

Mechanical Engineering - National Diploma (ND)

Mechanical courses

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Mechanical Engineering Science I (Statics)

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: MECHANICAL ENGINEERING SCIENCE (STATICS)		Course Code: MEC 111	Contact Hours: 4HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 1.0: Know the Basic Principles of Statics			
Week	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Define a Scalar quantity 1.2 Define vector quantity 1.3 Distinguish between 1.1 and 1.2 1.4 Give examples in 1.1 and 1.2 1.5 Explain the concept of particles and rigid body	<ul style="list-style-type: none"> • Ask the students to <ul style="list-style-type: none"> i. State what they understand by static ii. The two forms of quantities iii. Differentiate between the two forms of quantities iv. Give examples of (b). • Ask the students <ul style="list-style-type: none"> (i) to state their understanding of a particle (ii) explain what they understand by rigid body 	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc.
General Objective 2.0: Understand the concept and effect of forces and their moments.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-4	2.1 Define force 2.2 Describe the conditions for the equilibrium of co-planar forces	<ul style="list-style-type: none"> • Ask the students <ul style="list-style-type: none"> i. to explain their understanding of force ii. state a definition of force 	

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Course: MECHANICAL ENGINEERING SCIENCE (STATICS)		Course Code: MEC 111	Contact Hours: 4HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 2.0: Understand the concept and effect of forces and their moments.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5	2.3 State the principles of parallelogram of force	<ul style="list-style-type: none"> • Ask the Student <ul style="list-style-type: none"> a. to explain what they understand by equilibrium b. determine the condition for equilibrium of co-planar forces c. to explain what is meant by parallelogram of forces and to state the principles of parallelogram of forces 	
6-9	2.3 Explain how to construct parallelogram of force 2.4 Calculate the resultant of a system of two forces 2.5 State the principle of triangle of force 2.6 Resolve forces into components 2.7 Resolve a force into force and couple 2.8 Define moment of a force 2.9 State the principles of moments 2.10 Solve problems related to 2.1 to 2.12 above	<ul style="list-style-type: none"> • Ask the students to construct parallelogram of forces • Ask the student <ul style="list-style-type: none"> a. What the resultant of a system of forces b. Calculate the resultant of a system of two forces Ask the students <ul style="list-style-type: none"> a. to explain what is meant by a triangle of forces b. state the principles of triangle of forces. c. Ask the student resolve forces into components d. Resolve a force into force and angle • Ask the students to state their understanding of <ul style="list-style-type: none"> (i) moment (ii) principles of moments • Ask the students to carry out Calculations on the 2.1 to 2.12 • Ask the students to state Lami' s Theorem 	<ul style="list-style-type: none"> • Recommended textbook, Chalkboard, duster, Chalk, • Lecture notes, etc

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: MECHANICAL ENGINEERING SCIENCE (STATICS)		Course Code: MEC 111	Contact Hours: 4HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective: 3.0 Understand the effect of friction and the law governing it			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-12	3.1 Define friction 3.2 State advantages and disadvantages of friction 3.3 Define coefficient of friction 3.4 Define limiting angle of friction 3.5 Define angle of Repose 3.6 Solve problems related to 3.1 to 3.5	<ul style="list-style-type: none"> • Ask the students to <ul style="list-style-type: none"> a) State their understanding of friction b) State a definition • Ask the student to mention <ul style="list-style-type: none"> a) Advantage of friction b) Disadvantages of friction Ask students to state what is limiting friction <ul style="list-style-type: none"> • Ask the students to define angle of Repose • Ask the students to solve problems on 3.1 to 3.5 	Recommended textbook, Chalkboard, duster, Chalk, Lecture notes, etc
General Objective 4.0: Know the forces in simple frames and structures			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-15	4.1 Explain forces in the members (including Trusses) using free Body Diagram 4.2 State the general conditions for equilibrium	<ul style="list-style-type: none"> • Ask the students to <ul style="list-style-type: none"> (a) Explain the forces in the member 	

PROGRAMME: MECHANICAL ENGINEERING SCIENCE (STATICS)			
COURSE SPECIFICATION PRACTICAL CONTENT			
Week	General Objective: 1.0 Understand and demonstrate the concept and effect of forces and Their movements.		
	Specific Learning Outcome	Teachers Activities	Resources
1-4	1.1 Construct parallelogram of force 1.2 Draw triangle of forces 1.3 Draw polygon of forces 1.4 Verify Lami' s theorem using a force board 1.5 Verify the parallelogram law of forces	<ul style="list-style-type: none"> Ask the students to construct parallelogram of forces find the resultant and Assess the students Ask the students to: (a) draw triangle of forces (b) draw polygon of forces and find the resultant in each. Assess the students. Ask the students to perform experiment to illustrate and verify Lami' s theorem, using a force board. Assess the students 	Drawing materials/instruments.
General Objective 2.0: Understand the effect of friction			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5-7	2.1 Determine the coefficient of friction by means of an inclined plane.	<ul style="list-style-type: none"> Ask the students to perform an experiment to determine the coefficient of friction by means of an inclined plane 	Specimens of mosses, inclined plain set-up. Protractor, etc.
General Objective 3.0: Know the forces in simple frames and structures			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-10	3.1 Apply Boyle' s notation for graphical analysis of simple frame structures. 3.3 Determine the nature of the forces acting on each member of simple frame.	<ul style="list-style-type: none"> Ask the students to (a) perform experiment to illustrate Boyle' s notation for graphical analysis of simple plane, and (b) determine the nature of forces acting on each members of simple frame. Assess the students. 	

PROGRAMME: MECHANICAL ENGINEERING SCIENCE (STATICS)			
COURSE SPECIFICATION PRACTICAL CONTENT			
General Objective 4.0: Know centroid of plane areas			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-12	4 Locate the centre of gravity of plane areas. 5 Determine graphically the centre of gravity of plane areas and solid bodies	<ul style="list-style-type: none"> Ask the students to perform experiment to: n Locate centre of gravity of plane areas and Graphically determine the centre of gravity of plane areas and solid bodies. 	Drawing instruments, graphic sheets etc.
General Objective: 5.0 Know centroid of Plane areas.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-14	5.1 Locate the centre of gravity of plane areas 5.2 Define graphically and analytically plane area. 5.3 Define graphically and analytically centre of gravity of solid bodies	<ul style="list-style-type: none"> Ask students to define centre of gravity and locate it for planes and solid bodies 	<ul style="list-style-type: none"> Recommended textbooks Diagrams.

Basic Workshop Technology & Practice

MEC 113 BASIC WORKSHOP TECHNOLOGY AND PRACTICE YI/1ST SEMESTER 1/0/2 Hrs/Wk

OUTCOMES:

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

1. Know safety precautions.
2. Use and maintain various bench tools.
3. Use simple measuring and testing requirements.
4. Know drilling and reaming operation.
5. Know various metal joining operation.
6. Cut and joint metal by gas welding.
7. Know various metal arc welding operations.
8. Know the various wood working tools and operations.
9. Know simple operations on plastics.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Basic Workshop Technology & Practice		CODE: MEC 113	CONTACT HOURS: 1 HOUR PER WEEK
Course Specification: Theoretical Content			
Week	General Objective 1.0: Know safety precautions		
	Specific Learning Outcome:	Teachers Activities	Resources
1-4	1.1 State safety precautions 1.2 Explain protective wears 1.3 List all safety rules and regulation.	<ul style="list-style-type: none"> • Ask students to observe safely precaution in the workshop • Discuss some unsafe acts in the workshop. • Ask students to list out protective wears in the workshop. • Discuss the types. • Discuss and list out safety rules in the workshop • Discuss and differentiate between measuring and testing. • Explain the principle and construction of micrometer screw gauge and vernier calipers. • Perform simple measuring exercises using steel rule, vernier calipers and micrometers 	<ul style="list-style-type: none"> • Chalkboard, textbooks, micrometer screw gauge, vernier calliper, steel rule, drill bits.
General Objective 2.0: Know drilling operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5-7	2.1 Discuss the nomenclature of a twist drill 2.2 Discuss the formulae for calculation of speed of various sizes of drills $n = [v \times 1000] / [\pi \times d]$ Where n = no. of rev/min d = dia of drill in mm v = cutting speed	<ul style="list-style-type: none"> • Ask student to grind drill bits accurately • Ask students to select correct drilling speed 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Basic Workshop Technology & Practice		CODE: MEC 113	CONTACT HOURS: 1 HOUR PER WEEK
Course Specification: Theoretical Content			
General Objective 3.0: Know various metal joining operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-9	3.1 State the correct tapping drill size 3.2 Explain how to correct taps 3.3 Fabricate metal container by knock-up joining 3.4 Explain out soft soldering	<ul style="list-style-type: none"> • Calculate the tapping drill size for v-threads. • Discuss and indicate how thread are characterised <ul style="list-style-type: none"> a. Pitch b. No. of starts c. Profile of thread d. Direction of thread Discuss in detail <ul style="list-style-type: none"> • Discuss the various metal joining methods • Distinguish between soldering and brazing • Discuss the importance of using flux. 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Basic Workshop Technology & Practice		CODE: MEC 113	CONTACT HOURS: 1 HOUR PER WEEK
Course Specification: Theoretical Content			
General Objective 4.0: Know the various wood working tools and operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-15	<p>4.1 Know and state the applications of the following:</p> <p>17. Geometric/marketing out tools e.g. try square, dividers and gauges</p> <p>18. Planning tools e.g. Jack, smooth, try planes, spoke shaves, etc.</p> <p>Cutting tools e.g. saws chisels, knives, boring tools a. Impelling tools e.g. hammer and mallets</p> <p>19. Pneumatic tools</p> <p>4.2 Describe portable electric hand tools in wood work, e.g. portable saw, portable planer, portable drill, portable sander and jig saw.</p> <p>4.3 Explain the operations of the tools in 4.1</p> <p>4.4. Carry out various woodworking operations using the tools in 4.1</p> <p>4.5 List basic wood working machine' s such as</p> <ol style="list-style-type: none"> 1. Surface planning and thickening machine i. Circular sawing machine 2. Morticing machine ii. Drilling machine 3. Single ended tenning machine 4. Band sawing machines and safety precaution in their operations 	<ul style="list-style-type: none"> • List and state the applications of this tools • Discuss with the student in more details the use of this tools • Ask students to identify the tools in 4.1 and describe them. <ul style="list-style-type: none"> _ Ask students to explain the use and operation of the tool in 4.1 _ Ask students to use the tools in 4.4 for the operations on an exercise or training model. • Ask student to identify the machines in 4.5 • State the safety precaution on the machines in 4.5 	<ul style="list-style-type: none"> _ Try Square _ Divider _ gauges _ Jack planes _ Smooths _ Try plane _ Panel saws _ Chisels _ Knives _ Boring tools _ Hammers _ Mallets _ Portable saw Portable planer Portable drill Portable sander Jig saw
<p>ASSESSMENT:- The practical class will be awarded 40% of the total score. The continuous assessment, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of the Semester Examination score.</p>			

