➢ Spur 9.2 Explain types of final circuit arrangements ➢ Power ➢ lighting 9.3 Explain the following as stated in on single-phase consumer's installation: ➢ Position of protective devices and switches ➢ Isolation and switching	• Explain the essential requirements of isolation, switching protection and standard circuit arrangements for socket outlets.	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts			

	➢ Means of isolation and protection ➢ Position of a protective device ➢ Position and operation of an isolator ➢ Means of isolation for an installation					
	General Objective: 10.0: Know the types of conductor and insulator used on cables and flexible cords					

	10.1 Explain the following terms: ➢ Ambient temperature ➢ Insulation ➢ Bunched ➢ Grouping ➢ Current-carrying capacity of a conductor 10.2 Describe the common materials used as conductors in cables 10.3 Differentiate properties of copper and aluminium as conductors 10.4 Explain the common materials used as insulators in cables. 10.5 Explain the following types of insulation: ➢ Basic insulation ➢ Double insulation ➢ Reinforced insulation ➢ Supplementary insulation	• Describe the types of conductor and insulator used on cables. • Describe the following types of insulation: ➢ Basic insulation ➢ Double insulation ➢ Reinforced insulation ➢ Supplementary insulation	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts	10.1 Measure cross-sectional area of cables. 10.2 Identify the types of insulation: ➢ Basic insulation ➢ Double insulation ➢ Reinforced insulation ➢ Supplementary insulation	• Show to measure the cross-sectional area of cables. • Show types of insulation in 10.2 using different types of cables. •	• Vernier caliper • Cables

	10.6 Explain the meaning of 'core' as applied to a cable 10.7 Explain why the size of a cable is normally indicated by the cross-sectional area of the conductor 10.8 state the voltage rating of cable. 10.9 Explain how the following details are required in the description of a cable: ➢ Type of conductor ➢ Type of insulator and sheath and/or mechanical protection ➢ Size of conductor ➢ Number of core 10.10 Explain the importance of selecting cables of the correct cross section	• Explain the meaning of 'core' as applied to a cable • Explain why the size of a cable is normally indicated by the cross-sectional area of the conductor • Explain the voltage rating of cable. • Explain how the following details are required to describe a given cable: ➢ Type of conductor ➢ Type of insulator and sheath and/or mechanical protection ➢ Size of conductor ➢ Number of core • Explain the importance of selecting cables of the correct cross section	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts		•	•

	10.11 Explain how the heat produced in a cable is dissipated to the surrounding area. 10.12 Explain voltage drop in a consumer's installation as dependent on: ➢ Conductor material ➢ Cross-sectional area of conductor ➢ Length of conductor ➢ Current flowing through conductor 10.13 Explain the following: ➢ Cable sizes 10mm^2 or less of copper ➢ Permissible voltage drop in cable ➢ Effect of ambient temperature on cable ➢ Cables exposed to direct sunlight ➢ nductor material Cross	• Explain how the heat produced in a cable is dissipated to the surrounding area. • Explain voltage drop in a consumer's installation as dependent on: ➢ Conductor material ➢ Cross-sectional area of conductor ➢ Length of conductor ➢ Current flowing through conductor • Explain the following: ➢ Cable sizes 10mm^2 or less of copper ➢ Permissible voltage drop in cable ➢ Effect of ambient temperature on cable ➢ Cables exposed to direct sunlight	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts		•	•

	10.14 Explain the standard colour codes of cables (live, neutral and earth)	• Explain the standard colour codes of cables (live, neutral and earth)	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts	10.14 Identify cables by colour (live, neutral and earth)	• Show students different cables by colour (live, neutral and earth)	• Different cables by colour

WEEK	**General Objective:** 11.0: Know the earth fault situations			**General Objective:** 12.0		
	11. 1 Explain the term 'earth 11.2 State the reason for earthing. 11.3 Illustrate an earth faults situation whereby a person may receive an electrical shock 11.4 State the effects of an electric current on a human body 11.5 Illustrate an earth fault situation under which the installation is effectively earthed 11.6 Explain the TN-S and TT earthing systems used in Nigeria	• Explain the reason for earthing. • Explain an earth fault situation	• Whiteboard • Projector • Laptop • Markers • Training Notes Charts			
	General Objective 12.0: Understand the essential requirement on earthin					
	12.1 Explain the following terms: ➢ Bonding conductor ➢ Earth	• Explain the essential requirement on	• Whiteboard • Projector • Laptop			

	➢ Earth electrode ➢ Earthing conductor ➢ Equipotential bonding ➢ Exposed conductive part ➢ Extraneous conductive part ➢ Main earthing terminal 12.2 Explain the examples of earthing arrangements and protective conductors as given in Nigeria 12.3 Explain the following clauses: ➢ Requirement of earthing arrangements ➢ Requirement of earth electrode ➢ Requirement of earthing conductor ➢ Requirement of main earthing terminals or bars ➢ Selection of a minimum size protective conductor ➢ Requirement of protective conductors	earthing	• Markers • Training Notes • Charts			

	General Objective 13.0: Understand the terms associated with earth leakage and protection			**General Objective:** 14.0		
	13.1 Explain the following terms: ➢ Earth fault loop independence ➢ Earth leakage current ➢ Circuit leakage current ➢ Circuit protective conductor 13.2 Explain the examples of the earthing arrangements and protective conductors	• Explain the terms associated with earth leakage and protection • Give examples of the earthing arrangements and protective conductors	• Whiteboard • Projector • Laptop • Markers • Training Notes Charts			
	General Objective: 14.0: Understand the function and application of the residual current-operated circuit breaker (RCCB) and earth fault relay					
	14.1 Identify the following parts of a residual current-operated circuit breaker: ➢ Magnetic core ➢ Supply terminals ➢ Load terminals ➢ Trip coils ➢ Test button ➢ Test resistor ➢ Fault detector coil	• Explain the functions of the residual current-operated circuit breaker (RCCB) and earth fault relay	• Whiteboard • Projector • Laptop • Markers • Training Notes • Charts			

	14.2 Explain the operation of a single-phase residual current-operated circuit breaker. 14.3 Explain the methods of testing the effectiveness of a residual current-operated circuit breaker 15.4 Explain the requirement of operation of the residual current-operated circuit breaker	. • Explain the applications of residual current-operated circuit breaker (RCCB) and earth fault relay				

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS

COURSE TITLE: Mechanical Engineering Science

COURSE CODE: MEC 111

DURATION: 3hrs/ 3 Credit Units

GOAL: This course designed to enable students acquire the basic knowledge of the principles of Statics, effect of forces and their moment, effect of friction and forces in simple frames and structures

GENERAL OBJECTIVES:

On completion of this course, the student will be able to:

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

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: Mechanical Engineering Science			**COURSE CODE: MEC**		**CONTACT HOURS: 3Hrs/Week**	
GOAL: This						
COURSE SPECIFICATION: Theoretical Content: 1				**Practical Content:** 2		
	General Objective 1.0: Understand the concept and effect of forces and their moments					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
	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	• Explain in details the concept of and effects of forces and their moments. • Illustrate how to solve problems relating to forces and its moments • Assess exercises of students.	• Whiteboard • Marker • Projector • Laptop • Drawing instruments	1.1Constratuct parallelogram of forces 1.2 Draw triangle of forces 1.3 Draw polygon of forces 1.4Verify Lami's theorem using a force board 1.5Verify the parallelogram law of forces	• Demonstrate the activities in 1.1 and 1.3. • Assist students to perform activities in 1.1 to 1.5 • Demonstrate how to verify Lami's theorem using a force board • Demonstrate how to verify parallelogram law of forces.	• Whiteboard • Marker • Projector • Laptop • Drawing instruments

	1.7 State the conditions for the equilibrium of co-planar forces 1.8 Define moment of a force 1.9 Stat the principles of moment 1.10 Solve problems related to 1.1 to 1.9 above.					
	General Objective 2.0: Understand the effect of friction and the law governing it.					
	2.1 Define friction 2.2 State the advantages and disadvantages of friction 2.3 State the law governing the effect of friction 2.3 Define coefficient of friction 2.4 Define limiting angle of friction 2.5 Define angle of Repose	• Explain principles of friction. • Explain the effects of friction and the • Explain the law governing the effect of friction • Explain the coefficient of friction. • Explain the limiting angle of friction.	• White board • Charts • Projector screen • Laptop • Training notes	2.1 Determine the coefficient of friction by means of an inclined plane.	• Demonstrate how to determine the coefficient of friction by means of an inclined plane.	• Whiteboard • Marker • Projector • Laptop • Specimens of mosses • Inclined plain set-up • Protractor,

	2.6 Solve problems relating to 2.1 to 2.5	• Explain the angle of Repose. • Illustrate how to solve mathematical problems relating to 2.1 to 2.5.				
	General Objective 3.0: Understand Linear and Angular motion of bodies					
	3.1 Define displacement, speed, distance, velocity and acceleration 3.2 State the units of displacement, speed, distance, velocity and acceleration 3.3 Derive the relationship between displacement, velocity and acceleration 3.4 Draw velocity time graph 3.5 Add velocities vector ally.	• Explain the concept of linear motion of bodies. • Explain displacement, speed, distance, velocity and acceleration and their units. • Illustrate how to derive the relationship between displacement, velocity and acceleration • Illustrate how to draw velocity–time graph.	• White board • Marker • Charts • Projector screen • Laptop • Training notes	3.1 Identify the various component features of capacitor-start and universal motors 3.2 Identify the applications of split-phase, capacitor-start and universal motors 3.3 Identify the functions of the various components of a single-phase induction method	• Show students the components features of capacitor-start and universal motors • Guide students to identify the applications of split-phase, capacitor-start and universal motors • Guide students to identify the functions of the various components of a single-phase induction method	• White board • Marker • Charts • Power point • Projector screen • Laptop • Cut away models of capacitor start motor and induction motor • Real objects

	3.6 Define relative velocity 3.7 Solve simple problems related to 3.1 to 3.6 3.8 Define angular motion of a body in a circle 3.9 Derive the relationship between angular velocity and acceleration 3.10 Draw angular velocity-time graph.	• Illustrate how to add velocities vector ally. • Define relative velocity • Solve simple problems related to 3.1 to 3.6 • Explain angular motion of a body in a circle • Illustrate how to derive the relationship between angular velocity and acceleration • Draw angular velocity-time graph				
	General Objective 4.0: Understand curvilinear motion of bodies					

	4.1 Develop the relationship between angular and linear motions 4.2 Define circular motion 4.3 Explain centrifugal acceleration and centrifugal force. 4.4Develop expressions for centripetal and centrifugal forces 4.5 Develop expressions for centripetal and centrifugal forces 4.6 Give examples of centrifugal effects e.g. Planetary motion, Conical pendulum, etc	• Explain the concept of curvilinear motion of bodies • Explain the relationship between angular and linear motion • Explain centrifugal acceleration and centrifugal force • Show how to develop expressions for centripetal forces • Show how to develop expressions for centrifugal forces • Explain examples of centrifugal effects e.g. Planetary motion, Conical pendulum, etc.	• White board • Marker • Charts • Power point • Projector screen • Laptop • Training notes	4.1 Show that centrifugal force varies with mass, speed of rotation and the distance of the mass from the center of rotation using centrifugal force apparatus. 4.2 Verify the equation of motion using Fletcher's trolley	• Show that centrifugal force varies with mass, speed of rotation and the distance of the mass from the center of rotation using centrifugal force apparatus. • Show how to verify the equation of motion using Fletcher's trolley.	• White board • Marker • Charts • Power point • Projector screen • Laptop • Practical guide • Centrifugal apparatus • Fletcher's trolley • Weights
	General Objective 5.0: Understand Momentum of Bodies					

8 - 9	5.1 Define Mass and Weight of a body 5.2 State Newton's Laws of motion 5.3 Define Impulse and Momentum 5.4 State the Law of Conservation of Momentum 5.5 Define Angular Momentum 5.6 Define Radius of Gyration 5.7 Explain Moment of Inertia 5.8 Solve problems related to 5.1 to 5.7	• Explain the principles of momentum • State Newton's Laws of motion • Explain Impulse and Momentum • Explain the Law of Conservation of Momentum • Explain Angular Momentum • Explain Radius of Gyration • Explain Moment of Inertia • Illustrate how to solve problems related to 5.1 to	• White board • Marker • Charts • Power point • Projector screen • Laptop • Training notes	**5.1** Determine moment of inertia 5.2 Verify the law of conversation of moment on Fletcher's trolley	• Illustrate how to determine moment of inertia. • Show how to verify the law of conversation of moment on Fletcher's trolley activities 5.1 to 5.2.	• White board • Marker • Charts • Recommended apparatus • Fletcher's trolley
	General Objective 6.0: Understand the concept of Work, Energy and Power					

10 - 11	6.1 Define Work, Energy and Power 6.2 State the units of Work, Energy and Power 6.3 Develop expressions for Work, Energy and Power 6.4 Define Torque and Work dine by Torque 6.5 Explain Tractive Force and Driving Torque of a system 6.6 Differentiate between Kinetic Energy and Potential Energy 6.7 Explain Kinetic Energy of rotating bodies 6.8 Explain Mechanical Efficiency in power transmission 6.9 Explain power transmission by flat belts, spur gearing	• Explain Work, Energy and Power • Explain the units of Work, Energy and Power • Illustrate how to develop expressions for Work, Energy and Power • Explain the concept of Torque and Work done by Torque • Explain Tractive Force and Driving Torque of a system • Explain the differences between Kinetic Energy and Potential Energy • Explain Kinetic Energy of rotating bodies • Explain Mechanical	• White board • Marker • Charts • Power point • Projector screen • Laptop • Training notes	6.1 Determine tractive force and driving torque of a system 6.2 Determine kinetic energy of rotation.	• Demonstrate how to determine tractive force and driving torque of a system • Demonstrate how to determine kinetic energy of rotation	• White board • Marker • Charts • Power point • Projector screen • Laptop • Training notes •

	and worm gearing.	Efficiency in power transmission • Explain power transmission by flat belts, spur gearing and worm gearing				
	General Objective 7.0: Understand general principles of operation of simple machines					
	7.1 Define simple machine 7.2 List examples of simple machines e.g. Lever, Pulley, Screw Jack, etc 7.3 Explain operations of 7.2 above. 7.4 Define following properties of a simple machine ➢ Mechanical Advantage ➢ Velocity Ratio ➢ Mechanical Efficiency of Wheel, Pulley, Screw jack.. 7.5 Develop the relationship for Mechanical	• Explain the meaning of a simple machine • Explain the features and types of simple machines • Explain operation of simple machines • Derive expression for the following: ➢ Mechanical Advantage Ratio ➢ Velocity Ratio ➢ Mechanical Efficiency of Wheel, Pulley, Screw jack. • Develop the	• White board • Marker • Charts • Power point • Projector screen • Laptop Training notes	**7.1** Determine the following properties of a screw jack: ➢ Mechanical Advantage ➢ Velocity Ratio ➢ Mechanical Efficiency 7.2 Determine the following properties of a simple pulley system: ➢ Velocity Ratio ➢ Mechanical Efficiency	• Show how to determine the following properties of a screw jack: ➢ Mechanical Advantage ➢ Velocity Ratio ➢ Mechanical Efficiency 7.2 Show how to determine the following properties of a simple pulley system: ➢ Velocity Ratio ➢ Mechanical Efficiency	• White board • Marker • Charts • Power point • Projector screen • Laptop • Training notes • Screw Jack • Pulley System • Lever

	advantage, Velocity Ratio and Mechanical Efficiency of a wheel, pulley and screw jack. 7.6 Solve simple problems related to 7.1 to 7.5	relationship for Mechanical advantage, Velocity Ratio and Mechanical Efficiency of a wheel, pulley and screw jack • Solve simple problems related to 7.1 to 7.5				
	General Objective 8.0: Know Simple Harmonic Motion (SHM)					
11 – 13	8.1 Explain periodic motion 8.2 Describe period, frequency and amplitude in Simple Harmonic Motion (SHM) 8.3Develop expressions for 8.2 above 8.4 Analyze the motion of a simple pendulum	• Explain the features of a Simple Harmonic Motion (SHM) • Explain the principles of Simple Harmonic Motion (SHM) • Guide student to derive expressions for period, frequency and amplitude of Simple Harmonic Motion (SHM) • Discuss the motion	• Whiteboard • Marker • Charts • Power point • Laptop • Projector Screen • Training notes	7.1 Determine experimentally the period and frequency of oscillation of a Simple Harmonic Motion (SHM)	• Demonstrate how to determine the period and frequency of oscillation of a Simple Harmonic Motion (SHM)	• Whiteboard • Marker • Charts • Power point • PLC Training kit • Programming console • Power supply 240v • AC drives

	8.5 Solve numerical problems related to 8.1 to 8.4 above.	of a simple pendulum • Solve numerical problems related to 8.1 to 8.4 above..				

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY

COURSE TITLE: ELECTRONICS I

COURSE CODE: EET 112

DURATION: 1 hr Lectures; 2hrs Practicals/3 Credit Units

GOAL: This Course is designed to equip students with necessary skills to interpret, construct and troubleshoot analogue electronic circuits.

GENERAL OBJECTIVES: On completing this course, students should be able to:

1.0 Understand the principle of operation, construction & application of transformer;

2.0 Understand the characteristics of transformer in terms of current, voltage & turns ratio;

3.0 Understand the basic function and application of Isolation Transformer;

4.0 Know the characteristics & functions of regulated power supply;

5.0 Understand the operating principle & characteristics of various types of voltage regulators;

6.0 Know the functions and applications of the 3-terminal voltage regulator;

7.0 Know the function & safety factor of switching mode power supply:

8.0 Understand the basic principles of amplifier

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: ELECTRONICS I	**COURSE CODE: EET 112**	**CONTACT HOURS: 3Hours/Week**				
COURSE SPECIFICATION: Theoretical Content: 1				**Practical Content:** 2		
	General Objective: 1.0 Understand the principle of operation and construction of transformers.					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
1	1.1 Explain the operational principle & function of the transformer. 1.2 Describe the basic construction of a transformer. 1.3 List common transformers & their symbols used in electronics circuit.	• Explain in details the operational principle & function of the Transformer. • Incidental theory to explain basic components & construction of a Transformer. • Explain with the aid of diagrams the common types of Transformers & symbols.	White board, Flip Chart board or multimedia projector.	1.1 Basic construction of the transformer.	• Split open & explain components of a Low Voltage Transformer.	Low voltage, 220/ 12 Volt Transformer.
	General Objective: 2.0 understand the characteristics of transformer in terms of current, voltage & turns ratio					
2	2.1 State transformer ratio. 2.2 Calculate the current, voltage & turns ratio of the ideal transformer.	• Show transformer ratios & explain turns ratio formula of the transformer. • Show calculation of current, voltage & turns ratio on transformers.	White board, Flip Chart board or multimedia projector.			