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
Week	General Objective 1.0: Know safety precautions.		
	Specific Learning Outcome:	Teachers Activities	Resources
1-2	1.1 Observe safety precautions 1.2 Operate safety equipment e.g. fire extinguishers, safety water hose etc. 1.3 Use of protective wears 1.4 Observe all safety rules and regulations	<ul style="list-style-type: none"> • Let students know that when accident happens on the workshop, they are caused <ul style="list-style-type: none"> a. Discuss some unsafe acts and condition in the workshop • Let students know why the workshop is arranged as it is vis-a-vis <ul style="list-style-type: none"> a. gangway b. exit doors c. machine layout d. illumination/ventilation • Ask students to differentiate between <ul style="list-style-type: none"> a. type of fires and medium to extinguish them operate fire extinguishers. • List types of protective wears suitable for the mechanical workshop <ul style="list-style-type: none"> a. Overall b. Safety boots c. Eye glasses (safety) d. Hand gloves etc. • Ask students to state safety rules applicable to mechanical workshop 	CO ₂ fire extinguisher Water hose Sand buckets

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
Week	General Objective 1.0: Know safety precautions.		
	Specific Learning Outcome:	Teachers Activities	Resources
3	<p>2.1 Use marking-out tools on the bench correctly</p> <p>2.2 Produce simple objects using bench/hand tools such as files, chisels, scrapers, saws etc.</p> <p>2.3 Maintain files, dividers, saws, gauges try squares, bevel edge square etc.</p>	<ul style="list-style-type: none"> • Ask students to differentiate between <ul style="list-style-type: none"> a. Hand tools and machine tools b. Bench tools and machine cutting tools • Ask students to list out marking out tools used on the bench typical workshop practical exercises. <ul style="list-style-type: none"> a. Ask students to identify this bench cutting tools b. Ask students to write process sheet or operation layout for the component to be produced. • Explain the use of this tools and their care • Explain the effect of not using this tools properly and keeping them in good working condition 	<p>Work bench</p> <p>Bench vice</p> <p>Hammers</p> <p>Set of drills</p> <p>Steel rule</p> <p>Scribers</p> <p>Scribing blocks</p> <p>Inside and outside caliper</p> <p>Surface place</p> <p>Dividers</p> <p>Centre punches, hammers</p> <p>Files, Chisels, Scrapers</p> <p>Hook saw, Bench drilling machine & access</p> <p>Sets of drills</p> <p>Bevel edge sq.</p> <p>File card or wine brush</p> <p>Chamous cloth</p>

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 3.0: Use simple measuring and testing equipment			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-5	<p>3.1 Perform simple measuring exercises using steel rules, vernier calipers and micrometers.</p> <p>3.2 Use dial indicators to (i) set up job jobs on the lathe (ii) roundness testing etc.</p> <p>3.3 Carry out exercises involving flatness squareness, straightness and surface finish test.</p>	<ul style="list-style-type: none"> • Ask students to differentiate the differing between measuring and testing in the workshop. • Ask students to use <ul style="list-style-type: none"> a. measuring instruments b. testing instruments • Explain <ul style="list-style-type: none"> a. the principle and construction of a micrometer screw gauge b. the least count of micrometer c. principle and construction of a vernier caliper and the least count. d. The types of micrometers e. The types of vernier calipers f. Accuracy of a steel rule • Explain to the students the principle and construction of a dial indicator, their types and their accuracy • Show students the following: <ul style="list-style-type: none"> a. Types of surface finish achievable in the workshop b. Differentiate between flatness, and straightness. 	<p>Micrometers- external & internal</p> <p>Vernier calipers</p> <p>Steel rule</p> <p>Test mandrel/test bar</p> <p>070 x 300 mm long dial indicator with stand</p>

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 3.0: Use simple measuring and testing equipment			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	3.4 Perform taper measurement on jobs using vernier protractor and sine bars. 3.5 Inspect jobs using simple comparators	<ul style="list-style-type: none"> Discuss different between the use of Vernier protractor and sine bar and their limitations. Ask students to state types of comparators and use them to inspect jobs. 	spirit level surface roughness tester (portable type) SURF TEST 4 90° angle gauge straight edge vernier protractor sine bar set of standard slip gauges marking out table bench comparator 0-100 mm S-d Test mandrels
General Objective 4.0: Know drilling operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5	4.1 Operate different types of drilling machine 4.2 Carry out drilling operations such as counter-boring and counter-sinking 4.3 Grind drill bits accurately 4.4 Select correct drilling speeds	<ul style="list-style-type: none"> Differentiate between <ol style="list-style-type: none"> drilling and boring operations radial drilling and sensitive drilling machine Ask students other types of drilling machine <ol style="list-style-type: none"> Pillar Column Multi spindle etc Ask students to differentiate between Counter boring and counter sinking 	Radial drilling machine Bench drilling machine Pillar drilling machine Column type drilling machine

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 4.0: Know drilling operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6		<ul style="list-style-type: none"> Ask students to indicate the nomenclature of a twist drill. <ul style="list-style-type: none"> a. clearance angle b. rake angle c. point angle etc. Ask students to calculate the speeds of various sizes of drills using appropriate formulae $n = v \times 1000 / [\pi \times d]$ <ul style="list-style-type: none"> v = cutting speed d = dia of drill in (mm) n = no. of rcv/s/min. 	Counter boring drills Counter sinking drills Centre drills. Pedestal grinding machine attached with a twist drill grinding attachment.
General Objective 5.0: Know reaming operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7	5.1 Carry out reaming operations <ul style="list-style-type: none"> i. on the bench ii. on drilling/lathe 5.2 Select correct speeds for reaming small and large holes.	<ul style="list-style-type: none"> Ask students to do reaming operation on a practical workshop exercise as figure 2 Ask students to drill a ream small; and large holes using correct speeds and feed and appropriate lubricants. 	Hand reamers Machine reamers Tap wrench Jacobs chuck and key Medium size Lathe Reduction sleeves Radial drilling machine Pillar drilling machine Reamers (machine)

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 6.0: Know tapping operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8	6.1 Select correct tapping drill size 6.2 Select correct taps 6.3 Carry out tapping operation (i) on the work bench (ii) on drilling machine (iii) on lathe	<ul style="list-style-type: none"> • Ask students - the purpose of tapping operation • Calculate tapping drill size using appropriate formulae • Ask students to indicate how taps are characterized <ul style="list-style-type: none"> a. pitch of the thread b. number of starts c. profile of the thread d. direction of the thread • show students the correct method of holding taps <ul style="list-style-type: none"> a. at the bench b. on the drilling machine c. on the lathe • Ask students to top some of holes already drilled 	<ul style="list-style-type: none"> _ Taps and wrenches _ Drill chuck and key _ Lathe machine - medium size _ Bench drilling machine _ Pillar drilling machine _ Cutting fluid or lubricants
General Objective: 7.0: Know various metal joining operations.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9	7.1 Fabricate metal container by Knock-up joining 7.2 Join metals by the grooving technique 7.3 Carry out soft soldering	<ul style="list-style-type: none"> • Ask students the various metal joining operations • Ask students to fabricate metal container by Knock-up joining • Join metals by grooving technique. 	<ul style="list-style-type: none"> OXY-acetylene gas welding set Manual rolling machine Guillotine shear Assorted cutting snips Bending machine/press brake.

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 8.0: Cut and join metals by gas welding			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10	<p>8.1 Assemble OXY-acetylene welding plant</p> <p>8.2 Select various welding regulators, clips, blow pipe and nozzles.</p> <p>8.3 Perform gas welding by various welding techniques Cut by flame cutting technique</p>	<ul style="list-style-type: none"> • Ask students to distinguish between soft soldering and brazing • Ask students to carryout soft soldering exercise using appropriate soldering flux and assess • Ask students to list out all the component parts of an OXY-acetylene welding plant and identify them. • Ask students to assemble them • Ask students to identify this components and select appropriately for welding exercise and assess • Ask students the various welding techniques • Ask students to perform gas welding using the various techniques • Ask students to adjust the flame appropriately for cutting 	<p>Blow lamps</p> <p>Soldering iron</p> <p>Soldering flux</p> <p>Safety welding goggles</p> <p>Oxygen gas cylinder</p> <p>Acetylene gas cylinder</p> <p>Regulators, clips, nozzles</p> <p>Hoses, flash gas lighter</p> <p>Welding nozzles</p> <p>Gas welding set</p> <p>Chipping hammer</p> <p>Wire brush</p> <p>Flame cutting blow pipe (nozzle)</p> <p>Gas welding set</p>
General Objective 9.0: Know various metal arc welding operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11	<p>9.1 Regulate current and determine polarity for metal arc welding</p> <p>9.2 Determine polarity and select current</p> <p>9.3 Perform various arc-welding joints by down and up and hand operation.</p> <p>9.4 Select and prepare metal edges for various thickness and technique welding</p>	<ul style="list-style-type: none"> • Ask students to determine polarity for metal arc welding and regulate current. • Ask students to distinguish between down welding and up welding operation • Perform down and up welding operation • Ask students to prepare appropriate metal edges for various metal thickness 	<p>Electric arc welding Machine</p> <p>Face shield</p> <p>Welding table</p> <p>Welding chipping hammer</p> <p>Wire brush</p> <p>Hand gloves</p> <p>Leather apron' s</p> <p>Hand grinder</p> <p>Pedestal grinding machine</p>

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 10.0: Employ various techniques for controlling distortion in welding operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13	10.1 Apply correctly the stop back and skip method of controlling distortion 10.2 Apply pre and post heating technique	<ul style="list-style-type: none"> • Ask students to distinguish between stop back and skip method of controlling distortion in welding. • Apply these methods in welding exercise and compare the results. • Ask students to distinguish between pre and post heating techniques in controlling distortion in welding operation • Ask students to state what materials require pre and post heating when welding. • Ask students to apply this technique in welding exercises. 	Electric arc welding Machine OXY-acetylene welding plant

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 11.0: Know the various wood working tools and operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14	<p>11.1 Carry out the applications using the following</p> <ol style="list-style-type: none"> 1. Geometric/marketing out tools e.g. try square, dividers and gauges. 2. Planing tools e.g. jack, smooth, try planes, spoke shaves etc. 3. Cutting tools, e.g. saws, chisels, knives, boring tools. 4. Impelling tools e.g. hammers and mallets. 5. Pneumatic tools. <p>11.2 Mark out and prepare wood to give using the tools in 11.1</p> <p>11.3 Maintain all tools in 11.1</p> <p>11.4 Carry out various wood work operations using the tools in 11.4</p>	<ul style="list-style-type: none"> • Ask students to list and state the applications of this tools (a) - (e) • Ask students to mark out and prepare wood to using tools in 11.1 on a practical exercise • Ask students to maintain tools in 11.1 using appropriate materials and tools. • Ask students to use the tools in 11.4 for the operations on an exercise or training model 	<p>Try square Dividers, Gauges Jack plane, Smooth plane Try plane, Panel saws Chisels, Knives Boring tools Hammers, Mallets Oil stone, Bench/table grinder, Oil can Portable saw Portable planner Portable drill Portable sander Jig saw</p>

COURSE: BASIC WORKSHOP TECHNOLOGY & PRACTICE		COURSE CODE: MEC 112	CONTACT HOURS: 2HRS Per /WK
Theoretical Content: PRACTICAL CONTENT			
General Objective 12.0: Know simple operations on plastics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
15	<p>12.1 Identify various types of plastic groups such as thermo-setting and thermo-plastic</p> <p>12.2 Use conventional metal cutting tools to perform operations on each type in 12.1</p> <p>12.3 Carry out joining operations using plastics in 12.1</p> <p>12.4 Review previous activities and assess students.</p>	<ul style="list-style-type: none"> • Ask students to distinguish between thermo-setting and thermo-plastic. • Ask students the characteristics of each type. • Ask students to use conventional metal cutting tools for operation on thermo-setting and thermo-setting plastic. What is the result of each operation? • Ask students to join the thermo-setting and thermo-plastic. 	<p>Set of drill</p> <p>Wood turning lathe</p> <p>HSS cutting tools</p> <p>Evostic glue</p>
ASSESSMENT: The practical class will be awarded 40% of the total score. The continuous assessments, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of Semester Examination score.			

Thermodynamics I

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I	Course Code: MEC 122	Contact Hours: 2HRS/WK	
Course Specification: THEORETICAL CONTENTS			
Week	General Objective 1.0: Understand and apply the basic principles of thermodynamics.		
	Specific Learning Out come:	Teachers Activities	Resources
1	1.1 Define Thermodynamics. 1.2 List the different thermodynamic processes and their characteristics 1.3 Identify the internal energy of gases 1.4 Compare the two heats 1.5 Find the ratio of 1.4 above in the form of $R = C_P/C_V$ 1.6 State Boyle's and Charle's Law for gases	<ul style="list-style-type: none"> • Ask students to explain thermodynamic media and working fluids. • Ask students to define internal energy of gasses • Ask students to explain the differences between the two heats. • Ask students to define Boyle's Law and Charles' Law. • Ask Students to Solve problems involving change of pressure, volume and temperature for ideal gases. 	Recommended textbooks, Chalkboard, Chalk duster, lecture notes, etc.
2	1.7 Derive the characteristic equation of ideal gases i.e. $PV = MRT$ 1.8 State the Zeroth Law of Thermodynamics 1.9 Define thermometric substances	<ul style="list-style-type: none"> • Ask students to plot a graph combining Boyle's and Charles' Laws and derive the characteristic equation. • Ask students to solve problems involving change of pressure, volume and temperature for ideal gases. • Ask students to explain Zeroth Law of thermodynamics • Ask students to define thermometric substances. • Assess the students 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
Week	General Objective 1.0: Understand and apply the basic principles of thermodynamics.		
	Specific Learning Out come:	Teachers Activities	Resources
3	1.10 Solve problems related to 1.8 and 1.9 1.11 Solve simple problems on determination of temperature when the thermometric property values at certain fixed points are given and a scale of temperature is prescribed 1.12 State the First Law of Thermodynamics 1.13 State the relationship between heat transfer Q Work Transfer W and related changes in the properties of the working substance or system 1.14 Derive the energy equation i.e. Heat Supplied = work done + change in internal energy for non flow processes	Ask students to solve problems related to 1.9 and 1.10 Ask students to solve problems on determination of temperature when the thermometric property values at certain fixed points are given and a scale of temperature is prescribed. Ask students to solve problems related to 1.5, 1.12 to 1.14	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 2.0: Understand Thermodynamic processes			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-5	2.1 Explain the constant volume process 2.2 Show that the work done is equal to zero for non flow processes 2.3 Explain constant pressure process. 2.4 Show that the work done = change in internal energy and heat added 2.5 Explain constant temperature process and determine the work done 2.6 Explain adiabatic process 2.7 Show that work done = change in internal energy 2.8 Explain polytropic process	<ul style="list-style-type: none"> • Ask student to explain constant volume process • Ask students to show that work done is equal to zero. • Ask students to explain constant pressure process • Ask the students to show that the work done = change in internal energy and heat added. • Ask students to explain constant temperature process and determine the work done • Ask students to explain adiabatic process • Ask students to show that work done is equal to change in internal energy • Ask student to solve problems related to 2.1. - 2.8. • Assess the students 	Recommended textbooks, Chalkboard, Chalk, Duster, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 3.0: Know the basic properties of different quality of steams			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-7	3.1 Define gas and vapour 3.2 Describe the generation of steam at constant pressure 3.3 Draw the temperature enthalpy diagram to illustrate the properties of steam 3.4 Explain heat, latent heat and degree of superheat 3.5 Describe between dry saturated and wet saturated steam 3.6 Describe dryness fraction 3.7 Describe the properties of steam using steam tables 3.8 Define Daltons law of partial pressures 3.9 Describe the steam calorimeter	<ul style="list-style-type: none"> • Ask student to define gas and vapour • Ask students to describe the generation of steam at constant pressure • Ask students to illustrate the properties of steam using temperature enthalpy diagram. • Ask students to explain sensible heat latent heat and degree of super heat • Ask students to differentiate between dry saturated and wet saturated steam • Ask students to determine dryness fraction • Ask students to determine the properties of steam using steam tables • Ask students to solve basic problems related to steam of different qualities • Ask students to define Dalton' s Law of partial pressures • Ask students to solve problems related to Dalton' s law of partial pressures. • Ask students to carry out experiments relating to dryness fraction of steam. • Assess the students 	Recommended textbooks, Chalkboard, Chalk, Duster, Lecture notes, etc. Boiler Steam Calorimeter