	General Objective: 3.0 Understand the basic functions and application of Isolation Transformer					
3	3.1 State the function of an isolation transformer and its applications. 3.2 Describe the danger in a "hot" chassis. 3.3 Describe the methods of protecting a "hot" chassis with an isolation transformer.	• Explain the safety aspect of Isolation of supply voltage. • Describe "hot" chassis using diagrams. • Explain with the aid of diagrams how Isolation transformers prevent short circuit & electric shock.	White board, Flip Chart board or multimedia projector. White board, Flip Chart board or multimedia projector.			
	General Objective: 4.0 Know the Characteristics and functions of a regulated power supply.					
4	4.1 Explain the internal resistance of a power supply. 4.2 Explain the loading effects in power supply in terms of current and voltage. 4.3 State $\text{Load regulation} = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100\%$ •	• Use illustrative diagrams to explain Internal resistance. • Demonstrate Loading effect using unregulated power supply. • State the Load regulation formula with worked examples.	White board, Flip Chart board or multimedia projector. White board, Flip Chart board or multimedia projector.	4.1 Determine the load regulation of a regulated power supply.	• Perform experiment to demonstrate loading effect.	Unregulated power supply, bread board, connecting wires, voltmeter, multi-meter

	4.4 Describe how zener diode can provide voltage regulation.	• Describe using circuit diagrams how the Zener Diode operates.				
	General Objective: 5.0 understand the operating principle & characteristics of various types of voltage regulators					
5	5.1 Draw a simplified regulator block diagram consisting of : • Reference voltage • Error detector • Sample circuit • Control element 5.2 Explain the operation of the series regulator. 5.3 Explain the functions of the components of an op-amp IC series regulated power supply. 5.4 Explain the short circuit protection circuit in a series regulator.	• Explain the block diagram of a voltage regulator. • Explain series regulator using block diagram. • Explain functional components of an IC series regulated PS. • Explain short circuit protection in series regulator.	White board, Flip Chart board or multimedia projector.	5.1 Measure the output voltage and load regulation of a Series and Shunt voltage regulator.	• Perform experiment on how to measure Output Voltage & Load regulation of a Shunt & Series Voltage regulator.	DC Power supply unit, Multi-meter, Voltmeter, Ammeter, Bread Board, Series regulator circuit, Shunt regulator circuit, Connecting wires.

	General Objective: 6.0 know the functions and applications of the 3-terminal voltage regulator;					
6	6.1 Draw the symbol of 3-terminal voltage regulator. 6.2 Draw the fixed voltage regulator circuit diagram. 6.3 Identify the pin connection of voltage regulator 7805. 6.4 Describe the characteristics of voltage regulator 7805 : • Output voltage • Output current	• Explain the Schematic symbol of a 3 terminal voltage regulator. • Explain with illustration the Fixed voltage regulator diagram. • Explain pin configuration of the 7805 IC. • Describe basic characteristic of the 5V regulator	White board, Flip Chart board or multimedia projector. White board, Flip Chart board or multimedia projector. White board, Flip Chart board or multimedia projector.	6.1 Connect a 5 volts fixed voltage regulator to measure the output voltage and current under different load conditions.	• Guide students to experiment measuring output voltage & current under various loads.	Regulator IC 7805, Bread board, connecting wires, voltmeter, ammeter, multi-meter, DC power supply unit.
7	6.5 Draw the symbol of a variable voltage regulator. 6.6 Draw the circuit diagram of a variable voltage regulator. 6.7 Identify the pin connection of the variable voltage regulator 317. 6.8 Describe the characteristics and applications of a variable voltage regulator :	• Show circuit symbol of a variable voltage regulator. • Show variable regulator internal circuit. • Explain pin configuration of the 317 IC. • Describe variable voltage regulator Characteristics.	White board, Flip Chart board or multimedia projector.	6.2 Connect a variable voltage regulator to measure the output voltage and current under different load condition.	• Guide student to perform experiment to measure output voltage & current under various loads.	Regulator IC 317, Bread board, connecting wires, voltmeter, ammeter, multi-meter, DC power supply unit.

	• Output voltage • Output current 6.9 Calculate the output voltage of a 317 voltage regulator.	Show calculations				
	General Objective 7: Know the function & safety factors of switching mode power supply					
8	7.1 State the difference between the unregulated and regulated power supply. 7.2 State the function of the switch mode power supply. 7.3 Draw the functional block diagram of switched-mode power supply. 7.4 State the function of various blocks of switched-mode power supply. 7.5 Explain the operation of the switched mode power supply.	Explain the difference between regulated & unregulated Power supply. Explain the functions of **SMPS.** Explain **SMPS** block diagram. Explain functional blocks of **SMPS**. Explain SMPS operation.	White board, Flip Chart board or multimedia projector.			

9	7.6 List the various types of configuration for a switched mode power supply.	Explain various SMPS configurations.	White board, Flip Chart board or multimedia projector.			
10	7.7 State the safety factor. 7.8 Calculate the average DC output of a switch mode power supply.	Explain & emphasize safety factor of **SMPS**. Solve problems on average DC SMPS power supply	White board, Flip Chart board or multimedia projector.			
	General Objective: 8.0 Understand the basic principles of amplifiers.					
11	8.1 Explain the following types of transistor: • PNP • NPN 8.2 Circuit configuration for Transistors • Common emitter configuration. • Common base configuration. • Common collector configuration.	Explain 2 types of bipolar transistor & explain their operation using PN junction Semi-conductor theory. Explain with the aid of diagrams basic transistor configurations.	White board, Flip Chart board or multimedia projector. White board, Flip Chart board or multimedia projector.			
12	8.3 Describe DC Biasing of a transistor	Explain DC biasing of a transistor. Explain with the aid of	White board, Flip Chart board or multimedia projector.			

	8.4 Describe the various methods of biasing a transistor.	diagrams the following methods of biasing a transistor: • Fixed bias • Emitter feedback • Collector-feedback bias • Voltage divider bias				
13	8.5 Draw the circuit of a transistor connected in the common-emitter (CE) configuration. 8.6 Identify the input/output characteristic curves of a common-emitter amplifier. 8.7 State the function of each component of the Common Emitter amplifier circuit. 8.8 Describe the biasing of a common-emitter amplifier.	Show with the aid of diagrams the various configurations of the transistor amplifier. Sketch & explain the characteristic curves of the Common Emitter amplifier. Explain the functions of the components of the circuit. Describe biasing methods of the Common Emitter amplifier.	White board, Flip Chart board or multimedia projector.	Conduct an experiment to plot a load line of a Common Emmiter characteristic curve. Conduct an experiment to verify the amplification characteristics of a Common Emitter transistor amplifier.	Assist students to perform practical session on Common Emitter Bipolar transistors characteristic curve; plot load line. Assist students to perform Lab session on Common Emitter amplification characteristics	Low power Transistor, resistors, coupling capacitors, DC power supply, Oscilloscope, Function Generator, Bread board, connecting wires, Multi-meter.

	8.9 State phase inversion of the output voltage of a Common Emitter amplifier. 8.10 State the input and output impedance of a Common Emmiter amplifier.	Explain the difference between input & output signals of the Common Emitter amplifier. Explain & compare the difference between input & output impedances of the Common Emmiter amplifier.				
14	8.11 Explain the application of a transistor : • As a switch • As an amplifier 8.12 Identify the following points in a family of characteristics curves : • Q point • Saturation point • Linear operating region • Cut- off point 8.13 Plot the DC load line and locate the quiescent (Q) point.	Explain the Semiconductor PN junction transistor as an electronic switch & amplifier. Sketch a typical Transistor characteristic curve with all operating points clearly indicated. Plot Load line.	White board, Flip Chart board or multimedia projector.	14.1 Conduct an experiment to plot load line of a Common Emmiter characteristic curve.	Guide students to perform Lab to plot load line of Common Emmiter amplifier.	Low power Transistor, resistors, coupling capacitors, DC power supply, Oscilloscope, Function Generator, Bread board, connecting wires, Multi-meter.
15	8.14Name the various classes of amplifier. 8.15 Locate the approximate Q-point position for classes A, B, AB and C amplifiers.	Explain the various amplifier classes. Demonstrate Q-point for various classes of amplifier.	White board, Flip Chart board or multimedia projector.			

	8.16 Draw the input and output waveforms for different classes of amplifiers, using the output characteristics. 8.17 State the applications of different classes of amplifiers.	Explain with the aid of diagram the input & output waveforms of various classes of amplifiers.				

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONIC TECHNOLOGY

COURSE: OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT

CODE: AMT 112

DURATION: FIRST SEMESTER HOURS/WEEK LECTURE: THEORY: 1 PRACTICAL: 1

UNITS: 2

Goal: This course is designed to enable the trainee to acquire basic knowledge of Occupational Health, Safety and Environment

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

1.0 Know general safety
2.0 Know nature of accident, causes and consequences
3.0 Understand accident reporting and investigation
4.0 Understand fire precaution and fire fighting
5.0 Understand how to control hazards
6.0 Understand Risk assessment in work place.
7.0 Understand occupational Health and hygiene
8.0 Understand the use of personal protective equipment (PPE)
9.0 Know safety signs and markings
10.0 Understand the environment
11.0 Understand environmental protection
12.0 Understand Environmental Legislation.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT			**COURSE CODE: AMT 112**		**CONTACT HOURS: 2**	
COURSE SPECIFICATION: Theoretical Content: 1				**Practical Content:** 1		
	General Objective: 1.0 Know general safety					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
1- 2	1.1 Define Safety 1.2 List components of safety 1.3 Explain benefits of adherence to safety 1.4 Explain who is a safety professional 1.5 Explain different types of safety officers	1.1 Explain safety and its components 1.2 Discuss benefits of adherence to safety 1.3 Explain who is a safety professional and its types 1.4 Give assignment	White board Maker Duster Projector, and Recommended manuals	Carryout practical tips on safety measures	• Demonstrate safety precautions in work place	Safety Demonstration Kits
	General Objective: 2.0 Know nature of accident, causes and consequences					
4	2.1 Define accident and its type 2.2 List causes of accidents 2.3 Explain contributing factors to cause of accident 2.4 Explain the effects of accident on the worker	2.1 Explain accidents and its type 2.2 Explain contributing factors to cause of accident 2.3 Explain the effects of accident on the worker	White board Maker Recommended Manuals Sample Accident Reports Pictures Projectors Videos	Identify nature of accident, causes and consequences	Guide the students to Identify nature of accident, causes and consequences	White board Maker Recommended Manuals Sample Accident Reports Pictures Projectors Videos

	General Objective: 3.0 Understand accident reporting and investigation					
	3.1 Explain accident reporting and investigation 3.2 Explain the purpose of accident reporting 3.4 Explain the objectives of accident investigation 3.5 Explain techniques of accident investigation 3.6 List the standard procedures for accident investigation 3.7 List the pertinent questions that may arise when asking questions in an investigation 3.8 List the pitfalls to avoid when carrying out accident investigation 3.9 Explain the term FOLLOW-UP 3.10 List the techniques to use when interviewing a witness 3.11 Explain the consequences	3.1 Explain accident reporting and investigation 3.2 Explain the objectives of accident investigation 3.3 Explain in details the pertinent question that may arise during investigation 3.4 Explain the term FOLLOW-UP 3.5 Explain in details the techniques to be used when interviewing witness 3.6 Explain the need to report accident .	White board Maker Duster Recommended Manuals and Projector	Carry out accident Investigation exercise Write a report on Accident Investigation	• Simulate accident • Guide students to carry out accident investigation • Guide student to write a report	Sample Report Videos Pictures Projectors

	for failure to report an accident 3.12 List reasons why you should prevent accident					
	General Objective: 4.0 Understand fire precaution and fire fighting					
	4.1 Define fire and fire fighting 4.2 Explain the elements of fire 4.3 Explain the fire triangle 4.4 Explain the classes of fires 4.5 List the types of fires 4.6 Explain the various methods of extinguishing fire 4.7 List types of portable fire fighting extinguishers 4.8 Discuss the differences between portable and fixed fire fighting extinguishers 4.9 Explain fire alarm system 4.10 Define fire hydrant 4.11 List the fire fighting equipment 4.12 define fire prevention 4.13 Explain the purpose of fire	4.1 Explain fire and fire fighting 4.2 Discuss the classes and types of fires 4.3 Explain the fire triangle 4.4 Discuss types of portable extinguishers and classes of fire where applicable 4.5 Explain the differences between large fires and small fires 4.6 Explain Firefighting equipment and alarm system 4.7 Explain Fire Prevention methods	White Board Marker Dusters Projector Fire Fighting manuals.	• Identify fire, fire prevention, firefighting techniques and firefighting equipment	4.3 Demonstrate firefighting procedure	Portable Extinguisher Fire Fighting Suits Heat Protection Equipment Breathing apparatus Safety gloves and boots.

	prevention					
	General Objective: 5.0 Understand how to control hazards					
	5.1 Define hazards in relation to Automotive industry 5.2 Explain types of hazards 5.3 Explain effects of hazards to life and the company reputation 5.4 Outline hazard control 5.6 Differentiate hazards from Risk.	5.1 Explain the term hazards and its types 5.2 Explain the effects of hazards to life and company reputation 5.3 Distinguish between hazard and risk in respect of Automotive industry	Textbooks White Board Marker Projector	• Appreciate Hazards and its consequences in the Automotive Industry	5.1 Guide the students to appreciate Hazards	Books Charts Designs Videos Projects
	General Objective: 6.0 Understand Risk Assessment in work place					
	6.1 Define risk 6.2 Define risk in Automotive 6.3 Define risk control 6.4 Outline measures of risk control 6.5 Explain steps to risk assessment 6.6 Explain procedures for risk prevention.	6.1 Explain risk and how to control risk in the Automotive Industry 6.2 Explain risk assessment and prevention	Textbooks White Board Marker Projector	• Carry out risk assessment and prevention	6.1 Guide students to carry out risk assessment and prevention	Computer Sample report Project

	General Objective: 7.0 Understand Occupational Health and hygiene					
	7.1 Explain types of occupational health 7.2 Explain the requirements of occupational health service 7.3 Define First Aid 7.4 Explain the purpose of First Aid 7.5 List the items in a First Aid Box	7.1 Explain occupational health hazards 7. Explain the requirements of occupational health service	Textbooks White Board Marker Projector	• Demonstrate Cardio Preliminary Resuscitation (CPR) • Demonstrate how to give First Aid to fracture and other injuries 3 Maintain Healthy work • Environment	7.1 Guide on Cardio Preliminary Resuscitation (CPR) 7.2 Guide on how to give First Aid to fracture and other injuries	First Aid Box Stretcher
	General Objective: 8.0 Understand the use of personal protective equipment (PPE)					
	8.1 Explain types of Personal Protective Equipment (PPE) 8.2 Explain the importance of Personal Protective Equipment in workshop 8.3 Explain how to use Personal Protective Equipment (PPE) 8.4 Explain care and maintenance of Personal Protective Equipment	8.1 Explain types of Personal Protective Equipment (PPE) 8.2 Explain the importance of PPE 8.3 Explain how to use PPE 8.4 Explain how to maintain PPE	Textbooks White Board Marker Projector PPE	• Demonstrate the use of various Personal Protective Equipment (PPE)	8.1 Guide on the use of Personal Protective Equipment (PPE)	Safety Goggle, Workshop Overall, Safety Boots, Hand gloves Safety Videos, Breathing Apparatus, etc

	General Objective: 9.0 Understand Safety signs, symbol and markings					
	9.1 Explain various signs in the workshop 9.2 Explain use of sign on our roads and workshops 9.3 Explain types of signs 9.4 Explain types of symbols 9.5 Explain markings 9.6 Explain the importance of Signs, symbols and markings	9.1 Explain various signs in the workshop 9.2 Explain symbols and markings	Textbooks White Board Marker Projector	• Identify various signs, symbols and markings	9.1 Guide students to identify various signs, symbols and markings	Health Signs Workshop Signs Road Signs Marking Charts.
	General Objective: 10.0 Understand the environment in relation to automotive					
	10.1 Define the Environment 10.2 Explain the composition of environment 10.3 Explain factors that affects the environment and its inhabitants 10.4 Define environmental pollution 10.5 List the causes of pollution 10.6 Explain the effect of pollution on the environment and Ozone layer	10.1 Explain the environment and its composition 10.2 Explain the factors that affect the environment 10.3 Explain environmental pollution 10.4 Explain the causes of pollution 10.5 Explain the	White Board Marker Chalk Projector Lecture Notes Journals	• Identify the different types of environmental pollution • Carryout exhaust gas analysis	10.1 Guide the students to identify environmental pollution 10.2 Guide the students how to carry out exhaust gas analysis	Waste Bins Trash bags Cleaning equipment Video clips Pictures

	10.7 List the types of pollution. 10.8 Explain vehicle emission in relation to the environment	effect of pollution on Ozone later and the environment				
	General Objective 11.0 Understand Environmental Protection					
	11.1 Define Environmental Protection 11.2 Explain Environmental Protection tools 11.3 Explain the benefits of protecting the environment 11.4 List Action parties responsible for the protection of environment 11.5 Define recycling process. 11.6 Differentiate between recycling materials and Non-recycling materials. 11.7 Explain recycling bins and non-recycling bins	11.1 Explain Environmental Protection 11.2 Explain tools that protect the environment 11.3 Discuss the benefits of protecting the environment and list the ways we can improve the environment. 11.4 Discuss the responsibility of the Action Parties for the protection of the environment 11.5 Explain the recycling	White Board Marker Chalk Projector Lecture Notes	• Demonstrate techniques that help in the protection of the environment • Demonstrate how recycling process works • Demonstrate how to use recycling bins	• Demonstrate techniques that help in the protection of the environment • Demonstrate how recycling process works • Demonstrate how to use recycling bins	Recycling bin, and non-recycling bins.

		materials and identify the differences 11.6 Discuss the recycling process and help differentiate between recycling bin and non-recycling bin.				
	General Objective 12.0 Understand the Knowledge of Environmental Legislation					
	12.1 Explain National policy on environment 12.2 Explain policy goals on environnement 12.3 List environnemental agences 12.4 Explain environnemental regulations in Nigeria 12.5 Explain the purpose of these policy on the environment 12.6 Mention the benefits of these legislative policies on the environment	12.1 Explain National Policies and identify Policy goals on the environment. 12.2 Discuss environmental agencies and environmental regulations in Nigeria 12.3 Discuss the purposes of his policy in the environment, and their	White Board Marker Chalk Projector Lecture Notes Research Journals	• Appreciate national Policy and regulations on environment in Nigeria	12.1 Guide student to appreciate National Policy and Regulations on environment in Nigeria	Books Charts Law Books Notes.

		benefits of these legislative policies and how they impact the environment				

SECOND SEMESTER

LOGIC AND LINEAR ALGEBRA
MTH 112

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY

COURSE TITLE: COMPUTER AIDED DESIGN AND DRAFTING (CADD)

COURSE CODE: COM 201

DURATION: 3HRS/ 3 CREDIT UNITS

GOAL: This course is designed to provide students with knowledge and skills of drafting and simple designs using computer.

GENERAL OBJECTIVES:

On completion of this course, students should be able to:

1.0 Understand the use of Computer in the design and drafting process

2.0 Understand how to construct simple geometric shapes

3.0 Understand the different edit boxes

4.0 Understand how to use edit command

5.0 Understand how to create layers

6.0 Understand how to create linear and aligned dimensions

7.0 Understand how to do simple design

PROGRAMME: **NATIONAL INNOVATION DIPLOMA INAUTOMOTIVE MECHATRONICS TECHNOLOGY**						
COURSE: **COMPUTER AIDED DESIGN AND DRAFTING (CADD)**	COURSE CODE: **COM 201**	CONTACT HOURS: 3 Hours				
COURSE SPECIFICATION: **Theoretical Course**	**Course Specification: Practical Content**					
General Objective 1.0: Understand the use of computer in the design and draft process						
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	1.1 State the advantages and disadvantages of computer in the design process. 1.2 Explain the links between CAD and CAM. 1.3 Understand the principles of operation capabilities and system requirements of AutoCAD. 1.4 Identify the main parts of the screen of Auto CAD or later version. 1.6 Explain the functions of the above. 1.7 Understand and use the different input methods: keyboards, mouse, digitisers, and scanners.	➢ Explain advantages and disadvantages of computer in the design process. ➢ Explain the links between CAD and CAM. ➢ Show the students the main parts of the screen of Auto CAD 14. ➢ Explain the function of the above. ➢ Ask the students to explain and use the different input methods. ➢ Ask students to explain differences between Cartesian and polar coordi-nates systems.	• Complete Computer Sets. • 1 Computer to 2 Students • 1 Large Format Printer or Plotters in a Network • 1 Digitiser to 2 students. • Manuals, Recommended Textbooks. • Complete Computer Sets • 1 Computer to 2 Students • 1 Large Format Printer or Plotters in a	1.1 Install the Auto CAD Software correctly. 1.2 Demonstrate the uses of HELP Menu in solving problems when using package. 1.3 Use the OSNAP facility to select options. 1.4 Use layer control to change the layers in drawing. 1.5 Use Cartesian and Polar coordinates to draw lines.		

	1.8 List the different coordinate systems.	➢ Ask students to demonstrate the above options on the computer screen ➢ Ask students to construct lines at set lengths and angles using above coordinate systems. ➢ Ask students to use snap points to construct lines. ➢ Ask students to explain the use of snap points and ortho-commands. ➢ Assess the students.	Network ➢ 1 Digitiser to 2 students.	1.6 Prepare and change the size of the drawing field. 1.7 Show how to save drawings on demand and also how to set up the auto- save features.		
Week	**General Objective 2.0: Understand how to construct simple geometric shapes.**					
	Specific Learning Outcome	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	2.1 Know how to hatch the shapes drawn and change the hatch pattern and scale. 2.2 Explain how to draw circles, ellipse and arcs to given dimensions.	Ask the students to hatch the shapes drawn. Ask the students to change the hatch pattern and scale. Ask the students to draw circles, ellipse and arc to given dimensions.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a	Produce a simple drawing.	Ask the students to construct polygons and squares to a given dimensions	Complete computer sets, 1 computer to 2 students, 1 large format printer or plotters in a network, 1

	2.3 Explain how to construct polygons and squares to given dimensions. 2.4 Produce a simple drawing – Drawing 1.		Network 1 Digitiser to 2 students.			Digitiser to 2 students

Week	**General Objective 3.0: Understand the different edit boxes**					
	Specific Learning Outcome	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	3.1 Explain the different edit boxes, how to use them and their attributes. 3.2 Explain how to select the shapes using edit boxes. 3.3 Explain how to use the offset command	➢ Ask students to explain the different edit boxes. ➢ Ask students to use them. ➢ Ask students to explain their attributes. ➢ Ask students to draw both polar and rectangular arrays using array command. ➢ Ask students to draw using the offset command.	• Complete Computer Sets • 1 Computer to 2 Students • 1 Large Format Printer or Plotters in a Network • 1 Digitiser to 2 students.	Use array command to draw both polar and rectangular arrays		

	General Objective 4.0: Understand the different edit boxes					
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	4.1 Explain how to use edit commands. 4.2 Demonstrate how to move objects accurately; using both snap commands and coordinates. 4.3 Demonstrate how to copy objects from one position to another accurately using snap and coordinate entry. 4.4 Demonstrate how to erase object. 4.5 Demonstrate how to trip objects. 4.4 Demonstrate how to fillet and chamfer angles.	Demonstrate the installation of MD Word Identify the different features of the software. Ask students to type a short document and save it. Ask student to edit a document and carry out a spell check. Demonstrate the use of tables.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.	Demonstrate how to move objects accurately; using both snap commands and coordinates. Demonstrate how to copy objects from one position to another accurately using snap and coordinate entry. Demonstrate how to erase object. Demonstrate how to trip objects.	Demonstrate the installation of MD Word Identify the different features of the software. Ask students to type a short document and save it. Ask student to edit a document and carry out a spell check. Demonstrate the use of tables.	

	General Objective 5.0: Understand how to create layers					
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	5.1 Demonstrate how to create layers. 5.2 Demonstrate how to change colour of layers. 5.3 Demonstrate how to change the line types of a layer. 5.4 Demonstrate how to move objects from one layer to another. 5.5 Demonstrate how to switch layers on and off. 5.6 Understand the use of layers and how they help in the construction and understanding of a draw.	Ask students to create layers. Ask students to change colour of layers. Ask students to change the line type of a layer. Ask students to move objects form one layer to another. Ask students to switch layers on an off. Ask students to use layers to construct drawings.	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.	5.1 Demonstrate how to create layers. 5.2 Demonstrate how to change colour of layers. 5.3 Demonstrate how to change the line types of a layer. 5.4 Demonstrate how to move objects from one layer to another. 5.5 Demonstrate how to switch layers on and off. 5.6 Understand the use of layers and how they help in the construction and understanding of a draw.	Ask students to create layers. Ask students to change colour of layers. Ask students to change the line type of a layer. Ask students to move objects form one layer to another. Ask students to switch layers on an off. Ask students to use layers to construct drawings	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students.

	General Objective 6.0: Understand how to create linear and aligned					
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
	6.1 Explain how to create linear and aligned dimensions. 6.2 Understand how to create angular dimensions. 6.3 Demonstrate how to add to tolerances to dimension. 6.4 Demonstrate how to create leader lines. 6.5 Demonstrate how to add single line and multiple line texts to drawings. 6.6 Demonstrate how to edit dimensions and text.		Sets of Personal Computers Recommended Textbooks Manuals etc.	6.1 Demonstrate how to add to tole-rances to dimension. 6.2 Demonstrate how to create leader lines. 6.3 Demonstrate how to add single line and multiple line texts to drawings. 6.4 Demonstrate how to edit dimensions and text.		Complete computer sets 1 computer to 2 students, 1 large format printer or plotters in a network 1 Digitiser to 2 students.

	General Objective 7.0: Understand how to do simple design					
Week	**Specific Learning Outcome**	**Teaching Activities**	**Learning Resources**	**Specific Learning Objective**	**Teaching Activities**	**Learning Resources**
				7.1 Create the title block for a drawing Write letters and numbers on drawings 7.2 Draw circles be able to erase parts lines or circles. 7.3 Produce a simple drawing with correct details in terms of title block etc. 7.4 Select parts of a drawing in order to do further work. 7.5 Move, copy and rotate drawing parts. 7.6 Produce a full drawing with title blocks from a real engineered object. 7.7 Show all the views. 7.8 Produce a fully dimensioned drawing of a component appropriate to the engineering specification of the de-partment.	Ask each student to carry out his/her own drawing. Let each student carry out his/her own drawings. Ask each student to carry out his/her own drawing. Ask each student to carry out a drawing that is specific to his/her department. Assess the students Grade each student's drawing	Complete Computer Sets 1 Computer to 2 Students 1 Large Format Printer or Plotters in a Network 1 Digitiser to 2 students

PROGRAMME: **NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY**

COURSE TITLE: **ELECTRONICS II**

COURSE CODE: **EET 123**

DURATION: **3**hrs/ 3 Credit Units

GOAL: Students should be able to demonstrate the operation of basic logic circuits and various digital electronic components. They should also be able to construct prototype electronic projects.

GENERAL OBJECTIVES:

Having successfully completed this course, students should:

1. Understand the principles and operations of number system
2. Understand the principles and operations of Logic gates
3. Understand the principles and operations of Boolean Algebra
4. Understand the operations of Electronics Display Devices
5. Know the various TTL/CMOS Logic families
6. Understand the operations of Flip-Flops.
7. Know the working principles of Counters and their Applications.
8. Understand the principle and working Decoder and Encoder
9. Know the operation of Multiplexers and Demultiplexers
10. Design a project using the various digital components.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: ELECTRONICS II	**COURSE CODE: EET 112**	**CONTACT HOURS: 3**				
COURSE SPECIFICATION: Theoretical Content: 1		**Practical Content:** 2				
	General Objective: 1.0 Understand the principle and operation of digital number system					
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
1- 3	1.1 Explain why the binary number system is ideal for digital logic applications. 1.2 Convert decimal whole numbers and fractional numbers into binary numbers and vice versa. 1.3 Convert decimal whole numbers into hexadecimal and octal numbers and vice versa. 1.4 Explain the term binary coded decimal (BCD). 1.5 Convert BCD to decimal number and vice versa.	Explain number system Explain how to decimal whole numbers and fractional numbers into binary numbers and vice versa Explain how to convert decimal whole numbers into hexadecimal and octal numbers and vice versa. Discuss the term binary coded decimal (BCD) Explain the conversion BCD to decimal number and vice	Projector Lesson notes White board and maker			

		versa				
	1.6 Perform addition, subtraction using the binary and hexadecimal number systems. 1.7 Explain the use of: • 1's complement of a binary number and • 2's complement of a binary number.	Explain how to perform calculations using number systems	Projector Lesson notes White board and maker			
	General Objective: 2.0 Understand the principles and operations of Logic gates					
4	2.5 Explain the positive and negative logic systems. 2.6 Explain the use of logic gate. 2.7 Describe the function of the basic logic gates (i.e. NOT, AND, NAND, OR, NOR, X-OR and X-NOR) with the help of symbol, truth table and its equivalent switching circuit. 2.8 Conduct tests to verify the operation of the logic gates. 2.9 Describe how NOT, AND, OR, NOR can be constructed from NAND	Explain the process and functioning of logic gates Enumerate the use of logic gate. Discuss the function of the basic logic gates (i.e. NOT, AND, NAND, OR, NOR, X-OR and X-NOR) with the help of symbol, truth table and its equivalent switching circuit. Explain how to conduct tests to	Projector Lesson notes White board and maker	Verify the operation of logic gates OR, AND, NAND, NOT, NOR	Guide student to experimentally verify the operation of logic gates OR, AND, NAND, NOT, NOR	Logic Trainer System 74LS00 74LS02 74LS04 74LS08 74LS32 Jumper wires

	gates. 2.10 Describe how NOT, AND, OR, NAND can be constructed from NOR gates.	verify the operation of the logic gates. Explain how NOT, AND, OR, NOR can be constructed from NAND gates. Discuss how NOT, AND, OR, NAND can be constructed from NOR gates.				
5	2.11 State the uses of a parity bit. 2.12 Define what even parity is. 2.13 Define what odd parity is. Give examples of applications where the X-OR/X-NOR are widely used: • Parity generator and • Parity checker	Explain parity Explain what even parity is Explain what odd parity is. Give examples of applications where the X-OR/X-NOR are widely used: Parity generator and Parity checker	Projector Lesson notes White board and maker	Conduct experiments to verify the operation of the parity generator and parity checker.	Conduct an example showing how to determine parity Explain IC pin configuration Assess the students' performance	Logic trainer system (ETS-5000) TTL IC 74LS04(Hexinverter) 74LS86(Quad 2 inputs XOR 74LS00(Quad 2 inputs NAND 74LS04 (Hex inverter) 74LS08(Quad 2 inputs AND), 74LS32(Quad 2 inputs OR), 74LS04(Hex

						inverter), 74LS86(Quad 2 inputs XOR)
6	2.14 List the four basic steps in the troubleshooting sequence: • Determine the symptoms of failure. • Localize the trouble to a complete functional unit or module. • Isolate the trouble to a circuit within the module. • Locate the specific trouble. 2.15 State the basic troubleshooting approaches for a simple digital logic circuit. • Logic signal tracing (monitor input/output logic signal.) • Open and short circuit test.\	Explain the process of troubleshooting	Projector Lesson notes White board and maker	Diagnose and rectify fault in a simple digital logic circuit.	Show how to diagnose faults in digital logic circuits Give examples showing how the logic gates operates Assess the students' performance	Logic Trainer System 74LS00 74LS02 74LS04 74LS08 74LS32 Jumper wires
	General Objective: 3.0 Understand the principles and operations of Boolean Algebra					
	3.0 State the purposes of	Explain	Projector			

	DeMorgan's Theorem. 3.1 State the two basic theorems in Boolean algebra (DeMorgan's Theorem) • $\overline{A + B} = \overline{A} \cdot \overline{B}$ • $\overline{A \cdot B} = \overline{A} + \overline{B}$	DeMorgan's theorem Give examples showing how to apply the theorem. Lecture Ask questions to assess the students level of understanding	Lesson notes White board and maker			
	3.2 Simplify Boolean expressions using DeMorgan's theorems. 3.3 Draw the equivalent logic gate circuits after simplifying the Boolean expressions.	Explain how to simplify the expressions using DeMorgan's theorem	Projector Lesson notes White board and maker			
	3.4 State the function of Boolean algebra. 3.5 State the 9 equalities of Boolean algebra: • $\overline{A} \neq A$ • $A \cdot 1 = A$ • $A \cdot 0 = 0$ • $A \cdot A = A \ (\neq A^2)$ • $A \cdot \overline{A} = 0$ • $A + 1 = 1$ • $A + 0 = A$ • $A + \overline{A} = 1$	Explain the simplification process Discuss the 9 equalities of Boolean algebra:	Projector Lesson notes White board and maker			

	• A + A = A 3.6 State the Commutative Law • A + B = B + A • A .B = B . A 3.7 State the Associative Law : • A + B + C = A + (B +C) = (A + B) + C = B + (A + C) • A .B.C = A (B .C) = (A . B) C = B (A . C) 3.8 State the Distributive Law : • A (B + C) = A .B + A.C • A + (B . C) =(A + B) .(A + C)	Explain what is meant by Commutative Law Discuss the Associative Law Discuss the Distributive Law				
	3.9 Determine the output logic expression from a given logic circuit. 3.10 Use Boolean algebra to simplify logic expressions. 3.11 Draw the simplified logic circuit.	Explain how to determine the expression from a logic circuit. Explain the process of simplify logic expressions Demonstrate the drawing of the simplified logic circuit.	Projector Lesson notes White board and maker	Construct an experiment to verify that the simplified expression has the same truth table as the original logic circuit.	Demonstrate using an example how to verify a simplified expression Asses the students' understanding and performance	TTL IC 74LS08(Quad 2 inputs AND), 74LS32(Quad 2 inputs OR), 74LS04(Hex inverter), 74LS00(Quad 2 inputs NAND), 74LS02 (Quad2 inputs NOR)

	3.12 Draw a 2-to-4 variables Karnaugh map. 3.13 Mark the sum-of- product terms on the Karnaugh map with a given sum-of-product expression. 3.14 Write down the simplified logic expression based on the Karnaugh map rules.	Explain how to determine the expression from a logic circuit. Discus how to mark the sum-of- product terms on the Karnaugh map with a given sum-of-product expression. Explain how to write down the simplified logic expression based on the Karnaugh map rules.	Projector Lesson notes White board and maker	Design and implement simplified logic circuits using either NAND or NOR gates only.	Explain how to design and implement logic circuits using specific gates only. Give a few examples. Ask questions to assess the students level of understanding	TTL IC - 74LS00(Quad 2 inputs NAND), 74LS02(Quad 2 inputs NOR)
	General Objective: 4.0 Understand the operations of Electronics Display Devices					
	4.1 Describe the basic construction and operation of LED. 4.2 State the ratings of a typical LED: • Forward voltage • Current and • Colours (red, yellow, green, etc) 4.3 List the advantages of light emitting diode (LED): • Long operating	Explain the basic construction, operation and ratings of LED Explain the process of Stating the ratings of a typical LED as listed in 4.2 Explain the advantages of light emitting	Projector Lesson notes White board and maker			

	life. • Small size • Low power dissipation and • Superior to most other light sources except where large area illumination is required.	diode (LED) as listed in 4.3				

	4.4 Identify 7-segment display format. 4.5 Describe the operation of a common anode and common cathode LED 7-segment display.	Explain the operation of a 7-segment display using common anode and common cathode Ask questions	Projector Lesson notes White board and maker	Carry out experiment to verify the operation of either common anode or common cathode LED 7-segment display.	Demonstrate to students through experiment how to verify the operation of 7-Segment display. Give a few examples. Ask questions to assess the students	DC power supply. Multimeter. Logic Trainer, 150 -7 pcs, 7 segment C-A - 1 pc, 7 segment C-C - 1 pc
	General Objective: 5.0 Know the various TTL/CMOS Logic families					
	5.1 Identify the following logic gates digital IC families: • Standard TTL (74 series) • Schottky TTL (74S series) • Low-Power Schottky TTL (74LS series) • Advanced Schottky	Explain how to identify digital IC families. Describe the characteristics of TTL/CMOS ICs	Projector Lesson notes White board and maker			

	TTL (74AS series) • Advanced Low-Power Schottky TTL (74ALS series) • CMOS 4000 series and • CMOS 74C series. 5.2 Describe the characteristics of TTL / CMOS logic IC in terms of: • Logic level. • Power dissipation. • Noise immunity. • TTL loading and • Fan in /out.					
	5.3 Explain the following methods of TTL to CMOS interface: • Voltage level translator. • Open collector buffer.	Explain the voltage level translator and open collector buffer methods of CMOS to TTL interfacing	Projector Lesson notes White board and maker	5.1 Conduct an experiment to demonstrate the interfacing between TTL (Driver) and CMOS (Load) logic gates	Demonstrate briefly how to interface Assess the performance of the students.	Logic Trainer, IC 74LS00, IC CD4001B, IC CD4050B, 1 kΩ, ¼ W, 3.3 kΩ, ¼ W , Oscilloscope, TTL data book, CMOS data book
	5.4 Explain the following methods of CMOS to TTL interface: • Inverting/non-inverting buffer. • Voltage level translator.	Explain the process of CMOS to TTL interfacing	Projector Lesson notes White board and maker	5.2 Conduct an experiment to demonstrate the interfacing between CMOS (Driver) and TTL (Load) logic gates.	Demonstrate briefly how to interface Assess the performance of the students.	Logic Trainer, IC 74LS00, IC CD4001B, IC CD4050B, 1 kΩ, ¼ W, 3.3 kΩ, ¼ W , Oscilloscope, TTL data book, CMOS data book

	General Objective: 6.0 Understand the operations of Flip-Flops.					
	6.1 Draw the symbol of an RS flip-flop and explain the operations of a RS flip flop with the aid of a truth table. 6.2 Show how an RS flip flop can be constructed from • NAND gates and • NOR gates 6.3 Differentiate between edge and level triggered flip flops and explain the following terms: • Prohibited/Indeterminate state • Synchronous and • ASynchronous 6.4 Describe with the aid of truth tables the operation of the following flip flops : • D type flip flop • JK flip flop • T flip flop	Explain the construction and operation of the RS flip flop. Discuss how an RS flip flop can be constructed from items listed in 6.2 Discuss how to differentiate between edge and level triggered flip flops and explain those listed in 6.3 Explain with the aid of truth tables the operation of the listed in 6.4	Projector Lesson notes White board and maker Relevant IC chips			
	General Objective: 7.0 Know the working principles of Counters and their Applications.					
	7.1 Identify 2 different types of counter : • Ripple up counter and • Ripple down counter 7.2 Describe the operation of a 4 bit asynchronous ripple up/down counter with the	List and Explain the different counters and their operations Discuss the operation of a 4 bit asynchronous	Projector Lesson notes White board and maker Relevant ICs	1.1 Conduct an experiment to verify the operation of an up/down counter.	Explain the process of setting up the experiment Assess the students' level performance	

	aid of a waveform diagram. 7.3 Construct the truth table. 7.4 State the MOD number of counter. MOD number = 2^N	ripple up/down counter with the aid of a waveform diagram Explain the process of constructing the truth table Explain the process of Stating the MOD number of counter. MOD number = 2^N				
	7.5 Explain the use of register as a temporary storage device. 7.6 Explain the different classifications of registers: • Parallel In / Parallel Out • Serial In / Serial Out • Parallel In / Serial Out and • Serial In / Parallel Out	Explain and discuss the use of registers as temporary storage devices Discuss the different classifications of registers listed in 7.6	Projector Lesson notes White board and maker			
	7.7 Describe how registers can be constructed by using : • RS flip flop • D flip flop and • JK flip flop	Discuss how to construct registers using different flip flops Describe the	Projector Lesson notes White board and maker Data specification sheets	1.2 Conduct an experiment to illustrate the operation of a register	Explain the process of setting up the experiment to illustrate the operation of a register	Projector Lesson notes White board and maker Logic Train System