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 4.0: Know different types of fuels and their composition			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8	4.1 List typical solid, liquid and gaseous fuels and their sources 4.2 State the chemical composition of fuels 4.3 Define complete, incomplete and stoichiometric combustion 4.4 Evaluate the theoretical quantity of air required in 4.3 4.5 Define air fuel ratio, rich mixture lean mixture and mixture strength 4.6 Define gross (higher) and net (lower) calorific values	<ul style="list-style-type: none"> • Ask student to list typical solid, liquid and gaseous fuels and their sources • ask students to state the chemical composition of fuels • ask students to define complete, incomplete and stoichiometric combustion • ask students to define air/fuel ratio, rich mixture, lean mixture and mixture strength. • Ask students to define higher and lower calorific values. • Assess the students 	Recommended textbooks, Chalkboard, Chalk, Duster, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 5.0: Understand Heat transfer			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9-10	5.1 Define heat transfer across the boundaries of a system. 5.2 Describe the 3 methods of heat transfer as conduction, convection and radiation 5.3 Differentiate between thermal conductors and insulators 5.4 State Fourier' s Law of conduction in one dimension 5.5 State Newton' s Law of cooling 5.6 Describe heat exchangers and their practical application 5.7 Explain natural and forced convection 5.8 Explain black body radiation and grey body radiation 5.9 Define the Stefan - Boltzman law for the emissive power of a black body	<ul style="list-style-type: none"> • Ask students to define heat transfer across the boundaries of a system • Ask students to state Fourier' s law of conduction • Ask students to state Newton' s law of cooling • Ask students to list some common conductors and Insulators. • Ask students to describe heat exchanger and their practical application • Ask students to explain natural and forced convection • Ask students to explain black body radiation and grey body radiation • Ask students to define the Stefan Boltzman Law for the emissive power of a black body • Ask students to perform experiment on conduction of heat in a bar. • Assess the students 	Recommended textbooks, Chalkboard, Chalk, Duster, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Thermodynamics I		Course Code: MEC 122	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 6.0: Understand the principle and the use of air conditioners and refrigerators			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-14	6.1 List the common types of refrigeration systems 6.2 Describe refrigerators as reversed heat Pumps 6.3 List the refrigerants used in refrigeration systems 6.4 List hydrocarbon refrigerants 6.5 Explain the advantages of hydrocarbon refrigerants 6.6 Explain how a refrigerator works 6.7 Define air conditioning 6.8. State the roles of air conditioning in modern life 6.9 Illustrate dry bulb and wet bulb thermometer 6.10 Define the terms humidity, relative humidity and ideal psychometric 6.11 Explain how an air conditioner works.	<ul style="list-style-type: none"> • Ask students to list the common types of refrigeration systems • Ask students to explain refrigerator as reversed heat Pumps • Ask students to list various refrigerants used in refrigeration system • Ask students to list hydrocarbon refrigerants • Ask students to explain the advantages of hydrocarbon refrigerants • Ask students to explain how a refrigerator works, ask students to define air conditioning • Ask students to state the roles of air conditioning in modern life. • Ask students to illustrate dry bulb and wet bulb thermometer • Ask students to define humidity relative 	Recommended textbooks, Chalkboard, Chalk, Duster, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: THERMODYNAMICS I		COURSE CODE: MEC 122	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Know the basic principle of thermodynamics		
	Special Learning Outcome:	Teachers Activities	Resources
1-2	1.0 Determine experimentally, temperature when the thermometric property value at certain fixed points are given and a scale of temperature is prescribed.	<ul style="list-style-type: none"> Illustrate and ask the students to perform the experiment. 	<ul style="list-style-type: none"> A well laid-out apparatus, Graphic books, Practical guide, etc.
2-4	2.0 Determine experimentally specific heat capacities for solids, liquids and gass.	<ul style="list-style-type: none"> Illustrate and ask the students to perform the experiment to determine heat capacities for solids, liquids and gases 	
5-7	3.0 Determine the quality of wet steam using the steam calorimeter	<ul style="list-style-type: none"> Illustrate and ask the students to perform experiment to determine the quality of wet steam using the steam calorimeters 	<ul style="list-style-type: none"> Steam calorimeter
8-10	4.0 Determine the calorific values of fuels using dulong' s formula.	<ul style="list-style-type: none"> Illustrate ask the students to perform experiment to determine the calorific values of fuels using dulong' s formula 	<ul style="list-style-type: none"> Bomb calorimeter
11-15	5.0 Carry out a method for the determination of the composition of an exhaust gas		Orsat gas analyser.

Machine Tools Technology & Practice

MEC 123 MACHINE TOOLS TECHNOLOGY AND PRACTICE

Y1/2ND SEM 1/0/2 Hrs/Wk

OUTCOMES:

On completion of this module, the students should be able to:

1. Understand cutting action in machining operation.
2. Understand the importance of cutting fluid in machining operation.
3. Know various types of lathes, their functions and operations.
4. Understand the features, functions and uses of shaping machines.
5. Understand the features, functions and uses of milling machines.
6. Know the features, functions and uses of grinding machines.
7. Understand and apply sheet metal work techniques.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: MACHINE TOOLS TECHNOLOGY & PRACTICE		Course Code: MEC 123	Contact Hours: 6 Hrs Per/WK
Course Specification: Theoretical Contents			
Week	General Objective 1.0: Understand cutting action in machining Operation		
	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Explain the theory of metal cutting 1.2 Define forces acting at a tool point 1.3 Sketch a diagram of forces acting at tool point 1.4 Relate the tool angles to cutting efficiency 1.5 List the types of chip for motion 1.6 Sketch diagram for 1.4 1.7 List factors affecting 1.5	<ul style="list-style-type: none"> • Ask students to explain the theory of metal cutting • Ask students to list forces acting at and tool point • Ask students to draw a diagram of forces acting at tool point • Ask students to name the types of chips that may be formed • Ask students to list factors affecting the types of chips that may be formed in cutting 	Chalk board, Chalk, text book, charts, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: MACHINE TOOLS TECHNOLOGY & PRACTICE		Course Code: MEC 123	Contact Hours: 6 Hrs Per/WK
Course Specification: Theoretical Contents			
General Objective 2.0: Understand the importance of cutting fluids in machining operation			
Week	Specific Learning Outcome:	Teachers Activities	Resources
2	2.1 Explain how heat is generated during cutting 2.2 List common types of cutting fluid 2.3 State functions of cutting fluid 2.4 Outline the characteristics of cutting fluid	<ul style="list-style-type: none"> Ask students to explain the function of cutting fluids in machining operation. 	
General Objective 3.0: Appreciate the importance of cutting tool materials			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-4	3.1 Out line the properties of cutting tools materials 3.2 List common types of cutting tools. 3.3 Outline constituents in 3.2	<ul style="list-style-type: none"> Ask students to list properties of cutting tools. Ask students to list types of cutting tools and state the materials from which they are made. 	
General Objective 4.0: Know various types of lathes and their functions			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5-6	4.1 Describe main types of lathes (such as capstan, turret, centre and bench lathes) and their accessories 4.2 Describe the different operations that could be carried out on the lathe 4.3 List the safety precautions necessary while working on the lathe machine 4.4 List the various methods of carrying out various operations e.g. taper turning, set screw cutting.	<ul style="list-style-type: none"> Ask students to sketch any type of lathe. Explain activities 4.1 to 4.4 and assess the students Explain activities 4.1 to 4.4 and assesses the students 	Chalk board, chalk note book, text books, chalk.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: MACHINE TOOLS TECHNOLOGY & PRACTICE		Course Code: MEC 123	Contact Hours: 6 Hrs Per/WK
Course Specification: Theoretical Contents			
General Objective 5.0: Know various machining operations on the centre lathe			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7-8	5.1 Describe the following using centre lathe a. facing operation b. Cylindrical turning c. Step turning d. taper turning e. drilling f. boring g. parting h. knurling i. reaming j. thread cutting	Explain the processes in 5.1, make notes and assesses the student	Chalk board, chalk note book, text books, chalk
General Objectives 6.0: Understand the features, functions and uses of shaping machines.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9	6.1 Describe the main features of shaping machines 6.2 Describe how to adjust the length and position of the stroke of the shaping machine. 6.3 Explain how to set the clapper box of a given operation. 6.4 List the advantages of a swan-necked tool on a shaping machine 6.5 List the advantages of a swan-necked tool on a shaping machine. 6.6 Describe the methods of how to set up work-pieces on the shaping machine	<ul style="list-style-type: none"> Ask students to list the features of shaping machines. Ask students to carry out the adjustment of length and position of the stroke of a shaping machine Explain activities 6.1 to 6.6, make noted and assesses the students. 	- do -

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: MACHINE TOOLS TECHNOLOGY & PRACTICE		Course Code: MEC 123	Contact Hours: 6 Hrs Per/WK
Course Specification: Theoretical Contents			
General Objective 7.0: Understand the feature, function and uses of milling machines.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10	7.1 Describe the main features of milling machines 7.2 Describe how to mount cutters on the milling machine 7.3 Describe the various work piece and cutter holding devices and attachments used on the milling machine 7.4 List and state the use of different types of milling cutters, e.g. arbor cutters - plain cutters, shank cutters - and mills, T-slot side and mill cutters etc. 7.5 Describe the features and working principle of the dividing head. 7.6 Explain various methods of indexing e.g. direct, simple, differential, angular indexing.	Explain the activities in 7.1 to 7.6, make notes and assesses the students	- do -
General Objective 8.0: Understand milling operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11	8.1 Define feed and cutting speed as applied to milling and state factors which influence cutting speed determination for milling work, e.g. material to be cut, use of coolant, type of finish etc. 8.2 Determine cutting speeds and feeds for a given milling work. 8.3 Out line the safety and operational precautions to be observed when milling 8.4 Describe up and down milling 8.5 Describe straddle and gang milling 8.6 Describe the various features of the tool and cutter grinder	<ul style="list-style-type: none"> • Ask students to explain feed and cutting speed. • Ask students to explain relationship between feed and cutting speed. • Explain activities in 8.1 to 8.6, make notes and assesses the students. 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: MACHINE TOOLS TECHNOLOGY & PRACTICE		Course Code: MEC 123	Contact Hours: 6 Hrs Per/WK
Course Specification: Theoretical Contents			
General Objective 9.0: Understand the features and functions of grinding machines			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12	9.1 Describe different types of grinding machines. 9.2 Identify the main features of grinding machines in 10.1 9.3 Describe the structure of grinding wheels. 9.4 Identify wheels for grinding different types of materials.	<ul style="list-style-type: none"> Ask students to name and identify in the workshop, different types of grinding machines Ask students to select appropriate grinding wheels for different types of grinding machines. 	Grinding machines Assorted grinding wheels.
General Objective 10.0: Know the uses of grinding machines.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13	10.1 Explain the surface grinding operation 10.2 Explain taper grinding operation 10.3 Explain tool and cutter grinding 10.4 Explain centreless grinding 10.5 Describe gauge grinding		
General Objective 11.0 Understand testing, mounting, balancing, alignment and trueing of grinding wheels.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14-15	11.1 Explain wheel testing and mounting 11.2 Explain wheel balancing and alignment 11.3 Describe wheel dressing and trueing	<ul style="list-style-type: none"> Ask students to explain wheel testing and mounting. Ask students to explain wheel balancing and alignment as well as wheel dressing and trueing. Explain and make notes for students 	
ASSESSMENT: The practical class will be awarded 40% of the total score. The continuous assessment, tests and quizzes will be 10% of the total score, while the remaining 50% will be for the end of the Semester Examination score.			