	7.8 Determine the number of flip-flops required for an N-bit shift register.	process of determining the number of flip-flops required for an N-bit shift register			Assess the students' performance	
	7.9 Draw a 4 bit shift left or right register using JK or D flip flops, illustrating its operation with the waveforms and truth table.. 7.10 Compare serial and parallel data transfer operations between shift registers.	Explain how to draw the operation of flip-flops in waveform and truth tables Explain how to compare serial and parallel data transfer operations between shift registers	Projector Lesson notes White board and maker Data sheets	1.3 Conduct an experiment to verify the operations of a 4-bit shift register.	Explain the process and requirements of the experiment. Assess the students level of understanding	Projector Lesson notes White board and maker Data sheets Relevant ICs, tools and equipment
	7.11 Explain the principle of operation of an asynchronous up and down counter. 7.12 Draw a 4-bit asynchronous up and down counter using gates and JK flip-flops and describe its operation using the truth table. 7.13 Explain the principle of operation of a	Describe the asynchronous up and down counter Discuss how to draw a 4-bit asynchronous up and down counter using gates and JK flip-flops and describe its operation using the truth table.	Projector Lesson notes White board and maker Data sheets ICs			

	synchronous up and down counter. 7.14 State the main differences between synchronous and asynchronous counters. 7.15 Calculate the output frequency of a counter for a given input frequency.	Discuss the principle of operation of a synchronous up and down counter. Explain the main differences between synchronous and asynchronous counters Solve calculations of the output frequency of a counter for a given input frequency.				
	7.16 State some common MSI asynchronous and synchronous counter chips. 7.17 Write down the control pins to select various functions on an MSI chip. 7.18 State the functions of the various control pins. 7.19 Design simple asynchronous up/down	Discuss common MSI asynchronous counter chips Explain how to write down the control pins to select various functions on an MSI chip. Enumerate the functions of the	Projector Lesson notes White board and maker Data sheets			

	counters based on given MSI technical reference.	various control pins Explain the process of designing simple asynchronous up/down counters based on given MSI technical reference				
	7.20 State the common MSI lCs that can function as a: • parallel-to-serial converter. • serial-to-parallel converter. • shift left register. • shift right register. 1.21 Explain how the Universal Shift Register can be configured to behave as the above stated functions.	List common MCI ICs and how they function Describe how the Universal Shift Register can be configured to behave as the above stated functions	Projector Lesson notes White board and maker	1.4 Construct the following shift register circuits using the MSI ICs provided. • parallel-to-serial converter. • serial-to-parallel converter. • shift left register. • shift right register.	Explain how to design shift registers using MSI ICs Asses the students level of understanding and performance	Projector Lesson notes White board and maker Data sheets Relevant ICs Tools and equipment
	General Objective: 8.0Understand the principle and working of Decoder and Encoder					
	8.1 State the functions of a decoder and an encoder.	Discuss the functions decoders and encoders.	Projector Lesson notes White board	8.1 Construct a decimal-to-binary encoder	Describe how to construct encoders	

	8.2 Draw a decimal to 4-bit binary encoder using gates and explain its principle of operation. 8.3 Explain the operation of a 3-line to 8-line decoder using truth table. 8.4 Explain the operation of a BCD-to-decimal decoder. 8.5 Explain the operation of a BCD-to-7 segments decoder.	Describe how to draw a decimal to 4-bit binary encoder using gates and explain its principle of operation. Discuss the operation of a 3-line to 8-line decoder using truth table. Discuss the operation of a BCD to-decimal decoder Discuss the operation of a BCD-to-7 segments decoder	and maker	using MSI chip and verify its correct operation. 8.2 Construct a binary-to-decimal decoder using MSI chip and verify its correct operation.	using MSI chips Asses the experiments and make necessary suggestions or corrections	
	General Objective: 9.0 Know the operation Multiplexers/ and Demultiplexers					
	9.1 State the functions of a multiplexer. 9.2 Explain the operation of an N-input multiplexer. 9.3 Explain the principle of operation of using a multiplexer as a parallel-to--serial converter.	Discuss the operation of a multiplexer. Enumerate the operation of an N-input multiplexer Discuss the principle of operation of using	Projector Lesson notes White board and maker			

		a multiplexer as a parallel-to-serial converter				
	9.4 Explain the principle of operation of a Boolean function generator using a multiplexer. 9.5 Write down the Boolean expression for a given multiplexer circuit arrangement.	Explain Boolean function using a multiplexer Explain how to down the Boolean expression for a given multiplexer circuit arrangement.	Projector Lesson notes White board and maker			
	9.6 State the function of a demultiplexer. 9.7 Explain the principle of operation of a 1-line-to-8-line demultiplexer. 9.8 Explain the principle of operation of using a demultiplexer as a serial-to--parallel converter.	Discuss demultiplexers and their operation. Discuss the principle of operation of a 1-line-to-8-line demultiplexer Discuss the principle of operation of using a demultiplexer as a serial-to-parallel converter.	Projector Lesson notes White board and maker Data sheets			
				4.1 Wire up a MSI one-line-to-eight-line input demultiplexer IC and test its operation.	Explain how to wire a demultiplexer and test its operation. Assess the	Projector Lesson notes White board and maker Relevant tools and equipment

				4.2 Write down the truth table to illustrate the characteristics of a MSI IC.	students performance.	Logic Trainer Set demultiplexer ICs jumper wires
	General Objective: 10.0 Design a project using the various digital components					
				10.1 State the component layout rules to observe when designing circuit layout on the printed copper strip board. 10.2 Design the components and tracks layout diagram in accordance to the given schematic circuit diagram. 10.3 Solder the components onto the strip board. 10.4 Test the functionality of the completed project. 10.5 Perform the necessary	Demonstrate how to design components and tracks layout and how to solder components. Explain how to test the functionality of the project	Projector Lesson notes White board and maker Relevant IC chips Data sheets Relevant tools and equipment Bread board IC extractor Vero board Lead remover Soldering Iron sucker

				measurement on the completed project.		

MECHANICAL WORKSHOP TECHNOLOGY AND PRACTICE MCE 111

PROGRAMMEE:	NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE TITLE:	INTRODUCTION TO AUTOMOTIVE SYSTEM
COURSE CODE	AMT 121
YEAR:	YEAR 1, SEMESTER 2
DURATION:	3 HOURS/ 3 CREDIT UNITS
GOAL:	This course is designed to introduce the student to the history and evolution of automotive system.

GENERAL OBJECTIVES:

At the end of this course, the students should be able to:

1.0 Know the history of Automobile

2.0 Understand Automotive Systems and its operational functions

3.0 Understand the major Automobile Design Variations

4.0 Know the skills needed in Automotive Mechatronics Career

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: INTRODUCTION TO AUTOMOTIVE SYSTEM				**COURSE CODE: AMT 121**		**CREDIT HOURS: 3**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical:**		**Practical:**	
GOAL: This course is designed to introduce the student to automotive system history, evolution, basic parts, assemblies and systems						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Know the history of Automobile						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.1 Explain the history and Evolution of Automobiles. 1.2 Describe the various Vehicles' classes. 1.3 Describe the different classes of automobile engines: - According to number strokes - According to fuel type - According to combustion type	1.1 Explain the history and evolution of Automobiles. 1.2 Explain the various Vehicles' classes. 1.3 Explain the different classes of Automobile engines.	White Board Marker Projectors Computers Diagrams Pictures Documentary	1.1 Appreciate the evolution of Automobile. 1.2 Show the various vehicle classes 1.3 Identify the different classes of Automobiles engine	• Guide students to appreciate and identify different types of automobiles using pictures	White Board Marker Projectors Computers Diagrams Pictures
	GENERAL OBJECTIVE: 2.0 Understand the Automotive Systems and its operational functions					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
2-4	2.1 Describe the followings: - Frame - Body/ Types - Chassis 2.2 List the basic engine parts and their functions.	2.1 Explain the Following: (Frame, body/types and chassis) 2.2 Explain the basic engine parts and their functions	White Board Marker Projectors Instructional Drawings Computer Models	2.1 Identify the different auto parts, engine parts, assemblies, and basic components of each systems .	• Guide students to identify the parts, systems assemblies and body types	Models Pictures and Live vehicles Real Objects Video clips

	2.3 State the basic principle of an engine. 2.4 Explain the following automotive systems and their components: - Cooling - Lubricating - Suspension - Steering - Braking - Drive Train e.t.c 2.5 State the functions of the automotive systems in (2.4)	.2.3 Explain the basic principle of an engine. 2.4 Explain the automotive systems components and their functions.	Pictures		• Use visual aids to demonstrate the interactions and purpose of the systems,	
GENERAL OBJECTIVE: 3.0 Understand the major Automobile Engine Design Variations						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 explain the terms: • External Combustion Engines (ECE) • Internal Combustion Engines (ICE) 3.2 Explain the different Internal Combustion Engines: - CI engines - SI engines 3.3 Explain the following components: - Fuel systems	3.1 Explain the different ECE/ ICE Engines. 3.2 Explain the following (fuel and electrical systems) and its Components. 3.3 Explain the drive Train system, components and its functions.	Books Models Computer Projector White Board Pictures	3.1 Identify the different ECE/ICE engines 3.2 Identify fuel and Electrical systems. 3.3 Identify the various types of drive train System in an automotive system e.g. clutches, transmission drive shaft, axles and state their	• Show various automotive engines • Guide the students to identify the fuel system • Guide students to identify the component of electrical	Models Tool box Live vehicle Pictures Real Object Documentary Video clips

	- Electrical systems (ignition, lighting and battery charging) 3.4 Explain the various drive train systems, components and its functions: - clutch - drive shafts - axles (front, rear & trans axles) and their functions			functions,	systems in motor vehicle • Guide the students to identify the various components that make up the drive train system	
GENERAL OBJECTIVE: 4.0 Know the skills needed in Automotive Mechatronics Career						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
	4.1 Explain skills in automotive mechatronics career 4.2 explain the opportunities available in the career 4.3 List the successes in people who own automotive workshops,	4.1 Explain the skills, opportunities and successful in automotive mechanics career.	Projectors Pictures Charts White Board		Invite a successful entrepreneurs in Automobile Engineering to have career talk with students	
	ASSESSMENT CRITERIA					
	Coursework	**Course Test**	**Practical**	**Other: Examination/Project**		

PROGRAMME: **NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY**

COURSE TITLE: HYDRAULIC & PNEUMATIC SYSTEMS

COURSE CODE: MAT 122

DURATION: 4 Credit Units

GOAL: This course is designed to acquaint the students with basic understanding of the concepts and operation of Hydraulic Pneumatic systems.

GENERAL OBJECTIVES:

On successful completion of this course, students should:

1.0 Understand the principles of Hydraulic

2.0 Know the basic Hydraulic system.

3.0 Understand the working of Hydraulic reservoirs.

4.0 Know how to calculate Hydraulic cylinder parameters

5.0 Understand Hydraulic accumulators

6.0 Understand the working Hydraulic intensifier

7.0 Understand air and atmospheric pressure.

8.0 Understand the types and operations of various air compressors.

9.0 Understand the operation of a basic pneumatic system

10.0 Understand pneumatic circuits with up to 3 cylinders and explain the displacement-step diagram of the cylinders

11.0 Understand how to install and troubleshoot pneumatics circuits controlling up to 3 cylinders

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: : Hydraulic & Pneumatic Systems		**COURSE CODE: MAT 122**		**CONTACT HOURS: 4**		
COURSE SPECIFICATION: THEORETICAL CONTENT: 1hr/wk				**PRACTICAL CONTENT:** 3hrs/wk		
	General Objective: 1.0 Understand the principles of Hydraulic			**General Objective:** 1.0		
WEEK	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Learning Resources**
1	1.1 Define hydraulic and pressure. 1.2 Define pascal's law 1.3 Explain the units for pressure, Force and Area 1.4 Explain the conversion between different units of pressure 1.5 Explain Flow rate and Velocity 1.6 State the functions of hydraulic fluid 1.7 State the quality requirements of hydraulic fluid 1.8 Explain the properties of hydraulic fluid 1.9 Explain the storage and handling of hydraulic fluid	Explain the working principles of Hydraulic Explain the working of hydraulic fluid Principles Explain the units of Pressure, Force, and Area Convert between different units of pressure Solve simple problem on Pressure, Force and Area	• Whiteboard • Projector • Laptop • Marker • Training Notes	Demonstrate the working principles of hydraulic fluid	Guide students to learn the working principles of hydraulic fluid	- Syringe - Robber Tube - Hydraulic fluid

	1.10 Explain the in-operation care of hydraulic fluid 1.11 Explain how to calculate Hydraulic cylinder parameters					
	General Objective: 2.0 Know the basic Hydraulic system.			**General Objective:** 2.0		
2	2.1 List the components in a typical hydraulic system 2.2 Compare between pneumatics and hydraulics 2.3 State the advantages and disadvantages of hydraulics 2.4 Explain how hydraulic lines and filters are used 2.5 Explain the working of hydraulic pumps 2.6 Explain the workings of Hydraulic valves 2.7 Explain the working principles of an Actuator 2.8 Explain the working principles of an	• Explain the basic working of a hydraulic system Explain hydraulic pipes Explain hydraulic tubes Explain hydraulic hose Explain proper hose installations Explain hydraulic filters and strainers Explain methods of removing contaminants from the hydraulic system • State type of filtration by position in a system Explain hydraulic pump Explain pump's terminology	Whiteboard Projector Laptop Marker Training Notes Whiteboard Projector Laptop Marker Training Notes	Demonstrate the working principles of hydraulic system Demonstrate the uses of hydraulic lines and filters Demonstrate the working of hydraulic pumps Demonstrate the working of hydraulic valves	Guide students to demonstrate the working principles of a typical hydraulic system Show students hydraulic lines and filters Show students hydraulic Pumps Show students hydraulic valves	- Hydraulic jack workshop trolling - Car lift Machine Hydraulic lines Hydraulic filters Job sheet Hydraulic pump Hydraulic jack workshop trolling - Car lift Machine • Hydraulic lines Hydraulic filters Job sheet Hydraulic pump

	Accumulators 2.9 Explain the working principles of an intensifier	Explain types of hydraulic pumps Explain hydraulic valve Explain types of hydraulic control valves Explain types of pressure control valves Explain types of flow control valves • Explain the function of hydraulic cylinder • Explain single and double acting cylinder • Explain the maintenance of cylinder • Explain hydraulic cylinder mounting State the uses of an accumulator List the types of accumulators State the uses of an intensifier List the types of intensifier	Whiteboard Projector Laptop Marker Training Notes	Demonstrate the working of an actuator Demonstrate the working accumulator Demonstrate the working of intensifier	**Show the students the cut-out of an actuator** Show students working of an accumulator Show students how intensifier works	Hydraulic jack workshop trolling - Car lift Machine • Hydraulic lines Hydraulic filters Job sheet Hydraulic pump

	General Objective: 3.0 Understand the working of Hydraulic reservoirs.			**General Objective:** 3.0		
	3.1 Explain the working of hydraulic reservoirs 3.2 Explain reservoir sizing 3.3 State the features of reservoirs 3.4 Identify the types of reservoirs 3.5 Explain reservoirs cooling 3.6 Explain the function of breather, baffle plate, and intake strainer	Explain the working of hydraulic reservoirs	Whiteboard Projector Laptop Marker Training Notes	Identify a hydraulic reservoirs and how it works	Demonstrate the working of a hydraulic reservoir	Hydraulic system
	General Objective 4.0: Understand air and atmospheric pressure					
	4.1 Define air and atmospheric pressure. 4.2 State the advantages and disadvantages of using compressed air 4.3 State the physical properties of air 4.4 Define pressure and Unit 4.5 List different types of	Explain atmospheric pressure and the advantages and disadvantages of compressed air Explain the physical properties of air Explain units for pressure State down the formula for Pressure, Force and Area Calculate Pressure, Force and Area	• Whiteboard • Projector • Laptop • Marker • Training Notes	Demonstrate how air work when confirmed in an Elastic material Identify pressure units and their expression	Guide students to demonstrate how air works in an elastic material Guide students to identify pressure units	Ballon - Air pump - Tube

	pressure 4.6 Explain gauge pressure 4.7 Explain absolute pressure 4.8 State the mathematical expression of Pressure 4.9 Calculate problems on Pressure, Force and Area					
	General Objective: 5.0 Understand the types and operations of various air compressors.					
	5.1 Define air compressor 5.2 List type of air compressors 5.3 Explain single/two stage piston air compressors 5.4 Explain diaphragm air compressor 5.5 Explain rotary vane/screw air compressor 5.6 State various method of compressor Regulations 5.7 Explain the desire qualities of compressed air in terms of	Explain different types of compressors. Explain various components in a compressor Use diagrams to explain various components of a compressor Identify components used in the compressed air distribution system and their functions	Whiteboard Projector Laptop Marker Training Notes	Identify air compressor Demonstrate the uses of the components use	Guide students to identify air compressor Show the students the components used in the	-Compressors - Air distribution system

	cleanliness, coldness and dryness 5.8 Explain the functions of the following components use in the compressed air distribution: -Intercooler -After cooler -Air receiver -Moisture separator -Air dryer -Air service unit			in the compressed air distribution system	compressed air distribution system	
	General Objective: 6.0 Understand the operation of a basic pneumatic system					
	6.1 State the operation of a pneumatic System 6.2 Explain the industrial applications of the followings: -Linear Actuator -Rotary Actuator 6.3 Explain design specification, Manufacturers specification and installation guide of a Pneumatic system. 6.4 State common Pneumatic ISO Symbols	Explain the followings: - Design specification - Manufacturer's Specification - Installation guide - Explain the operation and industrial application of Pneumatic system Explain the common uses of pneumatic components and identify their ISO symbols	Whiteboard Projector Laptop Marker Training Notes	-Demonstrate the operation of a Pneumatic system Identify common pneumatic ISO symbols	Guide students to study the pneumatic circuit. Guide students to identify ISO symbols	- Job sheet - Pneumatic Trainer

	General Objective: 7.0 Understand pneumatic circuits with up to 3 cylinders and explain the displacement-step diagram of the cylinders					
	7.1 Explain basic pneumatic circuit with single, double Cylinder 7.2 Explain direct/indirect control of a single/ double acting cylinder 7.3 Explain control with Shuttle valve 7.4 Explain speed control on single/ double acting cylinder	Explain pneumatic schematic drawing Explain operations Of single/double Acting cylinder Explain operation of up to 3 Cylinder	Whiteboard Projector Laptop Marker Training Notes	Demonstrate cascade control with A+B+B-C+C-A- sequence	Guide the study the pneumatic circuit. Select the required components and connect up to the circuit	-Job sheet -Pneumatic Trainer -Double acting cylinder -5/2 way valve -3/2 way valve
	General Objective: 8.0 Understand the install and troubleshoot pneumatics system controlling up to 3 cylinders					
	8.1 Explain how to install troubleshoot pneumatics system controlling up to 3 cylinders	Explain how to install troubleshoot pneumatics system	Whiteboard Projector Laptop Marker Training Notes	Demonstrate installation troubleshooting process of cascade control with A+B+B-C+C-A- sequence	Check the cylinder operation sequence Troubleshoot the circuit to correct the sequence of operation. Modify the circuit if necessary	- Job sheet - Pneumatic Trainer Double acting cylinder - 5/2 way Valve 3/2 way valve

PROGRAMME:	NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE TITLE:	PRINCIPLES OF AUTOMOTIVE DIAGNOSTICS
COURSE CODE:	AMT 123
CREDIT HOURS	4 HOURS
DURATION:	Hours/Week: Theory: 1 Hour Practical: 3 Hours
GOAL:	This course is designed to provide the students with the basic knowledge and information required in carrying out Diagnostic activities in Automotive System

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Understand the fundamentals of Auto-Diagnostics

2.0 Know how to use tools and equipment in auto-diagnostics

3.0 Know common faults and fault codes in Automotive Systems

4.0 Understand types of Circuit diagrams associated with Automotive diagnostic system.

5.0 Know the types of principles and approach used in Auto-diagnostics

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: PRINCIPLES OF AUTOMOTIVE DIAGNOSTICS				**COURSE CODE: AMT123**		**CREDIT HOURS: 4**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**		**Theoretical: 1**		**Practical: 3**
GOAL: This course is designed to provide the trainee with basic knowledge and information required in carrying out Diagnosis activities in Automotive System						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Understand **the fundamentals of Auto-Diagnostics.**						
week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.1 Define Diagnostics 1.2 Define Auto Diagnostic 1.3 State reasons for auto-diagnostic 1.4 State the effects of wrong diagnostic. 1.5 State advantages of correct diagnostic 1.6 List areas of activities in auto-diagnostic	1. Explain Diagnostic showing the importance as seen in medical environment with dare consequences when wrongly carried out 1.2 Explain the cost of wrong diagnostics and advantages of accurate diagnostics in terms of cost, time and life savings 1.3 Explain areas in automotive diagnostics	Books Internets Charts Diagrams	1.1 Identify Auto Diagnostic areas, consequences of wrong/accurate diagnostics process 1.2 Identify areas of auto diagnostic in power-train, brakes, and transmission systems.	1.1 Show students the effects of wrong and accurate diagnostic principle 1.2 Guide students to identify areas in Automotive diagnostics	Complete automobile tool box Live vehicle Cooling fluids/coolants
	GENERAL OBJECTIVE: 2.0 Know how to use tools and equipment in auto-diagnostic					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
2-4	2.1 List common tools and equipment in Auto-diagnostics system 2.2 Explain the use of the following tools:	2.1 Explain tools and equipment used in Automotive Diagnostics 2.2 Explain use of each tool, and its area of application as in 2.2	Books Internets Projectors White Board Marker Journals	2.1 Identify tools and equipment in automotive diagnostics process. 2.2 Demonstrate safe handling precautions.	2.1 Guide students to identify tools and their area of use in automotive diagnostic process.	Books Internet Projector Relevant tools Digital Multimeter (DMM) Oscilloscope

	- Digital Multimeter (DMM) - Oscilloscope - Exhaust Gas Analyser - ABS Scan tools - Universal Scan tool for transmissions - Any Universal diagnostic tool e.g launch multi-diag, Bosch - Any customized diagnostic tools e.g PPS, Mercedes star - Fuel pressure tester - Cylinder Compression tester - Injector calibrating machine. 2.3 Describe areas of application and use of tools in 2.2 above. 2.4 Explain the method of operation of tool and equipment in Auto-diagnostic activities. 2.5 State the safety handling precautions of the various tools and equipment listed in 2.2 above. 2.6 Explain care of tools and	2.3 Explain the operational principle of the tools and equipment in Automotive diagnostic. 2.4 Explain care and precautionary measures necessary in tools and equipment.	Universal and customized tools.	Carry out care for tools and equipment.	2.2 Show the process of safe handling of tools/equipment	Exhaust Gas Analyser ABS Scan tools Universal Scan tool for transmissions Any Universal diagnostic tool e.g launch multi-diag, Bosch Any customized diagnostic tools e.g PPS, Mercedes star Fuel pressure teste Cylinder Compression tester Injector calibrating machine.

	Equipment.					
GENERAL OBJECTIVE: 3.0 Know common faults and fault codes in Automotive System						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Define fault in Automotive System 3.2 Define fault codes in Automotive System. 3.3 Differentiate faults according to units/section of operation in Automotive System. 3.4 Explain faults according to severity of occurrence. 3.5 State likely cause(s) of faults in Automotive System 3.6 Explain process of erasing faults in automotive system 3.7 Explain how to prevent re-occurrence of identified faults. 3.8 State the likely cause(s) of some of the following symptoms in automotive operating systems in: - Engine Overheating - Engine Misfiring	Explain various likely symptoms and their possible causes according to section and depart of operations as in 3.8.	Books Journals Magic Board Marker Faulty Engine and Vehicles	3.1 Detect faults, interpret and erase them. 3.2 Carry out practical actuation test on: - Injector pump operation - Operation of Stepper motor. - Solenoid. 3.3 Identify causes and symptoms common in automotive operating system as in 3.8. 3.4 Explain causes of the various faults observed in the section/unit of automotive system	Guide the students on the process of observing faults as they occur in the units/section in automotive engine.	Magic Board Projector Books Internet

	- Cold Starting - Anti-Pollution - Excessive fuel consumption - Excessive black, white, blue smoke - Engine check light on - Gear engagement problem - Difficult to engage - Delay in engagement - Remove in engagement - Noisy gear system - Suspension Fault - ESP Light Display - ABS light Display - Airbag Display - Seat Belt light Display - Under/ Over-Inflation - Comfort/Infotainment - AC Compressor picking - Radio Code Display and Interference - Irregular Oiling - Vehicle not pulling					
GENERAL OBJECTIVE: 4.0 Understand types of Circuit diagrams associated with Automotive diagnostic system.						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	4.1 Explain the following circuit diagrams:- (i) Synoptic diagram (ii) Schematic diagram (iii) Block/ location diagram	4.1 Explain circuit diagrams and their differences 4.2 Explain common	Books Magic Board Projector Internet Engine Model	4.1 Identify various electrical circuit diagrams in Automobile.	4.1 Guide students to identify various automobile	Chart Circuit Diagrams DMM Scan tools

	(iv) Wiring Diagram 4.2 Differentiate between the circuit mentioned in 4.1 above 4.3 Explain colour-codes in circuit diagram. 4.4 Explain common symbols in circuit diagrams 4.5 Explain the difference between: (i) Open circuit (ii) Short circuit 4.6 Explain Connectors, interconnectors, harnesses and splices in circuit diagrams.	symbols and colour-codes in circuit diagrams 4.3 Explain the difference between open and short circuit 4.4 Explain Connectors, interconnectors, harnesses and splices in circuit diagrams.	Automobile Circuit brand	4.2 Spot the differences between the circuit diagrams in 4.1. 4.3 Identify Connectors, interconnectors, harnesses and splices. 4.4 Identify: - open circuit - Short circuit using DMM.	electrical circuit diagrams 4.2 Guide the students to interpret colour-codes, symbols and connectors. 4.3 Guide the students to identify short and open circuits using DMM.	
	GENERAL OBJECTIVE: 5.0 Know the types of principles and approach used in Auto-diagnostics					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	5.1 Explain approaches to circuit diagrams in Automotive Electrical Systems: (a) Common wrong Approaches (b) Recommended Approaches (NALDRV Principles) N – Note A – Analysis L –Locate D –Detect	5.1 Explain common wrong approach and right approaches in automotive electrical circuit diagrams. 5.2 Explain the consequences of wrong approach in auto-diagram in terms of cost, time,	Books Magic Board Projector Demonstration Vehicle Breakout Boxes	5.1 Carry out diagnosis using wrong and right approaches 5.2 Interpret the acronym- NALDRV.	Guide students to treat both wrong and right approaches to Automotive electrical diagnostics.	Books Internet Demonstration Vehicle Breakout boxes Bulb Electrical cables Connectors Batteries/ Power source Diagnostic tools

	R – Review V – Verify 5.2 Explain the consequences of wrong approach in auto-diagram in terms of cost, time, damage to car, and personal injury.	damage to car and personal injury.				
	ASSESSMENT CRITERIA					
	Coursework	**Course Test**	**Practical**	**Other: Examination/Project**		

THIRD SEMESTER

PROGRAMME:	NID AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE:	INTRODUCTION TO ENTREPRENEURSHIP
CODE:	EDP 201
DURATION:	ONE SEMESTER HOURS/WEEK LECTURE: THEORY: 1 PRACTICAL: 2
UNITS:	2
Course Main Aim/Goal:	This course is aimed at providing the trainee with the basic skills and mindset for successful entrepreneurship.

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

13.0 Know what Enterprise is

14.0 Appreciate reasons for entrepreneurship

15.0 Know entrepreneurs

16.0 Know the requirements for entrepreneurship

17.0 Know the requirements for entrepreneurship

18.0 Know how to organize an enterprise.

19.0 Know how to start an enterprise.

20.0 Know how to operate an enterprise.

PROGRAMME: NID BUSINESS MANAGEMENT AND INFORMATION TECHNOLOGY						
Course: INTRODUCTION TO ENTREPRENEURSHIP		**Course Code: BMI 201**		**Credit Hours: hours/week 2**		
	Year 1	**Semester 1**		**Theoretical: hours/week 1**		
	Year: 1 SEMESTER 1	**Pre-requisite: Element of entrepreneurship**		**Practical: hours /week 2**		
	COURSE SPECIFICATION: Theoretical Content			**Practical Content**		
	General Objective 1.0: Know what Enterprise is.					
Week	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1----2	1.1 Define an enterprise. 1.2 Identify attributes required to engage in an enterprise. 1.3 Identify different forms of enterprises and classify them into: private/public, profit/non- profit, formal/informal, individual/common, local/foreign, business/social. small/large, manufacturing/service, consumer/industrial etc. 1.4 Identify the various roles people play in enterprises and factors that influence choice of role.	• Explain the meaning and scope of enterprises and their classifications. • Describe the roles different people play in an enterprise using a related organizational chart. Explain factors affecting choice of role. • .Explain types of entrepreneurs: self-employed, opportunistic, inventors, pattern multipliers, economy of scale exploiters, acquirers, Buy-sell Artists, speculators, etc.	Flip charts, Cardboards, Marker pens, Projectors, Computer , White board, Business games: e.g. Monopoly, Block Building	Explain role played in a simulated enterprise. Identify types of Enterprises and skills needed to run them. Debate for or against the existence of small businesses in an economy. Identify the contributions of SMEs to national economy	Create a simulated enterprise decided by the trainees. Each trainee to select a role he wants to play. Each trainee to explain their roles to colleagues. List roles and skills of entrepreneurs in business and compare with those identified by the students. Divide the trainees in to two groups to debate "Small business are not critical for the country's economic	

	1.5 List types of entrepreneurs. 1.6 Identify features and characteristics of small enterprises. 1.7 Explain strengths and areas where small businesses do well.	• Explain the characteristics of small enterprises. • Describe the strengths and areas where small businesses do well with examples.			economic development, as such many should be closed down for the sake of economic growth and competitive ness".	
	General Objective 2.0: Appreciate reasons for entrepreneurship					
2-4	2.1 Define Entrepreneur And Entrepreneurship. 2.2 Differentiate between entrepreneurship and management. 2.3 Explain elements of entrepreneurship 2.4 Identify entrepreneurial resources and group them into economic, human, knowledge and time. 5 Identify features of entrepreneurship in business.	• Explain entrepreneur and entrepreneurship. • Explain elements of entrepreneurship – observing the environment, identifying benefits from the environment, gathering physical and psychological tools for accomplishment, implementation, receiving rewards. • Explain entrepreneurial resources. • Explain principles/features of entrepreneurship in business: Open market economy; Private enterprise;		Analyse a life situations people engage in. Analyse a case on the role of entrepreneurship in national development bearing in mind the following: Employment /job creation. Improved standard of living. Increased competition Development of entrepreneurial Spirit /culture. National welfare Provision of skills.	Group trainees and ask each group to enumerate life situations people may find themselves in. Ask students to list employment opportunities from the environment. Group them into self or wage employment.	

	2.6 State roles and rewards of entrepreneurship in business. 2.7 Explain the entrepreneurial functions in business. 2.8 Assess the role of entrepreneurship in society.	Exploiting change; Value addition; Provision of needed product /service; Breaking of new frontiers.; Application of individual initiatives; Competition; Uncertainties;. Seeking opportunities; Creativity/innovation.; Wealth Creation.;		Evaluate your list with those of your colleagues. Add those you did not list. Choose your interest from the list.		

	2.9 Explain the concept of self-employment and wage employment 2.10 State the reasons for engaging in self-employment and wage employment	• Explain roles and rewards of entrepreneurship in business. • Explain entrepreneurial function in business: Finance, Management Uncertainty bearing (risk- bearing). • Encourage competition, Identify gaps in the market. • Explain the importance of entrepreneurship in society: • Products/ services, employment, income, taxes, investment in productive assets, National well-being etc. • Explain the terms: Self employment. wage employment. Justify why people choose either of them. • Explain the concept of empowerment.				

General Objective 3.0 Know Entrepreneurs						
5	3.1 Identify reasons for self-employment 3.2 Assess traits required for entrepreneurship 3.3 Explain the difference between entrepreneurs and businessmen 3.4 Identify entrepreneurial characteristics 3.5 Explain leadership role and leadership qualities required by entrepreneurs 3.6 Explain decision making and steps of the decision making process 3.7 Analyse a risk Situation 3.8 Explain the difference between entrepreneurs and businessmen.	• Justify the growing dissatisfaction in paid employment • Explain how to assess entrepreneurial potential • Explain how to identify entrepreneurial characteristics which are important for success in owning and operating a business • Explain theory X and Y and relate it to leadership • Explain using Power Point Presentation important leadership traits. • Interpret a given decision taken by an enterprise • Explain procedure for analyzing a risk situation.	Computer with multi-media	Decide the most important qualities essential for entrepreneurship Highlight various factors of risk taking from a ring tossing game.	Administer self-assessment test/questionnaire to students to assess their personal characteristics Advise them on those characteristics they may need to improve Invite a successful entrepreneur to give a talk Guide students to ask questions Introduce the ring tossing game. Guide students to play the game. Let them identify various factors of risk taking.	Use of practicing entrepreneur Questionnaire Sets of Rigns

	General Objective 4.0 : Know the requirements for entrepreneurships					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
6-7	4.1 Describe the key competencies required for setting up of a successful small business 4.2 Describe the key variables which might determine success in setting up a successful small business 4.3 State the role of ethics, morality and integrity in business 4.4 State the relationship between business ethics and business social responsibility 4.5 Explain factors responsible for business failure 4.6 Develop strategy to	• Explain the major competencies required for successful entrepreneurship: Knowledge , Skills and Traits • Explain how they are acquired or developed. • Provide examples of the competencies under each of knowledge, skills and traits • Explain the following as key success factors in entrepreneurship: motivation and Determination, Idea and market, Ability(MAIR	Flip chart/ Board White Board Marker pens Projector Computer	Identify the requirements of each department in terms of knowledge, skill or traits. Identify the factors for setting up the business under your heading. Present to the class your findings. Identify factors responsible for either the success or failure of the business. Examine factors to consider in deciding to start and run a business. Analyse case Studies	Draw an organogram of a chosen business organization/outfit, guide trainees to study the functions of the various departments and the knowledge and skills required for various positions. Select a small business and divide the class into 6 groups to identify key success factors in setting up the business under one of the major headings in the MAIR framework Guide trainees to analyse a case of business success/failure.	Flip charts, Cardboard marker pens, White Board, Computer, Projector etc. Practicing entrepreneur Case studies

	minimize business failure. 4.7 State reasons why and how entrepreneurs make the decision to start and run their own businesses. 4.8 List income generating activities you have been or could be involved in at home, school or within the community. 4.9 Describe your role in the activity in 4.8 above.	• Framework) Business plan Organization and Management. • Explain ethics, morality and their roles in business • Explain the relationships between ethics and business social responsibility • Explain factors that can lead to business failure and how to overcome them. • Explain with examples how individuals /groups arrive at the decision to start their own Business.			Give a practical assignment for trainees to list the people they know who have started businesses as a result of the factors presented justifying their choice in each case	

General Objective 5.0: Know sources of Business ideas						
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
8----9	5.1 Define a business idea and its sources. 5.2 Identify sources of business ideas 5.3 State the importance of generating business ideas. 5.4 Explain the concepts creativity and innovation and their importance in generating a good business idea. 5.5 Describe how to turn a business idea into a viable business opportunity. 5.6 State factors to consider in identifying and assessing business opportunities. 5.7 State characteristics of a good business opportunity	• Describe a business idea. • Explain sources of business ideas and how to spot or generate them: • Hobbies, exhibitions, survey, franchises, mass media, complaints, personal skills exercises, brainstorming. • Explain why business ideas should be generated: to respond to market needs. • Changing fashions and requirement; to stay ahead of competition; to explain technology because of product life cycle.; and to spread risk and allow for failure.	Sample Business Plan/ Sales plan	Perform both the 9 dot and creative square exercises. Implement business plan.	Guide students to do the 9 dot exercise. Ask them to connect the 9 dots by means of 4 straight lines. Provide the continuous solution on the Board and explain why the solutions lays outside the square of dots Also, guide students to do the creative square exercise. Provide a business plan for discussion by groups on implementation strategies	Cardboard or graph paper Pencil/marker Ruler Black//white board Flip chart. Sample business/ Plan/Sales plan.

		• Explain/differentiate between business idea and opportunity • Explain how to develop/ transform a business idea into a viable business opportunity. • Explain factors to consider in identifying and assessing business opportunities: industry and market; length of window of opportunities; personal translate business opportunity to business plan; goals/competencies of the entrepreneur; management team; competition; capital, technology & other resource requirements; environment; feasibility & business plan • Explain characteristic of a good business opportunity: real				

		demand, return on investment, be competitive, meet objective availability of resources & competencies				
	General Objective 6.0: Know how to organized an Enterprise					
10 - 11	6.1 Explain market 6.2 List what entrepreneurs should know about potential customers 6.3 List sources of customer information 6.4 Explain the marketing concept 6.5 Explain market research and marketing strategy 6.6 Explain target marketing 6.7 Explain marketing mix 6.8 Explain how to evaluate marketing performance	• Explain market and what should be known about potential customers • Explain sources of customer information • Analyze the marketing concept • Explain market Research and marketing strategy • Describe steps in conducting a market survey • Describe how to develop a sales plan • Explain target marketing and marketing mix		Carry out simple market survey and market research Prepare a simple sales plan from the market survey and research conducted Examine the viability of a typical business based on its location Given a selected business, analyze its initial financial requirements Prepare all necessary papers and sample application for a loan	Guide trainees to carry out simple market survey and market research in a typical market Undertake Field Trips Demonstrate how to prepare a simple sales plan from the market survey and research conducted Guide trainees to some selected businesses to find out why they are located there Select an existing business, analyze its capital requirement for establishment	Video camera Video tapes Video machine Television Real life project Sample of Covering letter CAC registration documents Cash flow projections for 3 years Tax clearance for 3 years Relevant licenses. Permits, authorizations, etc.