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: MACHINE TOOL TECHNOLOGY AND PRACTICE		COURSE CODE: MEC 123	CONTACT HOURS 4HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Understand Cutting fluids tools for machining operation.		
	Special Learning Outcome:	Teachers Activities	Resources
1	1.1 Identify cutting fluids using for machining different materials 1.2 Select cutting tools for various machine operations	Illustrate and ask the students to cut metal bars with and without cutting fluid to show the effect of the fluid Illustrate and ask the students to select cutting tools for some machining operations e.g turning or shaping. Assess the students	Practical manual, power saw, cutting fluids, mild steel, bars.
General Objective 2.0: Identify lather and perform machining operation on the Centre lather			
Week	Specific Learning Outcome:	Teachers Activities	Resources
2	2.1 Identify types of lather machine and its attachment for various operations	Illustrate and ask the students to identify the main lather types, and turn tapers on mild steel bars using attachments and taking safety precautions during machining operations	Mild steel bars, lather machine, assorted cutting tools and fluids.
General Objective 3.0: Demonstrate the skills in machining operations on the centre.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3	3.1 Perform the following using centre lather: a. Facing b. Cylindrical turning c. Step turning d. Tapper turning e. Drilling f. Boring g. Parting h. Knurling i. Reaming 3.2 Carry out thread cutting operations on the lather	Illustrate and ask the students to perform all the activities in 3.1 and 3.2	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: MACHINE TOOL TECHNOLOGY AND PRACTICE		COURSE CODE: MEC 123	CONTACT HOURS 4HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 4.0: Identify and make machine components with shaping machines			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-5	4.1 Identify the features functions and uses of shaping machines. 4.2 Carry out the adjustment of length and position of the stroke of a shaping machine. 4.3 Know how to set-up workpiece on the shaping machine. 4.4 Identify appropriate shaping tools and holding devices for different surface forms and carry out shaping operations on mild steel e.g key-way, slots	Illustrate and ask the students to demonstrate activities 4.1 to 4.4. Assess the students	Shaping machine, Assorted tools, and accessories mild steel.
General Objective 5.0: Demonstrate skills in milling operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-7	5.1 Identify features and types of milling machines. 5.2 Select and mount different types of cutters for appropriate jobs. 5.3 Select and use various types of work and cutter holding devices for different types of jobs. 5.4 Perform milling exercises using the dividing head and index plate. 5.5 Carry out milling using the following methods: i. Up milling ii. Down milling iii. Gang milling 5.6 Using tool grinder to sharpen milling cutters	Illustrate the activities in 5.1 to 5.6 and ask the students to perform the activities. Assess the students	Milling machine, Assorted cutters including arbor, Plain shank, etc. Dividing Head, Brassm, Mild steel, High carbon steel.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING															
COURSE: MACHINE TOOL TECHNOLOGY AND PRACTICE		COURSE CODE: MEC 123	CONTACT HOURS 4HRS/WK												
Course Specification: PRACTICAL CONTENT															
General Objective 6.0: Demonstrate skills in grinding operations															
Week	Specific Learning Outcome:	Teachers Activities	Resources												
8-9	6.1 Identify main features, types of grinding machine and wheels for grinding different types. 6.2 Select work holding devices and use them on grinding machine. 6.3 Carry out different types of grinding operation. 6.4 Select the appropriate shapes, types and sizes of grinding wheels for various applications	Illustrate the activities in 6.1 to 6.4 and ask the students to perform the activities. Ask the students	Grinding machines, Assorted grinding wheels. Practical grinder etc.												
General Objective 7.0: Demonstrate skills in wheel balancing, trueing and dressing															
Week	Specific Learning Outcome:	Teachers Activities	Resources												
10-12	7.1 Balancing grinding wheel 7.2 Carry out wheel trueing and dressing. 7.3 Perform grinding exercise involving surface, cylindrical, type, tool, crank shaft and internal grinding.	Demonstrate the activities in 7.1 to 7.3 and ask the students to carry out all the activities. Assess the students	Complete kits for wheel balancing, trueing and dressing												
General Objective 8.0: Demonstrate skills in sheet metal work															
Week	Specific Learning Outcome:	Teachers Activities	Resources												
13-15	8.1 Carry out cutting operations 8.2 Carry out bending operations 8.3 Carry out rolling operations.	Illustrate the activities in 8.1 to 8.3 and ask the students to perform all the operations. Ask students to develop graphically and produce from sheet metal a vessel with spout that intersect e.g oil can, watering can, kettle etc. Assess the students.	Cutting, bending, rolling, machines. Practical grinder												
Assessment profile: <table style="width: 100%; border: none;"> <tr> <td style="width: 30%;">Practical</td> <td style="width: 10%;">=</td> <td style="width: 10%;">40%</td> <td style="width: 50%;"></td> </tr> <tr> <td>Test, and quizzes</td> <td>=</td> <td>10%</td> <td></td> </tr> <tr> <td>Semester Examination</td> <td>=</td> <td>50%</td> <td></td> </tr> </table>				Practical	=	40%		Test, and quizzes	=	10%		Semester Examination	=	50%	
Practical	=	40%													
Test, and quizzes	=	10%													
Semester Examination	=	50%													

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
Week	General Objective 1.0: Understand Linear motion of a body understand curvilinear motion of bodies		
	Specific Learning Out come:	Teachers Activities	Resources
1- 3	1.3 Define displacement, velocity and acceleration 1.4 State units of displacement, velocity and acceleration 1.5 Derive the relationship between displacement, velocity and acceleration 1.6 Draw velocity time graph 1.7 add velocities vectorially 1.8 define relative velocity 1.9 solve simple problems related to 1.1 to 1.6 above. 1.10 Define angular motion of a body in a circle 1.11 Derive the relationship between angular velocity and acceleration 1.12 Draw angular velocity-time graph	<ul style="list-style-type: none"> • Ask Students to define displacement, velocity, and acceleration. • State and explain the units of displacement, velocity and acceleration to students. • Assist the students to derive relationship between displacement, velocity and acceleration • Ask students to draw velocity-time graph • Explain and assist students to add velocities vectorially • Ask students to define relative velocity • Assist students to solve simple problems related to 1.1 to 1.6 above • Ask the students to define angular motion of a body in a circle. Assist the students to derive the relationship between angular velocity and acceleration • Ask the students to draw angular velocity-time graph • Assess the Students 	Chalk, Black Board, Duster, Recommended textbooks, Lecture notes, Graph sheets, etc. rawing board, Chalk, Black Board.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective: 2.0: Understand curvilinear motion of bodies			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-5	2.1 Develop the relationship between angular and linear motions 2.2 Define circular motion 2.3 Explain centrifugal acceleration and centrifugal force 2.4 Develop expressions for centripetal and centrifugal forces 2.5 Give examples of centrifugal effects e.g. Planetary motion, Conical pendulum	Assist the students to develop the relationship between angular and linear motions <ul style="list-style-type: none"> Ask the students to define circular motion Explain to students centrifugal acceleration and centrifugal force 	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.
	2.6 Calculate banking required for roads and tracks 2.7 Analyse the motion of a projectile 2.8 Solve problems related to 2.1 to 2.9	<ul style="list-style-type: none"> Explain and assist the students to develop expressions for centripetal and centrifugal forces. Ask the students to give examples of centrifugal effects. Assess the students. Explain and ask the students to calculate banking required for roads and tracks. Explain and assist the students to analyze the motion of a projectile. Explain and assist the students to solve problems related to 2.1 to 2.8 Assess the students 	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 3.0: Understand momentum of bodies			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-7	3.1 Define mass and weight 3.2 State Newton' s Law of motion 3.3 Define Impulse and momentum 3.4 State the Law of Conservation of momentum 3.5 Define angular momentum 3.6 Define radius of gyration 3.7 Explain moment of inertia 3.8 Solve problems related to 3.1 to 3.7	<ul style="list-style-type: none"> • Explain the difference between mass and weight, and assist the student to define the terms. • State and explain to students Newton' s Laws of motion • Define and explain to students Impulse and momentum • State and explain to students the law of Conservation of momentum • Define and explain angular momentum • Define and explain radius of gyration • Explain and assist the students to solve the problems related to 3.1 to 3.7. • Assess the Students 	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc. Chalk, Blackboard