	6.9 Explain how to analyze the feasibility of a product/service 6.10 Explain factors that affect the consumer market with reference to the "5 Ws" 6.11 State factors for business location 6.12 Explain the legal forms of business ownership 6.13 Estimate the financial requirements to start a small business 6.14 Explain "investment capital and working capital" 6.15 Examine ways of getting into business 6.16 Examine various sources of capital to start an enterprise 6.17 Describe procedures for obtaining a business loan	• Evaluate marketing performance • Explain how to analyze product feasibility • Explain with reference to a chosen business factors for business location • Explain factors considered by bankers in evaluating loan • Explain criteria for evaluating loan sources: Cost Risk Flexibility Control Availability Weighing Evaluation Criteria • Explain various ways of entering business: Starting new Buying			Guide trainees to prepare necessary documents to file for a loan	

	6.18 Describe factors to consider by bankers when evaluating a loan applicant 6.19 Analyze criteria for evaluating loan sources 6.20 Explain uses of capital	Existing business Franchise • Explain various sources of capital to start an enterprise • Explain procedures for and considerations in applying for business loan: Type of loan Purpose Credit Worthiness/ Integrity Capability Repayment period Security Guarantors Flexibility of Project Customer status with bank • Explain considerations for loan evaluation by banks				

COURSE SPECIFICATION;	**Theoretical Content**			**Practical Content**		
	General Objective 7.0: Know how to start an enterprise.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

12--13	7.1 Identify information required by entrepreneurs. 7.2 Identify where to source the required information as an entrepreneur. 7.3 List the methods of obtaining assistance and provider of the assistance under each method: • Personal contacts: * entrepreneurs * professionals * customers • Observation: * trade exhibitions. • Interviews: * customers * suppliers * competitors. * * distributors * ex-employees * agents	• Explain nature, sources, and suppliers of information required by potential Entrepreneurs. Marketing Technical ICT Financial Legal • Explain methods of obtaining assistance and providers of such assistance. personal contact observation interviews direct mail reading web/internet research		Describe information and assistance required by a potential entrepreneur, sources and nature of assistance to be provided. Identify sources of information and assistance required by potential entrepreneurs.	Invite an entrepreneur / consultant to give a talk on information required to start a business and the sources of the information and how to get it. Divide the trainees into groups. Each group to write down all the information and assistance required by a potential entrepreneur, sources and nature of assistance to be provided.	Practicing entrepreneur Presentation material s: Computer Projector Television Video recorder

	* experts/practitioners. • Direct mail: • Reading: * reports • media • books • literature • directories • govt. information trade associations. • Web/Internet Research • competitors • markets • industry information • govt. department. 7.4 Analyze a business plan. 7.5 Identify the legal requirements to comply with before starting a business. 7.6 Calculate total capital requirements for a typical business. 7.7 Maintain various types of records and reports kept by a business.	• Explain a business plan, why it is written, when it is written, types of business plans, who writes the plan, how it is written, what is done with it, how it looks like, its contents, how it is organized. • Explain compliance requirements of a business to operate within the law. • Explain how to calculate total capital requirements for a selected business. • Explain types of record and reports to be kept by a business .		List the equipment/tools/machines etc required in a selected business. Identify compliance requirement. List all the fixed and current assets required to start a selected business. Determine personal contribution to start a business. Note other sources of funding a business. Identify supporting evidence/ documents such as certificate of proficiency, entrepreneur's awards, reference letters, bank statements, tax returns which may be required to support loan application. List records/reports kept by a business such as cheque book, receipts, petty cash,	Duties of each employee. Qualifications of the employees. Organizational chart of the business. Outside /professional services that may be required to support the business. Equipment/facilities available for operation. Compliance requirements. Total capital required to start. Personal capital contribution to finance the business. Intended borrowed capital. Support evidence/documentation acquired to borrow required funds.	Sample Business Plan

	7.8 Determine total sales, expenses, working capital etc for a typical business. 7.9 Prepare sales and costs fore casts for a typical business. 7.10 Prepare forecasted cash flow, income statement, balance sheet for a typical business. 7.11 Calculate contribution margin of a business from given sales and cost of stock figures using appropriate formula.	• Provide list of legal Statutory business agencies: CAC, SON, NAFDAC, State Ministry of Commerce, Local Govt. etc.and their roles • Explain how to determine total sales, expenses, working capital, and total amount for fixed assets, total costs for stocks, labour and overheads. • Explain how to prepare sales and costs forecast. • Explain how to prepare forecasted cash flow, forecasted income statement, balance sheet.				

		• Explain how to calculate contribution margin. •				

	7.12 Describe the responsibility of a typical small business to the Community.			payroll, purchase vouchers, tax returns, cash flow, income statements, balance sheets etc. Calculate total sales, expenses, working capital, total amount for fixed assets, total costs for stocks, labour overheads, etc. required for starting a business. Prepare sales and costs forecasts, forecasted cash flow, forecasted income statement, forecasted balance sheet for the end of first year. Calculate gross profit/contribution margin in terms of percentage. Identify areas the business can make contribution to the immediate environment/community (social responsibility) Prepare a business plan for a chosen business.	Records/reports required in running the business. Monthly/annual total sales. Expected pre-operation expenses . Required working capital. Total amount for fixed assets. total cost, stocks, labour, overheads. Sales and costs forecast for the first years. Cash for cast for the first year. (Show forecast cash flow). Profit forecast for first year. (show forecast income statement). Net worth of the	

COURSE SPECIFICATION;	Theoretical Content			Practical Content		
WEEK	**General Objective** 8.0: Know how to operate an enterprise.					
	Specific Learning Objective	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
14---15	8.1 Explain how to select, motivate and discipline staff in a small business. 8.2 List necessary skills required by an entrepreneur to manage his personnel. 8.3 Explain why it is necessary to manage time. 8.4 Explain techniques of time management. 8.5 Describe a sales person and his attributes. 8.6 Describe characteristics of potential customers. 8.7 Describe the steps taken by a sales person in selling a product. 8.8 Explain importance of promotional activities in promoting sales.	• Explain personnel practices in a small business. Recruitment and selection. Orientation. Job design, specification and assignment. Motivation Discipline. • Describe skills required to manage people. • Explain time management and its techniques. • Explain qualities of successful sales person. • Explain qualities of potential customers.		Prepare a suitable job advertisement for an existing vacancy in a small business. Schedule daily activities. Prepare sales promotion campaign to address a specific problem of sales.	Guide trainees to prepare a suitable job advertisement for a determined vacancy. Guide trainees to prepare a time schedule of their activities. Ask them to prioritize their activities for the next day. Advise them on best practices. Guide trainees to prepare a promotional campaign to address a specific problem of sales. Invite successful Entrepreneur for experience sharing.	Samples of packaged Products. Newspaper cuttings of job adverts

	8.9 Describe steps to take in dealing with suppliers. 8.10 Explain factors in selecting appropriate technologies for a typical small business considering its characteristics and major considerations. 8.11 Analyse a decision to introduce new technology in a small business	• Explain the role of communication in selling .vii .Explain the role of promotion in sales. • Explain steps of doing business with suppliers. • Determine your business needs. Identify potential suppliers. • Contact suppliers and obtain quotations. Select best suppliers. Order goods. Check received goods. • Check the invoice and Pay suppliers.				

		• Explain how to determine appropriate technologies for use in a small business. Simple Effective Availability Flexibility Durability Efficiency Cost effectiveness • Explain the major considerations to make before introducing new technology in a small business. • Explain how new technology will improve market share. • How the technology will affect business profits. Whether market study has been conducted to determine the				

		demand for the new product.. Period it will take for the new product to gain acceptance.				
COURSE SPECIFICATION;		**Theoretical Content**		**Practical Content**		
WEEK	**General Objective** 8.0: Know how to operate an enterprise.					
	Specific Learning Objective	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
14---15	8.1 Explain how to select, motivate and discipline staff in a small business. 8.2 List necessary skills required by an entrepreneur to manage his personnel. 8.3 Explain why it is necessary to manage time. 8.4 Explain techniques of time management. 8.5 Describe a sales person and his attributes. 8.6 Describe characteristics of potential customers.	• Explain personnel practices in a small business. Recruitment and selection. Orientation. Job design, specification and assignment. Motivation Discipline. • Describe skills required to manage people. • Explain time management and its techniques. • Explain qualities of successful sales person.		Prepare a suitable job advertisement for an existing vacancy in a small business. Schedule daily activities. Prepare sales promotion campaign to address a specific problem of sales.	Guide trainees to prepare a suitable job advertisement for a determined vacancy. Guide trainees to prepare a time schedule of their activities. Ask them to prioritize their activities for the next day. Advise them on best practices. Guide trainees to prepare a promotional campaign to address a specific problem of sales.	Samples of packaged Products. Newspaper cuttings of job adverts

	8.7 Describe the steps taken by a sales person in selling a product. 8.8 Explain importance of promotional activities in promoting sales. 8.9 Describe steps to take in dealing with suppliers. 8.10 Explain factors in selecting appropriate technologies for a typical small business considering its characteristics and major considerations. 8.11 Analyse a decision to introduce new technology in a small business	• Explain qualities of potential customers. • Explain the role of communication in selling .vii .Explain the role of promotion in sales. • Explain steps of doing business with suppliers. • Determine your business needs. Identify potential suppliers. • Contact suppliers and obtain quotations. Select best suppliers. Order goods. Check received goods.			Invite successful Entrepreneur for experience sharing.	

		• Check the invoice and Pay suppliers.				
		• Explain how to determine appropriate technologies for use in a small business. Simple Effective Availability Flexibility Durability Efficiency Cost effectiveness • Explain the major considerations to make before introducing new technology in a small business. • Explain how new technology will improve market share. • How the technology will affect business				

		profits. Whether market study has been conducted to determine the demand for the new product.. Period it will take for the new product to gain acceptance.				

CALCULUS
MTH 102

PROGRAMME: **NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY**

COURSE TITLE: **PRACTICE OF AUTOMOTIVE DIAGNOSTICS**

COURSE CODE: **AMT 211**

CREDIT HOURS **4 HOURS**

DURATION: **Hours/Week: Theory: 1 Hour Practical: 3 Hours**

GOAL: This course is designed to provide the trainee with knowledge and skill to carryout diagnostics and repairs in the various components of electrical/electronic communication in automotive systems.

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Know Automotive Sensors and Actuators.

2.0 Understand the role of Engine Control Unit (ECU) in Automotive Mechatronics System

3.0 Know how to rectify faults associated with the Built-in System Interface (BSI)

4.0 Know how to rectify faults in Fuse Boxes

5.0 Understand the basic of Automotive Multiplex System

6.0 Know how to rectify faults in automotive Mechatronic Systems.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: PRACTICE OF AUTOMOTIVE DIAGNOSTICS				**COURSE CODE: AMT 211**		**CREDIT HOURS: 4**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical: 1**		**Practical: 3**	
GOAL: This course is designed to provide the trainee with knowledge and skills to carry out diagnostics and repairs in the various components of electrical/electronic communication in automotive systems.						
Theoretical Content				**Practical Content**		
1.0 GENERAL OBJECTIVE: 1.0 Know Automotive Sensors and Actuators.						
week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.1 Define Sensors 1.2 Define Actuators 1.3 Explain types of sensor and actuators. 1.4 Explain the functions of sensors and actuators. 1.5 Explain faults as indicated from sensor and actuator	1.1 Explain sensors and actuators, their types and functions 1.2 Explain location and fault indicated by sensors and actuators.	• Sensors • Actuators • Model Engine • Live Vehicle • Magic Board • Projector • Marker	1.1 Detect faults indicated by sensors and actuators and rectify them.	Guide students to detect and rectify faults indicated by sensors and actuators.	• Sensors • Actuators • Models Engine • Model Cars • Projector • Marker • Tool box • Diagnostic tools • DMM
	1.0 GENERAL OBJECTIVE: 2.0 Understand the role of Engine Control Unit (ECU) in Automotive Mechatronics System					

Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
2-4	2.1 Explain Engine Control Unit (ECU) 2.2 Explain types and functions of Engine Control Unit (ECU) 2.3 Explain location of Engine Control Unit (ECU) 2.4 Explain master Engine Control Unit (ECU) 2.5 Explain slave Engine Control Unit (ECU)	2.1 Explain Engine Control Unit (ECU) types, functions and locations.	• ECUs • Model Engine • Charts • DMM • Diagnostic tools	2.2 Interpret ECU Communications. 2.3 Dismantle and refit ECU	• Guide students to interprete, dismantle and refit ECUs.	• Tool Box • Diagnostic tools • DMM • ECUs • Magnifier
1.0	**GENERAL OBJECTIVE: 3.0 Know how to rectify faults associated with the Built-in Systems Interface (BSI)**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Explain the functions of Built-in Systems Interface (BSI) 3.2 Explain components in Built-in Systems Interface (BSI) 3.3 Differentiate between BSI and ECU	3.1 Explain the functions of BSI. 3.2 Explain the location of both the ECU and BSI 3.3 Explain common faults related to BSI.	• Textbooks • Internet • Circuit Diagrams	3.1 Identify components of BSI . 3.2 Identify the functions of component of BSI	• Show the students the internal components of BSI • Guide students to identify and	• Complete Tool Boxes • Precision tool Boxes • BSI Component • DMM • Oscilloscope • Charts

	3.4 Explain location of Built-in Systems Interface (BSI) 3.5 Discuss equipment linked to the BSI. 3.6 Explain faults linked to BSI and how to rectify Them 1.6 Discuss care and precautions while working on BSI.				rectify faults in BSI.	• Circuit Diagram • Magnifier
1.0	**GENERAL OBJECTIVE: 4.0 Know how to rectify faults in Fuse Boxes**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	4.1 Explain types and purpose Fuse boxes. 4.2 Explain location of fuse boxes. 4.3 Explain circuit diagrams related to a fuse box. 4.4 Explain components of a Fuse Box. 4.5 State the roles of the various types of Fuse boxes 4.6 Differentiate between functional and faulty Fuse boxes. 4.7 Explain process of Fuse	4.1 Explain fuse boxes, their types and components. 4.2 Explain circuit diagrams related to a fuse box. .	• Text books • Internet • Circuit Diagrams	Interprete circuit diagrams, identify and rectify faults in a fuse box.	Guide students to interprete circuit diagrams, identify and rectify faults in a fuse box.	• Complete Tool Boxes • Precision tool Boxes • BSI Component • DMM • Oscilloscope • Charts • Circuit Diagram

	Repair 4.8 Explain safety precaution while handling Fuse Boxes.					
	1.0 GENERAL OBJECTIVE: 5.0 Understand the basics of Automotive Multiplex System					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	5.1 Define Multiplex System 5.2 Discuss history of Multiplex Systems 5.3 Discuss areas of Application of a Multiplex System. 5.4 Explain the generation of Multiplex System 5.5 Explain main purpose of Multiplex System 5.6 List Discrete components in Automotive Multiplex system. 5.7 Explain BUS System 5.8 Define Local Area Network (LAN) 5.9 Explain area of application of LAN	5.1 Explain Multiplex and its Application 5.2 Explain LIN, LAN, VAN and CAN. 5.3 Explain the purpose of each in 5.2 above. 5.4 Explain the cable that represent LIN, LAN, VAN and CAN 5.5 Explain faults associated with each network and how to rectify.	• Text books • Internet • Circuit Diagrams	5.1 Identify cables of LIN, LAN, VAN and CAN 5.2 Identify CAN High and CAN Low, VAN High and VAN low 5.3 Carryout fault tracing in each Network in a Circuit System	Guide students to identify cables of LIN, LAN, VAN and CAN. • Demonstrate fault tracing on each Network	• Diagnostic Scan tools • DMM • Live Vehicle • Circuit diagrams • Complete tool box • Oscilloscope • Computer system

	5.10 Explain LAN. wiring in a Circuit 5.11 Define Local Interconnection Network (LIN) 5.12 Explain application of LIN 5.13 Explain LIN wiring in a Circuit diagram 5.14 Define Control Area Network (CAN) 5.16 Explain area of application of CAN. 5.17 Explain CAN - high and CAN – low in a circuit diagram. 5.18 State faults common with CAN 5.19 Define Vehicle Area Network (VAN) 5.20 Explain areas of application of VAN 5.21 Explain VAN – low and VAN-High in a circuit diagram 5.22 State fault common with VAN networks					

	5.23 Differentiate between LIN, LAN, VAN and CAN					
	1.0 **GENERAL OBJECTIVE: 6.0 Know how to rectify faults in automotive Mechatronic Systems.**					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	6.1 Explain how to use the Following software: - Auto Data - All Data 6.2 Explain precautionary measures in electrical fault tracing 6.3 Explain Safety requirement for components, Car, Personnel and Environment during electrical fault tracing	6.1 Explain the use of All Data and Auto Data software in fault tracing 6.2 Discuss the Safety precautions required in the electrical fault tracing workshop	• White Board • Marker • Recommended textbooks etc.	6.1 Identify and rectify faults in Instrument cluster. 6.2 Identify and rectify faults in motorised throttle housing 6.3 Identify and rectify faults in Transmission Unit 6.4 Identify and rectify faults in power-train 6.5 Identify and rectify faults in Infotainment units 6.6 Identify and rectify faults in BSI, fuse box and ECU. 6.7 Identify and rectify faults in comfort unit (A/C)	• Guide the students on steps to identify and trace the faults created.	• Circuit diagrams for a specific fault • Live Engine • Complete tool box • Oscilloscope • Digital Multimedia • DMM • Fuel Pressure tester • All Data and Auto Data • Diagnostic Scan tools • Personal Computer

				6.8 Identify and rectify short and open circuit faults. 6.9 Identify and rectify fault in fuel system 6.10 Identify and rectify fault in ESP, ABS units. 6.11 Identify and rectify faults on Actuators and Sensors		
	ASSESSMENT CRITERIA					
	Coursework	**Course Test**	**Practical**	**Other: Examination/Project**		

PROGRAMMEE: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY

COURSE TITLE: PRINCIPLES OF AUTOMOTIVE SYSTEMS 1

COURSE CODE AMT 212

YEAR: YEAR 1, SEMESTER 2

DURATION: 4 HOURS/4CREDIT UNITS

GOAL: This course is designed to equip students with the basic working principles and operations of the cooling, lubrication, fuel and transmission systems

GENERAL OBJECTIVES:

At the end of this course, the students should be able to:

1.0 Understand the working principles and operations of an engine system

2.0 Understand the working principles and operations of the cooling system

3.0 Understand the working principles and operations of lubrication system

4.0 Understand the working principles and operations of the fuel system

5.0 Understand the working principles and operations of transmission system

6.0 Understand the working principles and operation of the Vehicle air conditioning system

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: PRINCIPLES OF AUTOMOTIVE SYSTEMS 1				**COURSE CODE: AMT 212**		**CREDIT HOURS: 4**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical:**		**Practical:**	
GOAL: This course is designed to equip students with the basic principles and operations of the cooling, lubrication, fuel and transmission systems						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Understand the working principles and operations of the cooling system						
Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.7 Explain engine cooling systems and its purpose. 1.8 List the component of a cooling system 1.9 Explain the function of the components in the cooling system 1.10 Explain the types of cooling system 1.11 Explain the schematic structural flow of the cooling system 1.12 Explain importance of engine coolants 1.13 Explain forced water circulation cooling system 1.14 Explain thermo-siphon water cooling systems	1.1 Explain engine cooling systems and its purpose. 1.2 List the component of a cooling system 1.3 Explain the function of the components in the cooling system 1.4 Explain the types of cooling system 1.5 Explain the schematic structural flow of the cooling system 1.6 Explain importance of engine coolants 1.7 Explain forced water circulation cooling system	• White Board • Projectors • Laptop • Flip Chart • Drawings •	1.2 Identify engine cooling system and its components 1.3 Identify types of cooling fluids 1.4 Perform trouble shooting and service of cooling system 1.5 Observe safety precaution while working on cooling system	• Guide students to demonstrate engine cooling system operations • Show students how to drain and replace engine coolant fluid • Demonstrate trouble shooting techniques and service of cooling systems.	• Complete automobile tool box • Live vehicle • Cooling fluids/coolants • Audio-visual • Models • Real objects

	1.15 Differentiate between forced circulation and thermo-siphon water cooling system 1.16 Explain the common problems associated with a cooling system 1.17 Explain the maintenance and service procedure of cooling system	1.8 Explain thermo-siphon water cooling systems 1.9 Differentiate between forced circulation and thermo-siphon water cooling system 1.10 Explain the common problems associated with a cooling system 1.11 Explain the maintenance and service procedure of cooling system				
	GENERAL OBJECTIVE: 2.0 Understand the working principles and operations of lubrication system					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
2-4	2.1 Define Automotive lubrication system 2.2 Explain the purpose and functions of lubricating systems 2.3 list the component parts of lubricating system 2.4 explain the schematic structural flow of lubricating system	2.1 Explain the functions and purpose of lubricating system 2.2 Describe the effect of friction and the need for lubrication	• White Board • Marker • Projectors • Laptop • Flip Chart	2.1 Identify types of lubricants 2.2 Identify types of oil filters 2.3 Carry out gauging, draining and replacement of engine oil	• Demonstrate the procedure for draining, replacement and gauging of engine oil • Compare types of lubricants and their effects	• Automobile Tool box • Live vehicle • Demonstration engine • Different types of lubricants, additives and filters

	2.5 Explain the principles of lubricating systems 2.6 explain types, composition and properties of lubricating oils 2.7 Explain oil additives and oil rating	2.3 List types of lubrication and lubricants 2.4 Explain the layout of lubricating system 2.5 Explain types of oil additives and their effect.			• Show types of oil additives and oil filters	
GENERAL OBJECTIVE: 3.0 Understand the working principles and operations of the fuel system						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Explain fuel injection system for SI and CI engines 3.2 Explain types and modes of injection system. 3.3 State functional operations and requirements of an injection system 3.4 Explain the functions of fuel injector, fuel pump and fuel filter 3.5 Explain types of nozzles and fuel spray. 3.6 explain maintenance and service of fuel system	3.1 Describe fuel injection system for CI and SI engines 3.2 list components of the automobile fuel system 3.3 explain the functions of fuel injectors, fuel pumps and fuel filter 3.4 explain types of nozzles and fuel spray 3.5 explain maintenance procedure of fuel system	• White Board • Marker • Projectors • Laptop • Flip Chart	3.1 Identify Basic assembly of injector system 3.2 Identify components of the fuel system 3.3 Troubleshoot the fuel injector system 3.4 Carry out servicing of injectors 3.5 Replace a fuel pump and filter	• Show the basic assembly of an injector system • identify the components along the fuel system • Perform fault diagnosis of the fuel system • Guide students to replace fuel pump and filter	• Automobile Tool box • Live vehicle • Fuel Injector Trainer • Fuel Pump • Fuel Filter • Injector Nozzles • Injector Cleaner • Fuel pressure tester • Model • Real object
GENERAL OBJECTIVE: 4.0 Understand the working principles and operations of transmission system						

Week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
	4.1 Explain the operational principles and functions of the transmission system 4.2 Explain the operational function of the clutch and its component 4.3 Explain the operational function of gear box in manual transmission and its components 4.4 Explain common types of gear box in manual transmission 4.5 Explain operational principles of automatic transmission system and its components parts 4.6 Explain the importance of automatic transmission fluid (ATF) 4.7 Describe the operational principles of propeller shaft and drive shaft in relation to the power train. 4.8 State the functions of the differential and final drive in the transmission system.	4.1 Describe the operational principles and functions of the transmission system 4.2 Describe the operational function of the clutch 4.3 Explain the working principles of gear box 4.4 Differentiate common types of manual gear box: ▪ Sliding-mesh gear box ▪ Constant-mesh gear box ▪ Synchro-mesh gear box 4.5 Describe the working principles of automatic transmission systems 4.6 Describe the working principles of torque Converters. 4.7 Explain the	• White Board • Maker • Flip Chart • Projectors • Laptop	4.1 Demonstrate the working principles of transmission system 4.2 Demonstrate the function of the clutch 4.3 Compare the operational principles of manual gear boxes, gear synchronization and engagement 4.4 Demonstrate the operation of the automatic transmission system 4.5 Demonstrate the function of the Torque Converter. 4.6 Demonstrate the working function of propeller shaft, differential and final drive	• Guide students to demonstrate the working principles of automobile transmission system • Show students the working principles of the clutch • Guide students to demonstrate the operation of automatic transmission systems • Demonstrate the operation of Torque Converter • Apply uses of Automatic Transmission Fluid	• Complete Automobile Tool Box • Live Vehicles • Manual gear box • Automatic gear box • Torque Converter • Automatic Transmission Fluid (ATF) • Automobile Transmission Trainer.

		operational function of propeller shafts. 4.8 Explain the operational function of differential and final drive			• Demonstrate the operational link between the engine, propeller, differential and final drive.	
	GENERAL OBJECTIVE: 5.0 Understand the working principles and operation of the Vehicle air conditioning system					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	5.1 Explain air-conditioning cycle and its principles 5.2 Explain fundamentals of vehicle air-conditioning 5.3 Explain components of vehicle air-conditioning 5.4 Describe refrigerant types and their function 5.5 Describe routine maintenance of vehicle air-conditioning system	5.1 Explain air-conditioning cycle and its principles with diagrams 5.2 Explain vehicle air-conditioning fundamentals. 5.3 List components required in vehicle air-conditioning systems 5.4 Explain refrigerants and their function 5.5 Explain routine maintenance for vehicle air- conditioning systems.	• White Board • Maker • Flip Chart • Projectors • Laptop	5.1 Demonstrate the working principles of air-conditioning cycle 5.3 Identify components of vehicle air-conditioning system. 5.4 Perform Refrigerant discharge and evacuation 5.5 Perform refrigerant charging and system lubrication/oiling	• Guide students to demonstrate working cycle of vehicle air-conditioning system • Show the functional components of vehicle air-conditioning system • Guide students to perform routine maintenance of vehicle	• Complete automobile tool box • Live vehicle • Compressor • Evaporator • Condenser • Dryer • Assorted refrigerant types • System pressure/temperature gauge tester • Vehicle air-condition trainer • Leak detector • Gas extractor and recharge device

					air-conditioning system including system discharging, evacuation and charging of refrigerants.	
	ASSESSMENT CRITERIA					
	Coursework	**Course Test**	**Practical**	**Other: Examination/Project**		

PROGRAMME: **NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY**

COURSE TITLE: **AUTOMOTIVE ELECTRICAL TECHNOLOGY I**

COURSE CODE: **AMT 213**

CREDIT HOURS **4 HOURS**

DURATION: **Hours/Week: Theory: 1 Hour Practical: 3 Hours**

GOAL: **This course is designed to provide the students with knowledge and skills to maintain and repair automotive electrical systems.**

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Understand the working principles of a cell and the constructional feature of a battery

2.0 Know how to maintain, repair and charge batteries

3.0 Know how to carry out repairs on alternators

4.0 Know types of Starter Motors and their repairs

5.0 Know automobiles electrical circuit components.

6.0 Understand automotive sensor technology

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: AUTOMOTIVE ELECTRICAL TECHNOLOGY I				**COURSE CODE: AMT 213**		**CREDIT HOURS: 4**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical: 1**		**Practical: 3**	
GOAL: This course is designed to provide the trainee with knowledge and skill to maintain, repair and charge batteries efficiently.						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Understand the working principles of a cell and the constructional feature of a battery						
week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.18 Define cell. 1.19 Explain the various parts of a cell. 1.20 Explain types of cells: - Primary and - Secondary cells 1.21 Explain the working principles of Primary and Secondary cells	1.3 Explain Primary and Secondary cells 1.4 Explain working Principles of 1.1 above.	• Cells • Battery • Charts • Chalkboard • Text books • Internet	1.6 Construct a simple cell of battery 1.7 Connect batteries for charging system in (a) series (b) parallel 1.8 Prepare electrolyte for use in secondary cell 1.9 Measure the specific gravity (s.g) of the electrolyte	• Show students how to: • Construct simple cells of battery • Connect batteries in series to a battery charger • Connect batteries in parallel to a battery charger • Prepare electrolyte for use in secondary cell (Note: acid to water and not water to acid) • Use hydrometer to measure	• Insulated container, • Diluted Sulphuric Acid • Zinc Plate and Copper Plate • Rechargeable Batteries • Battery charger • Electrolyte • Acid and water • Plastic container • Hydrometer • Refractrometer • Rubber gloves • High-risk discharge tester

					the s.g. of the electrolyte	
	GENERAL OBJECTIVE: 2.0 Know how to maintain, repair and charge batteries					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
2-4 **9-10**	2.1 Explain the materials, equipment and tools used for battery charging 2.2 Describe the condition suitable for battery charging e.g. (a) Observe polarity and terminal (b) The room will be well ventilated (c) Remove the vent covers (d) Use non-corrosive base 2.3 Explain how to prepare electrolyte observing necessary precautions 2.4 Describe the various methods of charging battery e.g. Constant voltage, constant current, float charging, and trickle charging 2.5 Describe the various types of charging e.g. a. Trickle charging b. Floating charging	2.1 Show tools, materials and equipment used with battery in a charging room 2.2 Explain the precaution in charge room 2.3 Explain how to prepare electrolyte, observe all precautions 2.4 Explain methods of battery charging 2.5 Describe all types of charging system stated above 2.6 Use hydrometer to demonstrate how to test the specific gravity 2.7 Explain charging	• Cells • Battery • Charts • Chalkboard • Text books • Internet	2.4 Carryout different charging methods e.g. ▪ Trickle charging method ▪ Constant current method ▪ Constant voltage method ▪ Floating method 2.5 Observe charging and discharging condition of a secondary cell/ battery 2.3 Apply the necessary regulations while charging 2.4 Detect faulty cells in a battery using voltage tester	Guide students to: • Construct, charge, discharge, repair and replace batteries..	• Insulated container, • Diluted Sulphuric Acid • Zinc Plate and Copper Plate • Rechargeable Batteries • Battery charger • Electrolyte • Acid and water • Plastic container • Hydrometer • Refractrometer • Rubber gloves • High-rate discharge tester

	c. Equalizing charging d. Ordinary charging e. Initial charging 2.6 Explain how to determine the specific gravity of electrolyte. 2.7 Explain how to determine the charge and discharge condition 2.8 Explain how to protect terminals from corrosion and safeguard the battery cells in a charged condition 2.9 Describe the constructional features of a charger	and discharging state 2.8 Explain charging and discharge state show how to determine them 2.9 Explain how to protect terminals from corrosion. Draw a well labeled diagram of a charger. 2.10 Show parts of charger 2.11 Explain regulations guiding battery installation charging and maintenance 2.12 Show how to detect the condition of cells in a battery 2.13 Show how to repair and replace faulty cells 2.14 Demonstrate how to seal battery tops with sealing compound.		2.5 Repair and replace fault cells in a battery 2.6 Seal battery top with the appropriate sealing compound		

GENERAL OBJECTIVE: 3.0 Know how to carry out repairs on alternators						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Explain the component parts of an alternator 3.2 Explain the operational and working principles of an alternator 3.3 Explain the term rectification 3.4 Explain the design and purpose of voltage regulator 3.5 Explain the content of reverse current block and over voltage protection 3.6 Explain the internal circuit of an alternator. 3.7 Explain problems associated with alternators.	3.1 Explain alternator, its components and functions.	• Textbooks • White board • Chart • Multimedia Projector	3.1 Identify component parts of an alternator. 3.2 Interpret the internal circuit of an alternator. 3.3 Identify and replace faulty parts of an alternator.	• Guide the student to identify and replace faulty parts of an alternator.	• Tool Box • Alternator • A work bench
GENERAL OBJECTIVE: 4.0 Know types of Starter Motors and their repairs						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	4.1 Explain the history of automobile starting system 4.2 Explain parts of a starter motor and their designs 4.3 Explain the meshing drive	4.1 Explain the history, parts, types and process of starter motors.	• Textbooks • White board • Chart • Multimedia Projector	4.1 Identify and rectify faults in a starter motor	• Guide students to Identify and rectify faults in a starter motor.	• Tool Box • Starter Motor • Training Models of Starter motor

	and starting process 4.4 Explain types of starter motors. 4.5 Explain common problems associated with starter motors.					
	GENERAL OBJECTIVE: 5.0 Know automobiles electrical circuit components.					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	5.1 Explain types of automobile electrical circuit component 5.2 Describe automobile electrical circuit load e.g. - Lamps - Bulb, e.t.c. 5.3 Define relay. 5.4 Explain the operational principles of a relay 5.5 Explain different types of Relays.	5.1 Explain automobile electrical circuit components.	• Textbooks • White Board • Charts • Multimedia Projector	5.1 Identify automobile electrical circuit component 5.2 Identify parts of a Relay 5.3 Remove and replace faulty relay in a circuit.	• Guide students to: (a) Identify automobile electrical circuit components (b) Identify parts of a relay. (c) Remove and replace faulty relay in a circuit.	• Battery • Wires • Relays • Lumps • Bulbs • Models

TECHNICAL REPORT WRITING

PROGRAMMEE:	NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE TITLE:	FUNDAMENTALS OF AUTOMATION AND ARTIFICIAL INTELLIGENCE
COURSE CODE	AMT 215
YEAR:	YEAR 2 SEMESTER 3
DURATION:	2 HOURS/WK 2 CREDIT UNITS
GOAL:	This course is designed to equip students with the basic understanding of the concept of automation and artificial intelligence

GENERAL OBJECTIVES:

At the end of this course, the students should be able to:

1.0 Understand the concept of automation

2.0 Understand the working principles and application of Control System

3.0 Understand the use of Personal Computer in automation

4.0 Understand Hardware configuration and Software Application in automation

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: INTRODUCTION TO AUTOMATION AND ARTIFICIAL INTELLIGENCE			**COURSE CODE:**		**CREDIT HOURS: 2**	
YEAR: 2	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical:**		**Practical:**	
GOAL: This course is designed to equip students with the basic understanding and concept of automation and artificial intelligences						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Understand the concept of automation						
week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1	1.22 Define automation. 1.23 Explain automation process 1.24 Explain stages of automation -early -intermediate -current 1.25 List requirements and equipment for basic automation	1.5 Explain automation technology and application 1.6 Explain evolution and development of automation 1.7 Explain current state of automation and its impact on technology 1.8 Explain components for basic automation including micro controller system	• White Board • Laptop • Lecture Note • Flip Chart	1.10 Identify process and stages of automation 1.11 Compare early and current stages of automation	• Guide students to demonstrate stages of automation • Guide students to compare early and current stages of automation	• Computer system • -solid - state relays • Micro-controller unit • Programmable Logic Controller trainer • Adriuno-uno automation kit
	GENERAL OBJECTIVE: 2.0 2.0 Understand the working principles and application of Control System					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
2-4	2.1 Define control system 2.2 Explain types of control systems 2.3 Explain input processor section of control system.	1.1 Explain the concept of control system 1.2 Explain types of control system	• Laptop • White Board • Marker • Projectors	2.6 Demonstrate control process and systems	• Guide students to demonstrate control process in automation	• Micro Controller Units • PLC Trainer • Computer Systems • Interface Card

	2.4 Explain development and types of Programmable Logic Controller (PLC) system 2.5 Explain the programming language used for PLC Control System	1.3 Explain input processor section in Control System 1.4 Describe stages of development of PLC system 1.5 Explain programming language for PLC's	• Laser pointer • Lecture Notes	2.7 Identify input process section in control system 2.8 Perform simple PLC Programming for Automation Control	• Show types of control system • Demonstrate PLC development stages • Guide students to perform simple PLC programming	
GENERAL OBJECTIVE: 3.0 Understand the use of Personal Computer in automation						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Explain the use of computers in automation 3.2 Explain the stages of computer interface in automation 3.3 Explain PC modularity programmability and sources of support 3.4 Compare PC, PLC and relay in automation 3.5 Explain types and application of automation software.	3.1 Explain the use of computer in automation 3.2 Explain stages of micro computer interface in automation 3.3 Explain computer modularity, programmability and source support 3.4 Explain the difference of PC, PLC and relays	• White Board • Marker • Projectors • Laptop • Flip Chart • Projector • Laser Pointer • Lecture Notes	3.1 Demonstrate the use of computers in automation 3.2 Identify the stages of computer interface in automation 3.3 Perform PC modularity and source support for automation 3.4 Demonstrate the use of PC, PLC and relay in automation	• Guide students to demonstrate application of PC in automation • Show interface in automation • Show the application of PC, PLC and relays in automation	• PLC Trainer • Automation Software • Adriuno-uno automation kit • Computer System

		3.5 Explain types of automation software		3.5 Install automation software	• Show how to install automation software	
GENERAL OBJECTIVE: 4.0 Understand Hardware configuration and Software Application in automation						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
	4.1 Explain the components of PC System used in automation system control 4.2 Explain automation process and PC control interface 4.3 Explain assembly and trouble shooting of PC	4.1 Explain micro computer components and configuration in control system 4.2 Explain automation process and PC control interface 4.3 Explain steps and procedures of PC assembly 4.4 Explain procedure for PC trouble shooting	• White Board • Maker • Computer system • Lecture Notes • Projector • Laser Pointer	4.1 Identify micro computer components used for automation 4.2 Connect an interface micro computer automation software and equipment 4.3 Identify and assemble micro computer parts and components 4.4 Trouble shoot and maintain PC used in automation	• Guide students to identify micro computer components used in automation • Show and guide students to connect an interface PC and PLC • Guide students to assemble micro computer • Show students the procedure for	• Micro Computer System Units • PLC trainer unit • Automation Software • Micro Controller Trainer Unit • Adriuno-uno Kit • internet

					PC trouble shooting	
	ASSESSMENT CRITERIA					
	Coursework	**Course Test**	**Practical**	**Other: Examination/Project**		

FOURTH SEMESTER

PRACTICE OF ENTERPRENEURSHIP
EDP 202

PROGRAMME:	NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE:	PRACTICE OF AUTOMOTIVE SYSTEMS
CODE:	AMT 221
DURATION:	SECOND SEMESTER HOURS/WEEK LECTURE: THEORY: 1 PRACTICAL: 3
UNITS:	4
Goal:	This course is aimed at providing the trainee with the basic working principles and operations of suspension, brake, steering, exhaust and air-conditioning systems

GENERAL OBJECTIVES:

On completion of the course, the trainee should be able to:

1.0 Understand the working principle, repair and maintenance of an automobile engine.

2.0 Understand the Principles of operation and requirements of suspension system

3.0 Know the principles of brake system

4.0 Understand steering system and its requirements

5.0 Understand the working principles of exhaust system

6.0 Understand the working principles and operation of air-conditioning system

PROGRAMME:	NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE TITLE:	AUTOMOTIVE ELECTRICAL TECHNOLOGY II
COURSE CODE:	AMT 222
CREDIT HOURS	4 HOURS
DURATION:	Hours/Week: Theory: 1 Hour Practical: 3 Hours
GOAL:	This course is designed to provide the students with the knowledge and skills to diagnose and repair automobile ignition and data transmission systems in an automobile.