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 4.0: Understand the concept of work, energy and power			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-9	4.1 Define work, Energy and Power 4.2 State the units of work, energy and power 4.3 Develop expressions for 4.1 4.4 Define torque, work done by torque 4.5 Explain tractive force and driving torque of a system. 4.6 Differentiate between kinetic energy and potential energy. 4.7 Explain kinetic energy of rotation 4.8 Explain mechanical efficiency in power transmission 4.9 Explain power transmission by flat belts, spur gearing and worm gearing	Define and explain work, energy and power with examples. State and explain work, energy and power. Explain and develop expressions for 4.1. Explain and define torque, work done by torque. Define and explain the difference in kinetic energy and potential energy. Define and explain the difference in kinetic energy and potential energy. Explain to students power transmission by flat belts, spur gearing and worm gearing including applications. Assess the students	Chalk, Blackboard duster, Recommended textbooks, Lecture notes, etc. Chalk, Blackboard.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 5.0: Understand the general principle of operation of simple machines			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-11	5.1 Define simple machine 5.2 Give example e.g. Lever, Pulley, Screw Jack 5.3 Explain the operations of 5.2 5.4 Define (i) Mechanical Advantage (ii) Velocity ratio (iii) mechanical efficiency 5.5 Develop the relationship for Mechanical advantage, velocity ratio and efficiency of a wheel, pulley and screw jack 5.6 Solve simple problems related to 5.1 to 5.5 above.	Define and explain simple machine 1.3 Ask the students to give examples. 1.4 Explain the operations of 5.2 1.5 Define and explain velocity ratio, mechanical advantages, and mechanical efficiency 1.6 Explain and develop the relationship for mechanical advantage, velocity ratio and efficiency of a wheel, pulleys and jacks. 1.7 Explain and solve problems related to 5.1 to 5.5 above	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Mechanical Engineering Science II (DYNAMICS)		Course Code: MEC 124	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 6.0: Know simple harmonic motion			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12-15	6.1 Describe periodic motion 6.2 Describe period, frequency and amplitude in simple harmonic motion 6.3 Define period, frequency and amplitude in simple harmonic motion 6.4 Develop expressions for 6.3 above 6.5 Analyze the motion of a simple pendulum 6.6 Solve problems related to the above	1.8 Define and ask the students to describe periodic motion 1.9 Define and ask the students to describe period, frequency and amplitude in simple harmonic motion 1.10 Explain and ask the students to define period, frequency and amplitude in S.H.M. 1.11 Explain and ask the students to develop expressions for 6.3 above. 1.12 Explain and ask the students to analyze the motion of a simple pendulum 1.13 Explain and ask the students to solve problems related to the above	Chalk, Blackboard, Duster, Recommended textbooks, Lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: MECHANICAL ENGINEERING SCIENCE II (DYNAMICS)		COURSE CODE: MEC 124	CONTACT HOURS 2HRS/WK
Course Specification: PRACICAL CONTENT			
Week	General Objective 1.0: Understand Curvilinear motion of bodies		
	Special Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Show that centrifugal force varies with mass, speed of rotation, and the distance of the mass from the centre of rotation using centrifugal force apparatus. 1.2 Verify the equation of motion using fletcher' s trolley	Illustrate 1.1 to 1.2 and ask the students to perform experiment to verify activities 1.1 to 1.2. Assess the students.	Practical guide, Centrifugal apparatus. Fletcher' s trolley Weights.
General Objective 2.0: Understand momentum of bodies			
4-5	2.1 Determine moment of inertia 2.2 Verify the law of conservation of moment on fletcher' s trolley	Illustrate activities 1.1 to 1.2 and ask the students to perform experiment to determine moment of inertia and verify the law of conservation of moment of fletcher' s trolley. Assess the students,	Recommended apparatus. Fletcher' s trolley
General Objective 3.0: Demonstrate the skills in determining force and torque of a system.			
6-10	3.1 Determine tractive force and driving torque of a system. 3.2 Determine mechanical efficiency in power transmission. 3.3 Determine kinetic energy of rotation	Demonstrate to the students the activities in 3.1 to 3.3 and ask the students to perform experiment to determine the activities in 3.1 to 3.3	Practical guide, Recommended apparatus
General Objective 4.0: Determine the practical principle of operation of simple machine.			
11-14	4.1 Determine the velocity ratio, mechanical advantage and mechanical efficiency of a screw jack. 4.2 Determine the velocity ratio and efficiency of simple pulley system.	Demonstrate the activities in 4.1 and 4.2, and ask the students to perform experiment to determine the activities in 4.1 and 4.2 Assess the students.	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: MECHANICAL ENGINEERING SCIENCE II (DYNAMICS)		COURSE CODE: MEC 124	CONTACT HOURS 2HRS/WK
Course Specification: PRACICAL CONTENT			
Week	General Objective 5.0: Understand simple harmonic motion		
	Special Learning Outcome:	Teachers Activities	Resources
15	5.1 Determine experimentally the period and frequency of oscillation	Demonstrate and ask the students to carry out experiment to determine the period and frequency of oscillation Assess the student	-do-
	Assessment profile:	Practical	40%
	Test, and quizzes	=	10%
	Semester Examination	=	50%

Engineering Measurement

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: Engineering Measurement		Course Code: MEC 212	Contact Hrs: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
Week	General Objective 1.0: Know the fundamentals of measurement		
	Specific Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Describe workshop standards of length 1.2 List the sub-divisions of standard of length 1.3 Discuss the sub-divisions in 1.1	<ul style="list-style-type: none"> Ask students to explain the fundamentals of measurement and give the standards of length 	Chalk Chalkboard, Vernier caliper Bench testing centres Recommended textbooks, chalkboard, chalk, etc.
General Objective 2.0: Understand the types and sources of errors			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-5	2.1 Describe the types of errors commonly found in engineering measurement 2.2 Explain sources of errors in measurement such as equipment errors, operational interference, and installation. 2.3 Explain means of over-coming errors mentioned in 2.1 above. 2.4 Describe drunken thread.	<ul style="list-style-type: none"> Ask students to explain common sources of error and how to over-come them Ask students to draw and explain drunken thread 	-do-
General Objective 3.0: Understand the constructional details of simple measuring instruments			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-8	3.1 Explain the principles construction and operation of the following (a) dynamometer (b) bourdon tube manometers (c) thermometer, pyrometer, thermocouple etc. 3.2 State the precautions to be observed when using the measuring instruments in 3.1 3.3 Differentiate between direct measurement and measurement by comparison	<ul style="list-style-type: none"> Explain the topics and make notes for students. Assess the students Ask students to draw and explain the details of simple measuring instruments. Ask students to explain with aid of diagrams the operation of dynamometer, bourdon tube manometer etc Assess the students. 	Ask students to draw and explain the details of simple measuring instruments. Ask students to explain with aid of diagrams the operation of dynamometer, bourdon tube manometer etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: Engineering Measurement		Course Code: MEC 212	Contact Hrs: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 4.0: Understand the principle of limit gauging			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9	4.1 Explain the concept of calibration 4.2 Describe the principles of calibrating (i) pressure gauges (ii) thermometers (iii) flow meters	<ul style="list-style-type: none"> Ask students to calibrate pressure gauges, thermometer etc. Ask students to explain how to maintain measuring instruments and Assess the students. Ask students to define maximum and minimum metal limits. 	Recommended textbooks, charts,
10	4.3 State the precautions to be observed during calibration of measuring instruments. 4.4 Define maximum and minimum metal limits 4.5 Describe the limits of gauging 4.6 State Taylor' s principle of gauging 4.7 Give examples of principle of gauging	<ul style="list-style-type: none"> Ask students to explain the limits of gauging and state the Taylor' s principle of gauging Ask students to differentiate between gauging and direct measurement. Ask students to list materials used in making 	Lecture notes. Chalkboard, chalk, etc.
General Objective 5.0: Know strain gauges and its uses			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-14	5.1 Describe various forms of strain gauges for measuring strains in radial, axial and biaxial directions 5.2 Discuss the effect of heat and other environmental factors in the use of strain gauges.	<ul style="list-style-type: none"> Ask students to illustrate the various ways to mount strain gauges Ask students to determine stresses measured from strain gauges. Ask students compare measurements from strain gauges and other gauges. Assess the students 	Recommended textbooks, charts, lecture notes, etc. Chalkboard, chalk, etc, strain gauges. Load cells

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING TECHNOLOGY			
COURSE: Engineering Measurement		Course Code: MEC 212	Contact Hrs: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 6.0: Introduction to load cells and Piezoelectric devices			
Week	Specific Learning Outcome:	Teachers Activities	Resources
15	6.1 Explain the use of load cells in tensile and compression testing machines 6.2 Differentiate between load cells and strain gauges in taking of quantity measurement and accuracy	<ul style="list-style-type: none"> Ask students to distinguish between the tensile and compression load cells and Assess the students <ul style="list-style-type: none"> Assess the students. 	
	Assessment profile:	Practical	40%
	Test, and quizzes	=	10%
	Semester Examination	=	50%

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: ENGINEERING MEASUREMENT		COURSE CODE: MEC 212	CONTACT HOURS 1HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Identify sources of errors in measurement		
1-3	1.1 Identify sources of errors in measurement such as equipment errors, operational interference, and installation and ways of eliminating	Remonstrate the activity in 1.1 and ask the students to identify the sources of error and suggest ways of overcoming them.	Comperator, Limit guages, steel rule, Dynamometers, Thermometer, etc.
General Objective: 2.0: Know the Constructional details of simple measuring instruments			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-6			
7-9	2.1 Identify the following: a. Dynamometer (b) burdon tube manometers (c) thermometer, pyrometer, thermocouple. 2.2 Determine forces acting on a cutting tool using dynameter. 2.3 Determine the pressure in a vessel using the burdon tube manometer. 2.4 Determine the temperature in a cutting zone using a thermocouple. 2.5 Determine the speed of a grinding wheel using a tachometer. 2.6 Determine the flow of liquid in an orifice using a flow meter	Illustrate the activities in 2.1 to 2.6 and ask the students to carry out all the activities in 2.1 to 2.6 observing safety precautions. Assess students.	Dynamometer, Burdon tube Manometers, Thermometer, Pyrometer, Thermocouple, etc

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: ENGINEERING MEASUREMENT		COURSE CODE: MEC 212	CONTACT HOURS 1HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective: 3.0: Demonstrate skills in limit gauge measurement and design.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-12	3.1 Calibrate pressure gauges, thermometer. 3.2 Understand the precautions to be observed during calibration. 3.3 Identify materials for gauges and its heat. 3.4 Compare gauging with direct measurement. 3.5 Design a gauge	Demonstrate the activities in 3.1 to 3.5 and ask the students to carry out the activities	Gauge apparatus and calibration kits
General Objective: 4.0: Demonstrate skills in use of strain gauge, load cells and piezoelectric devices.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-15	4.1 Identify the following: <ul style="list-style-type: none"> a. Strain gauges b. Load cells c. Piezoelectric devices 4.2 Make measurement with strain gauges and compare with other gauges. 4.3 Make measurements with load cells, piezoelectric devices and compare with strain gauge measurement in terms of accuracy	Demonstrate the activities in 4.1 to 4.3 for students to learn and ask the students to carry out the activities	Strain gauges, load cells, piezoelectric devices, etc.

Thermodynamics II

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Thermodynamics II		Course Code: MEC 213	Contact Hrs: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
Week	General Objective 1.0: Understand the concepts of thermal efficiency		
	Specific Learning Out come:	Teacher Activities	Resources
1-2	1.1 Define thermal efficiency 1.2 Compute the thermal efficiencies of common heat energy plants e.g. (a) The new corner steam engine (b) The automobile engine. 1.3 Define heat engine 1.4 Explain the concept of reversible and irreversible processes.	<ul style="list-style-type: none"> • Ask students to explain thermal efficiency. • Ask students to explain a heat engine. • Ask student to carry out inspection of equipment in heat engines laboratory. • Ask students to explain the difference between an automobile engine and steam engine 	Recommended textbooks, charts, lecture notes,
General Objective 2.0: Understand the principles of the second law of thermodynamics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-4	2.1 State the Kelvin Plank' s and Clausius version of the second law of thermodynamics 2.2 Define the Carnot cycle efficiency 2.3 Compute the Carnot cycle efficiencies assuming typical practical thermal reservations.	<ul style="list-style-type: none"> • Ask students to explain the second law of thermodynamics. • Ask students to explain why 100% heat input cannot give 100% work output from heat engine. • Ask students to explain carnot cycle • Ask students to solve problems involving Carnot cycle. • Assess the students. 	Recommended textbooks, charts, lecture notes,

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Thermodynamics II		Course Code: MEC 213	Contact Hrs: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Understand the principles of operation and use of Solar Energy.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5-6	3.1 Define Solar energy 3.2 Explain the time scale of fossil fuels and solar energy option 3.3 Explain overview of solar energy conversion methods. 3.4 Explains the limitations of Solar energy. 3.5 List some of the equipment used to harness the solar energy	<ul style="list-style-type: none"> • Ask students to define solar energy • Ask students to explain principles of operation of solar energy • Ask students to explain the cycle of production of fossil fuels. • Ask students to explain the natural and technological collection systems of solar energy • Ask students to draw the overview of solar energy conversion methods. • Ask students to explain the thermal conversion of solar energy • Ask students to explain photovoltaic conversion of solar energy. • Ask students to explain the limitations of solar energy 	Recommended textbooks Lecture notes, chalkboard, charts Chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Thermodynamics II		Course Code: MEC 213	Contact Hrs: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 4.0: Understand the concept of Entropy			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7-8	4.1 Define entropy 4.2 Identify entropy as a Thermodynamic property of a system 4.3 Describe entropy as a measure of the degree of “ disorder” in a system. 4.4 Define an adiabatic reversible process. 4.5 Define isentropic efficiency 4.6 Compute isentropic efficiencies of turbines and compressors.	<ul style="list-style-type: none"> • Ask students to explain entropy as a property of a thermodynamics system. • Ask students to explain entropy as a degree of disorder of a system. • Ask students to explain an adiabatic process. • Ask students to explain the gas turbine and compressor cycles. • Ask students to explain the efficiency terms for turbines and compressor. 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.
General Objective 5.0: Know the relationship between the properties of pure substance			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9	5.1 Define a pure substance. 5.2 State the two property rules for pure substances.	<ul style="list-style-type: none"> • Ask students to explain pure substances. • Ask students to explain the two-property rule. • Ask students to explain dew point. • Ask the students to extract the various phases • Ask students to solve problems on enthalpy, adiabatic process and isentropic efficiency • Assess the students 	Steam Boiler Condenser.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Thermodynamics II		Course Code: MEC 213	Contact Hrs: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 6.0: Understand ideal gas laws			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-11	6.1 State (a) Boyles law (b) Charles law (c) The Pressure law (d) Ideal gas law (e) Solve problems involving laws in 6.1. 6.2 Distinguish between real and ideal gases. 6.3 Define exothermic and endothermic features.	<ul style="list-style-type: none"> • Ask students to explain the gas laws and the errors in using them solely. • Ask students to explain real gases and ideal gases. • Ask students to explain Exothermic and Endothermic sections. 	Gas Law apparatus Recommended textbooks, lecture notes, charts, chalkboard, chalk, etc.
General Objective 7.0: Know fuels and their combustion			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12	7.1 Define fuels. 7.2 Classify fuels into gaseous liquids or solids. 7.3 Know the hydrocarbons as fuels. 7.4 Describe the formation of fossils fuels 7.5 State the composition of natural gases 7.6 Explain the source of crude oil. 7.7 Describe the fundamental properties of fossils	<ul style="list-style-type: none"> • Ask students to name some fuels and classify them into liquids, gases and solids. • Ask students to explain a hydro carbon • Ask students to explain the composition of natural gas. • Ask students to explain the products from a refined process. • Assess the students 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Thermodynamics II		Course Code: MEC 213	Contact Hrs: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 8.0: Know fuels and their Combustion			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-15	8.1 Identify the application of fuels in 7.5. Define Gross and net calorific value of fuels in 7.8 8.2 Compute density of gases at S.T.P 8.3 Describe the chemical changes which takes place during the combustion (a) Carbon (b) hydrogen (c) hydro carbons 8.4 Define incomplete and stoichiometric combustion 8.5 Define air-fuel ratio, excess air and mixture strength of combustion. 8.6 Explain the causes and effects of incomplete combustion	<ul style="list-style-type: none"> • Ask the students to explain the uses of fuels from 7.5 • Ask students to explain energy trapped in fuels. • Ask students to explain the calorific values of fuels. • Ask students to explain the combustion process • Ask students to compare fuels based on calorific values. • Ask student to explain density at S.T.P. • Ask student to state why density differ at different temperature for a substance. • Ask student to explain incomplete and stoichiometric combustion and their gases. • Ask students to explain mixture strength and combustion. 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: THERMODYNAMICS II		COURSE CODE: MEC 213	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Demonstrate Skills in Measurement of thermal efficiency.		
	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Measure thermal efficiency of legged and unlegged water container with immersion heater	Demonstrate for the students to learn and ask them to make the measurement	Immersion heater, water container, thermometer
General Objective 2.0: Understand the second law of thermodynamics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
2	2.1 Verify the kelvin planks and clausins version of the second law of thermodynamics, through a simple experiment	Demonstrate for the students to learn and ask them to perform experiment to demonstrate kelvin plank' s and clausins version of the second law of thermodynamics Assess the students	Recommended apparatus.
General Objective 3.0: Demonstrate skills in Design of simple flat plate collecting for solar cell.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3	3.1 Identify and list the equipment to harness the solar energy. 3.2 Design and manufacture simple plate collectors.	Demonstrate for the students to learn and ask them to carry out the activities in 3.1 and 3.2	Solarimeters, Thermostats, Solar energy collector.
General Objective 4.0: Understand the practical concept of Entropy			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4	4.1 Determine by experiment the isentropic efficiencies of turbines and compressors	Demonstrate for the students to learn and ask them to measure experimentally the efficiency of an air compressor. Assess the students	Practical guide, Aircompressor.
General Objective 5.0: Understand the relationship between the properties of pure substance			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5	5.1 Identify the liquid, vapour and gaseous phase on the p-v diagram for pure substances	Show to students and ask them to identify them	P-V diagrams of pure substances.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: THERMODYNAMICS II		COURSE CODE: MEC 213	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 6.0: Demonstrate skills on verification of all the gas laws			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-7	6.1 Verify the following law: a. Boyles law b. Charles law c. The pressure law d. Ideal gas law	Demonstrate a simple experiment to verify all the laws listed in 6.1 and ask the students to carry out the experiment Assess the students.	Gas law apparatus.
General Objective 7.0: Know fuels and its combustion			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-15	7.1 Identify the hydrocarbons e.g conde oil as fuels 7.2 Define, experimentally, the calorific values of fuels and analyse the chemical changes, which occur when combustion takes place. 7.3 Determine experimentally, the effect of mixture strength on combustion, using the Bomb calorimeter.	Demonstrate the activities in 7.1 to 7.3 for the students to learn and ask them to perform all the activities. Assess the students.	Bomb calorimeter, Calorimeters.