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Know measuring, testing and fault diagnostics in automobile ignition system

2.0 Understand automobile ignition system

3.0 Know data transmission and reception in motor vehicle.

	PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS					
	COURSE:		Course Code: **AMT 221**	Contact Hours: **T: 1 hrs. /wk. P:3hrs/wk**		
	Theoretical Content			**Practical Content**		
	General Objective 1.0: understand the working principles and operations of an automobile engine.					
WEEK 1-3	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**	**Specific Learning Outcomes**	**Teacher's activities**	**Resources**
1	1.1 Define automobile engine. 1.2 State types of automobile engines such as; EC(Engine) IC(Engine) 1.3 List the types of IC engines. 1.4 Explain types of reciprocating piston engines. 1.5 Explain operational Cycle of SI engines 1.6 List different types of engines -Inline engine -Box engine -Horizontal - Oppose etc. 1.7 Explain in various stroke the working principle of an engine;	1.1 Discuss engine system of a motor vehicle. 1.2 Differentiate between ECE and ICE . 1.3 Discuss IC engines: Reciprocating and Rotary engines. 1.4 Discuss the various kind of reciprocating piston engines; SI and CI engines. 1.5 Explain the various types of engine classification. 1.6 Discuss the operational principles of two	-White board marker, -Recommended text books - Lecture note, - Engine Models - Pictures.	1.1 Identify various types of engine of a motor vehicle. 1.2 Identify cylinder block of various engine designs. 1.3 Overhaul an automobile engine.	1.1 Guide students to overhaul an automobile engine	-Various engine models. -Training vehicles -Live vehicle on workshop floor - Complete tool box - Compression tester - Engine Stethoscope - Dial Indicator - Air-compressor - Engine trainer (2 & 4 stroke) - Oil can

	Induction, compression, power and exhaust. 1.8 Explain the characteristics of two stroke and four stroke engine. 1.9 List the components of an engine, location and their functions. 1.10 Define the followings - Stroke -Swept volume -Clearance volume -Piston clearance etc. 1.11 List the components of valve train and their functions -Camshaft -Rocker arm -Valves -Push rod etc. 1.12 Explain the relationship between cylinder head and engine block, camshaft and crankshaft.	stroke and Four stroke cycle of an engine. 1.7 Discuss the characteristics, advantages and disadvantages of two stroke and four stroke engines. 1.8 Discuss the main components of an engine such as:- -Cylinder block -Cylinder Head -Cylinder Cover -Connecting Rod -Crank Shaft -Camshaft -Crank Case -Piston and big end bearings -Main journal bearings -Fly wheels etc. 1.9 Explain combustion chamber and the followings; -TDC -BDC -Bore				

	1.13 Explain the maintenance and repair procedures of an automobile engine. 1.14 Explain the procedure to overhaul an automobile engine	-Stroke -Swept volume -Clearance volume -Piston clearance. 1.10 Explain valve train/valve mechanisms of an engine, valve timing, valve overlap and valve clearance etc. 1.11 Explain the relationship between a cylinder head and an engine block, camshaft and crankshaft and their tightening sequence. 1.12 Discuss general maintenance and repair procedures of an engine. 1.13 Explain the procedure to overhaul				

		an automobile engine				

PROGRAMME:	NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY
COURSE TITLE:	AUTOMOTIVE ELECTRICAL TECHNOLOGY II
COURSE CODE:	AMT 222
CREDIT HOURS	4 HOURS
DURATION:	Hours/Week: Theory: 1 Hour Practical: 3 Hours
GOAL:	This course is designed to provide the students with the knowledge and skills to diagnose and repair automobile ignition and data transmission systems in an automobile.

GENERAL OBJECTIVES

On completion of this course the student should be able to:

1.0 Know measuring, testing and fault diagnostics in automobile ignition system

2.0 Understand automobile ignition system

3.0 Know data transmission and reception in motor vehicle.

PROGRAMME: NATIONAL INNOVATION DIPLOMA IN AUTOMOTIVE MECHATRONICS TECHNOLOGY						
COURSE: AUTOMOTIVE ELECTRICAL TECHNOLOGY II				**COURSE CODE: AMT 222**		**CREDIT HOURS: 4**
YEAR: 1	**SEMESTER 2**	**PRE: REQUISITE**	**Theoretical: 1**		**Practical: 3**	
GOAL: This course is designed to provide the trainee with knowledge and skills to diagnose and repair automobile ignition systems, and data transmission in motor vehicle.						
Theoretical Content				**Practical Content**		
GENERAL OBJECTIVE: 1.0 Know measuring, testing and fault diagnostics in automobile ignition system						
week	Specific Learning Outcome	Teachers Activities	Learning Resources	Specific Learning objectives	Teachers Activities	Learning Resources
1otive diagnosis	1.26 List types of Automobile faults e.g Cylinder misfiring. 1.27 Explain how to carry out fault checks using vehicle data and customer information 1.28 Explain how to carry out fault memory readout with machine. 1.29 Explain how to carry out mechanical test procedures 1.30 Explain how to carryout electrical test procedure	1.9 Explain items 1.1 to 1.6	• Text Books • White Board • Charts • Multi Media Projector	1.12 Carry out the following types of fault diagnosis: (a) Vehicle data and customer information (b) Visual checks and noise level testing (c) Fault memory readout (d) Interpretation of measurement results	• Guide students to carryout diagnosis in items 1.1 •	• Scan Tools • Result Sheet

	1.31 Explain how to interpret measurement data of automobile diagnosis.					
	GENERAL OBJECTIVE: 2.0 Understand automobile ignition system					
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
2-4	2.1 Outline the historical evolution of automobile ignition system 2.2 Explain the principles of automobile ignition system 2.3 Describe types of ignition coil 2.4 Explain the following features associated with ignition point: (a) Uncontrol combustion (b) Combustion of A/F mixture (c) Adjustment of ignition point (d) Causes of knocking combustion,	2.15 Discuss and explain items 2,1 – 2.4	• Text Books • White Board • Charts • Multi Media Projector	2.9 Identify types of ignition coil 2.10 Identify types of Knock Sensors	• Guide student to carry out item 1.1 • Carry out adjustment of ignition point	• Ignition Coils • Knock Sensor • Life Engine
GENERAL OBJECTIVE: 3.0 Know data transmission and reception in motor vehicle						
Week	**Specific Learning Outcome**	**Teachers Activities**	**Learning Resources**	**Specific Learning objectives**	**Teachers Activities**	**Learning Resources**
5-10	3.1 Explain data transmission in motor vehicle.	3.1 Discuss items 3.1 to 3.9	• Text Books • White Board	3.1 Calculate high frequency signals 3.2 Carryout	• Guide the students to carry out the calculations,	• Calculator • Transmitter Receiver •

	3.2 List types of data system 3.3 Explain the most important data bus system 3.4 List advantages of data bus system 3.5 Define high frequency Signals 3.6 List types high frequency signal in automobile 3.7 Explain the principles of operation of high frequency transmitter and receivers 3.8 Explain the principles of remote control and GPS 3.9 Explain reception and interference		• Charts • Multi Media Projector •	transmission and reception	transmission and reception of high frequency signals.	

Programme: National Innovation Diploma in Automotive Mechatronics

Course Title: Workshop Management and Organization

Course Code: AMT 223

Contact Hours: T: 1hr/week – P: 3hr/week

Goal: The goal of this course is to equip students with basic management and organisational skills for establishing and maintaining an auto workshop

General Objectives:

1.0 Know the typical layout and sections of an auto workshop

2.0 Understand specific safety rules for each task performed in an auto workshop

3.0 Understand workshop financial records and fund raising for startup businesses.

4.0 Understand how to maintain workshop job related records.

5.0 Understand basic functions of a manager

6.0 Know how to procure tools, materials and equipment.

PROGRAMME: **NATIONAL INNOVATIVE DIPLOMA IN AUTOMOTIVE MECHATRONICS**						
	Course : Workshop Management and Organisation		Course Code: AMT 223		Credit Hours: **4**	
Year: Two	**Semester: Second**		**Pre-Requisite: Nil**		**Theoretical: 1 hour**	**Practical: 3 hours**
GOAL: The goal of this course is to equip students with basic management and organisational skills for establishing and maintaining an auto workshop						
	Theoretical Contents			**Practical Contents**		
GENERAL OBJECTIVE: 1.0 Know the typical layout and sections of an auto workshop						
Week	**Specific Learning Objectives**	**Teachers Activities**	**Resources**	**Specific Learning Objectives**	**Teachers Activities**	**Resources**
1	1.1 State the basic requirements for a standard auto workshop. 1.2 Explain the different areas in an auto workshop. 1.3 State the purpose of repair areas, shop stall, lift area, alignment and tire service area, tool room, class room, locker room and an office	1.1 List the rudimentary requirements for a standard auto workshop. 1.2 Outline the different areas in an auto workshop. 1.3 State the purpose of repair areas, shop stall, lift area, alignment and tire service area, tool room, class room, locker room and an office 1.4 Assess the students' performances. 1.5 Give relevant printed and non-printed academic materials, websites and manuals as	Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes - Computer systems	1.1 Demonstrate the importance of departmentalization in an auto workshop 1.2 Identify specific space and facility requirements in a workshop.	Engage the students in group work. Assess the students' performances. Give relevant materials	A standard automotive workshop with well-defined layout including: Lift, Alignment Rack, Tire Removal Machine, Exhaust gas analyser, etc.

		references to students.				
GENERAL OBJECTIVE: 2.0 Understand specific safety rules for each task performed in auto workshop						
2	2.1 Explain common hazards in auto workshop 2.2 List and explain the safety symbols 2.3 List the personal protective equipment (PPEs) 2.4 Explain the concept of accidents, near misses, incidents and first aid. 2.5 State different causes of accident in an auto shop such as: Fire; explosion; asphyxiation (Airborne Poisons); chemical burns; electric shocks; physical injuries and their preventive measures. 2.6 Explain safety precautions in relation to each of the auto workshop activities.	2.1 Elucidate common hazards in auto workshop 2.2 List and explain the safety symbols 2.3 Introduce the personal protective equipment (PPEs) 2.4 Explicate the concept of accidents, near misses, incidents. 2.5 Explain the causes of accidents in an auto shop such as: Fire; explosion; asphyxiation (Airborne Poisons); chemical burns; electric shocks; physical injuries and their preventive measures. 2.6 List the safety precautions in relation to each of the auto	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes - Computer systems	2.1 Demonstrate the aims for keeping workshop accidents records. 2.2 Identify different safety symbols and their applications 2.3 Show the use of mandatory personal protective equipment	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.	Mandatory personal protective equipment: Hand globes; helmet; safety boots; eye glasses; reflective jacket, overall, etc., firefighting equipment first aid box and basic first aid apparatus and medicines Sample record book for entering accidents, incidents and near misses Short video clips on auto workshop accidents

		workshop activities. 2.7 Assess the students' performances.				
GENERAL OBJECTIVE: 3.0 Understand workshop financial records and fund raising for startup businesses.						
3-4	3.1 State reasons for keeping workshop financial records. 3.2 Explain the use of different financial records in a workshop. 3.3 Distinguish between receipts and invoices and their applications. 3.4 Discuss the preparation and use of receipts and invoices. 3.5 Explain safe and proper records keeping techniques. 3.6 Explain fund raising methods for startup micro and small scale businesses 3.7 Discuss the CAC and COREN registration requirements for sole proprietorship, partnership and Limited Liability companies	3.1 State reasons for keeping workshop financial records. 3.2 Explain the use of different financial records in a workshop. 3.3 Distinguish between receipts and invoices and their applications. 3.4 Discuss the preparation and use of receipts and invoices. 3.5 Explain safe and proper records keeping techniques. 3.6 Explain fund raising methods for startup micro and small scale businesses 3.7 Discuss the CAC and COREN registration requirements for sole	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes - Computer systems - Samples of job related and financial records	3.1 Demonstrate the preparation and use of receipts and invoices. 3.2 Demonstrate Safe and proper records keeping techniques 3.3 Distinguish between funds raising through partnership, clusters, cooperatives, bank loans (Commercial Banks, Bank of Industry, Jaiz Bank etc)	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, COREN handbook for registration engineering businesses

		proprietorship, partnership and Limited Liability companies. 3.8 Assess the students' performances.				
General Objective: 4.0 Understand how to maintain workshop Job related records.						
4-7	4.1 State workshop job related records. 4.2 Explain reasons for keeping workshop job related records. 4.3 Differentiate between workshop job related records and workshop financial records and their applications. 4.4 Explain the procedure for the preparation of workshop job related records and their uses. 4.5 Discuss safe and proper records keeping. 4.6 Highlight the importance of workshop job related records.	4.1 List workshop job related records. 4.2 State motives for keeping workshop job related records. 4.3 Explain the difference between workshop job related records and workshop financial records and their applications. 4.4 Explain the procedure for the preparation of workshop job related records and their uses. 4.5 Explain safe and proper records keeping. 4.6 State the importance of workshop job related records	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	4.1 Demonstrate the procedure for the preparation of workshop job related records and their uses. 4.2 Demonstrate safe and proper records keeping. 4.3 Maintain Workshop job related records.	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.	Job cards, vehicle reception card.

		4.7 Assess the students' performances.				
General Objective: 5.0 Understand basic functions of a manager						
8	5.1 Explain basic principles of Scientific Management 5.2 State the top 5 Functions of a manager: Planning, Directing, Organising, Controlling, Decision Making	5.3 Explain basic principles of Scientific and Management 5.4 Explain the top 5 Functions of a manager: Planning, Directing, Organising, Controlling, Decision Making 5.5 Assess the students' performances.	Whiteboard - marker - Duster - Multimedia Projector - Laptop - Text books - Journals - Lecture notes	5.1 Demonstrate basic managerial skills 5.2 Draw an organogram of atypical auto workshop 5.3 Exhibit corporate cultures in dealing with customers (Mock Exercise)	Engage the students in group work. Assess the students' performances. Demonstrate the procedure to perform these practical works.	Typical Auto workshop, workshop superintendent 's Office Cardboard Paper Ink and ruler
General Objective: 4.0 Know how to procure tools, materials and equipment						

9-12	6.1 State the various procurement methods used in the workshop, their reasons and applications. 6.2 Interpret manuals and reference materials. 6.3 Define basic procurement procedures. 6.4 Explain the determination of appropriate stock-level in the workshop. 6.5 Classify the various storage techniques, their advantages and disadvantages.	6.1 State the various procurement methods used in the workshop, their reasons and applications. 6.2 Interpret manuals and reference materials. 6.3 Define basic procurement procedures. 6.4 Explain the determination of appropriate stock-level in the workshop. 6.5 Classify the various storage techniques, their advantages and disadvantages. 6.6 Assess the students' performances.	- Whiteboard - marker - Duster - Instructional drawing - Text books - Journals - Lecture notes	6.1 Determine appropriate stock-level in the workshop. 6.2 Procure tools, materials and equipment.	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.	Manufacturer data, suppliers inventory records, requisition cards, computer with internet connectivity.

LIST OF EQUIPMENT FOR AUTOMOTIVE MECHATRONICS

1.	Car Lift (Hydraulic)	-	1
2.	Wheel Balancing Machine	-	1
3.	Tyre Removing Machine	-	1
4.	Wheel Alignment Machine	-	1
5.	Bosh Diagnostic Machine	-	optional
6.	Car AC Servicing Machine (Accurate & Refit	-	1
7.	Fault Finding Simulator Model Vehicle for Trouble Shooting-		1
8.	Exhaust Gas Evacuator	-	Optional
9.	Mobile Battery Charger	-	1
10.	Car AC training model	-	1
11.	Automatic Gear box Training model	-	1
12.	Four Stroke Engine Training Model	-	1
13.	Volkswagen Engine (Training)	-	Optional
14.	Rear Independent Suspension Model	-	1
15.	Front Wheel Independent Suspension System (Model)	-	1
16.	All Data and Auto Data Soft wear), Laptop and Television	-	1 set
17.	Brake Fluid Tester (Max boiling Pt. 280^{o}C	-	1
18.	Brake pressure Testing kits	-	1
19.	Fuel Pressure Testing kits	-	1
20.	Engine Fuel compression tester kits	-	1
21.	Engine Statoscope	-	1
22.	Brake fluid bleeding Machine	-	1
23.	Fuel Return measurement instrument (Diesel)	-	1
24.	Diesel Fuel pressure Dist kit detector)	-	1
25.	Brake piston compression kits	-	1
26.	Universal pullers (Removing Wheel bearing, brake disk, etc.)	-	1
27.	Injector Nozzle Extractor kits	-	1
28.	Compressor (air)	-	1
29.	Vehicle electrical system simulator	-	1

30. Electrical training board	-	1
31. Hand light calibration tester	-	1
32. Configuration panel for circuit construction	-	1
33. Simple hand drilling machine	-	2
34. Electrical multipurpose tester	-	1
35. Soldering kits	-	30
36. Electrical cable detector tool	-	3
37. Special soldering station	-	2
38. Battery testers	-	2
39. Sensor testers	-	2
40. Digital multi-meter	-	30
41. Working light	-	5
42. Brake dynamic analyzer	-	optional
43. Computerized axle alignment	-	optional
44. Engine oil extractor	-	1
45. Mobile compressor	-	2
46. Vacuum cleaner	-	1
47. Oil extractor	-	1
48. Hand heater	-	1
49. Engine clime	-	1
50. Lying board	-	(assorted)
51. Oil filter remover	-	2 sets
52. Hydraulic (press)	-	optional
53. Training vehicles	-	1

TABLE PROJECTOR
DESK TOP TRAINING MODEL

Brake drum e t c (all parts)	-	1 set
Piston model.	-	1 set
Differential modes	-	1 set
Alternator modes	-	1 set

Clutch modes.	-	1 set
Torque converter mode	-	1 set
Flywheel model	-	1 set
Gearbox model	-	1 set
Axle measurement modes	-	1 set
Common rail model	-	1 set
Planetary gear model	-	1 set
Brake master model	-	1 set
Water pump model etc.	-	1 set
Steering rag model	-	1 set
Exhaust and culet value model	-	1 set
Catalytic converter model	-	1 set
Kick starter model	-	1 set
Injector nozzle model	-	1 set
Diagnostic and engine analyzer (general diagnostic tool)	-	1 set

LIST OF FACILITIES

1- Diagnostic lab.
2- Tyre service lab.
3- Automatic and manual transmission.
4- A/C service station
5- Engine overhaul workshop
6- Computer laboratories
7- Electrical/Electronic lab.

Compressed to:

1. Auto mechanic workshop
2. Electrical electronics diagnostic lab
3. Computer laboratory.

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