Fluid Mechanics

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
Week	General Objective 1.0: Know the classification, types of fluids and their properties		
	Special Learning Outcome:	Teachers Activities	Resources
1-2	1.1 Define a fluid 1.2 List different types of fluids 1.3 Explain for liquids the following forms: Ideal, Real, Newtonian, Non-Newtonian Plastic, Slurry, Suspension 1.4 Explain for gases, the following forms: Ideal, Perfect and vapour 1.5 Explain the following fluid properties for liquids and for gases. Pressure, density, viscosity, adhesion, cohesion, surface tension, compressibility, capillarity. 1.6 State Newton' s Law of Viscosity. 1.7 Explain the effects of viscosity in fluids 1.8 Explain with sketches the relations between F & M for liquids and for gases.	<ul style="list-style-type: none"> • Ask students to define fluid • Ask students to list different types of fluids and differentiate between them. • Ask student to explain fluid properties and their units. • Assess the students 	Chalk, chalkboard duster. Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 2.0: Understand the concept of pressure and the principles of its measurement			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3-4	2.1 Explain how a fluid exerts pressure due to its own weight 2.2 Derive an expression for the pressure at a point in a fluid. 2.3 Explain why the pressure in a fluid varies with depth 2.4 Explain the concepts of absolute gauge and vacuum pressures in gas.	<ul style="list-style-type: none"> Solve simple problems related to pressure measurements 	Pitot tube, Manometer, Hydrostatic forces on plane surfaces, Bernoulli' s apparatus.
5	2.5 Explain vapour pressure 2.6 Explain the principles of pressure measurement in liquids and gases.	<ul style="list-style-type: none"> Derive an expression for the total thrust acting on a plane vertical surface submerged in a liquid. Identify the point where the resultant thrust acts. State parallel theorem Ask students to: <ul style="list-style-type: none"> Solve problems related to 1.6 Show by sketch the relationship between the three pressures in 1.7 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.
6	2.7 Describe the following Fluid pressure measuring instruments: Common Gauge, Piezometer, Pitot tube, U - tube manometer, Bourdon gauge and Aneroid Barometer. 2.8 Explain their construction and uses.	<ul style="list-style-type: none"> Assess the students 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Understand Archimedes Principles			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7-8	3.1 State Archimedes principles 3.2 Define (i) buoyant force (ii) Centre of buoyancy 3.3 Explain the working of a hydrometer 3.4 Explain the three equilibrium states of floating objects: (i) stable (ii) unstable (iii) neutral 3.5 Explain metacentric 3.6 Derive an expression for the metacentric height of a floating object	<ul style="list-style-type: none"> • Ask the students to: <ul style="list-style-type: none"> - Explain Archimedes principle - Apply Archimedes principles to determine the density of a substance (Solids) - Solve problems associated with floating objects • Assess the students. 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 4.0: Understand energy and motion of fluids for one dimensional flow			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9-10	4.1 Explain the principle of conservation of mass. 4.2 State the continuity equation 4.3 State the Bernoulli's theorem	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Derive the energy equation of a flowing fluid - Apply Bernoulli's equation for solving problems in fluid flow - Verify Bernoulli's equation in any flow Situation. • Assess the students. 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 5.0: Know the Momentum equation and its practical applications.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-13	5.1 Explain the momentum equation as a different statement of Newton' s second law of motion..	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Derive an expression for the momentum equation for one-dimensional fluid. - Apply the momentum equation in solving fluid flow problems • Assess the students 	Recommended textbooks, charts, lecture notes, chalkboard, chalk, etc.
General Objective 6.0: Know the characteristics in Pipes.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14	6.1 Explain the following types of flow (i) uniform flow (ii) non uniform flow (iii) non steady flow 6.2 Explain laminar and turbulent flows 6.3 Define critical velocity and Reynold' s number 6.4 Explain the friction loss along pipes	Illustrate with examples and make notes	Reynolds apparatus

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 7.0: Know some applications of fluid behaviour in fluid Mechanics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
15	7.1 Explain the principles of Fluid Mechanics as energy converters/machines 7.2 Explain the classification of Fluid Mechanics 7.3 Explain the principles, operation and uses of pumps as fluid machines 7.4 Explain the principles, operation and uses of Turbines as fluid machines. 7.5 Explain the principles, operation and uses of compressors as fluid machines 7.6 Explain the principles of hydraulic press and hydraulic jack	<ul style="list-style-type: none"> • Ask students to explain fluid mechanics and classifications • Ask students to differentiate between pumps, Turbines and compressors • Illustrate with examples and make notes • Assess the students. 	Various fluid machines in Laboratory.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENTS			
Week	General Objective 1.0: Identify fluids and its properties		
	Special Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Observe and identify different samples of fluid in the laboratory 1.2 Investigate boyle' s law to explain pv for perfect gas. 1.3 Draw F and M Curves for liquids and gases and draw a conclusion from it. 1.4 Obtain experimentally viscosities of some liquids	Demonstrate the activities in 1.1 to 1.4 for the students to learn and ask them to carry out all the activities Assess the students.	Viscometer, stop clock, Fall sphere apparatus, Hydraulic test benches and samples of different of different fluids..
General Objective 2.0: Understand the practical concept of pressure and its measurement.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-7	2.1 Demonstrate by experiment how a fluid exerts pressure due to its own weight 2.2 Calibrate the bourdon pressure gauge. 2.3 Measure vapour using a simple water vessel. 2.4 Measure fluid pressure with the following: a. Common gauge, b. Peizometer c. Pitot tube d. U-tube manometer e. Bourdon gauge and f. Aneroid Barometer	Illustrate activities 2.1 to 2.4 for the students to learn and ask them to practice all the activities. Assess the student.	Pitot tube, Manometer, Hydrostatic forces on plane surfaces, Bermouth' s apparatus. Piezometer, Aneroid Barometer, U-tube manometer, etc

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Fluid Mechanics		COURSE CODE: MEC 214	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENTS			
General Objective 3.0: Understand practical principles of density and its measurement			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-11	3.1 Use the hydrometer to determine the relative density of liquids. 3.2 Carry out simple experiment using Archimedes apparatus to determine density of substances. 3.3 Calibrate a hydrometer	Demonstrate activities 3.1 to 3.2 for the students to learn and ask them to carry out the activities.	Hydrometer, Archimedes apparatus, Calibration kits.
General Objective 4.0: Comprehend energy and motion of fluids for one dimensional flow			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12-13	4.1 Carry out experiment to compare different forms of energy for fixed quality of water talking through different weights. 4.2 Determine the mass flow rate and volume rate using a hydraulic bench or any other apparatus. 4.3 Determine experimentally the force exerted by a jet using impact of jets apparatus.	Demonstrate activities 4.1 and 4.3 for students to learn and ask them to perform the activities	Hydraulic, Bench and accessories, Stop clock, and weighing balance, impact jets apparatus.
General Objective 5.0: Demonstrate applications of fluid behaviour in fluid mechanics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14-15	5.1 Conduct experiment to investigate critical velocity, laminar and turbulent flows and plot appropriate graph. 5.2 Demonstrate experimentally the effect of water innpingement on series of blades on a froxely suspended drum. 5.3 Identify and differentiate between pumps, Turbines and compressors	Demonstrate the activities in 5.1 to 5.3 for the students to learn and ask them to perform the activities. Assess the students	Reynolds Apparatus Various fluid machines.

Foundry Technology & Forging Operations

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations	Course Code: MEC 215	Contact Hours: 1HRS/WK	
Course Specification: THEORETICAL CONTENT			
Week	General Objective: 1.0 Appreciate the development of the foundry Industry		
	Specific Learning Outcome:	Teachers Activities	Resources
1	1.1 Explain foundry technology 1.2 Trace the growth of casting technology in Nigeria and discuss case history of some countries like Great Britain, Germany, Russia, India, and China. 1.3 Discuss the role of foundry in technology development 1.4 List some industries that depend on foundry production. 1.5 Discuss the development of the foundry in Nigeria	<ul style="list-style-type: none"> • Ask the students to explain what they understand by foundry technology • Ask student to identify the roles of countries like Britain, Germany, Russia, etc. in the development of the foundry, industry • Ask students to assess the development of the foundry industry in Nigeria 	Recommended textbooks, lecture notes, Chalkboard, Chalk, etc.
General Objective 2.0: Understand the principles of foundry production			
Week	Specific Learning Outcome:	Teachers Activities	Resources
2	2.1 Define and give examples of alloys 2.1 Narrate the advantages of alloys over pure metal as engineering materials 2.3 Explain flowability of molten metals and alloys and the application in foundry processes 2.4 Classify foundries on: type of metal cast and type of production. For example (a) ferrous foundries (b) Non-ferrous (c) cast Iron foundries (d) malleable Iron foundries (e) independent foundries (f) captive foundries 2.6 Discuss the type listed in 2.4	<ul style="list-style-type: none"> • Ask students examples of alloy • Ask students to say what they understand by Pure metal Alloy • Ask students to explain why alloys are required • Ask students to explain why flowability is an important • Characteristics of metal for foundry • Ask students to classify foundries according to the metal cast and the type of production • Ask students to distinguish between Ferrous and Non-ferrous foundries Captive and independent Job and production shops and Assess the students 	Charts, Recommended textbooks, Lecture notes, Chalkboard.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Understand Pattern Making			
Week	Specific Learning Outcome:	Teachers Activities	Resources
3	3.1 Name the various types of patterns in common use in the foundry 3.2 List some important pattern material characteristics such as machinability; wear resistance, strength, reparability, corrosion, swelling etc. 3.3 Explain the fundamental of pattern designs and common pattern allowances. 3.4 List typical cast alloys and the approximate shrinkage used for such. 3.5 List factors that determine the selection of pattern materials 3.6 List properties and types of wood for pattern making 3.7 Describe various methods of seasoning timber, e.g. by natural and artificial methods 3.8 List other materials for pattern making e.g. plaster, plastics etc. 3.8 Describe stage and repairs of pattern.	<ul style="list-style-type: none"> Ask students to: (i) classify patterns (ii) Describe them Ask student to list some important pattern characteristics Ask student to explain how shrinkage allowance is provided on patterns. Ask students to list pattern materials and their properties Ask students to describe various wood seasoning method. 	Patterns Recommended textbooks, lecture notes, Chalkboard, Chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 4.0: Know mould and core making materials			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4	<p>4.1 Explain the characteristics and application of mould materials, e.g. natural sand, quartz, silica and other types of sand e.g. zirconite, olivine and chromate</p> <p>4.2 Explain the inter-relationship of mould sand characteristics.</p> <p>4.3 Explain the basic properties and characteristics of core sand, e.g. refractoriness, permeability, strength collapsibility and surface smoothness.</p> <p>4.4 Explain the basic characteristics of binders, e.g. particle size, clay content, jolling index and describe them.</p> <p>4.5 List common types of binders e.g. bentonites, kaolinities, organic type binders like cereal binders, resins and gums, drying oil, inorganic type of binders.</p> <p>4.6 State the functions and types of additives, e.g. coal, dust wood flour, cereal, etc.</p>	<p>Ask the students to list and describe the required characteristics of moulding sand.</p> <p>Ask students to explain why Specific sands are sometimes used.</p> <p>Ask students to explain some of the required characteristics of core sand.</p> <p>Ask students to: Explain the importance of binder Classify binders into clay-type, organic and inorganic Explain furan, Co₂ binder processes.</p> <p>Ask students to state functions of additives</p> <p>Ask the students to make the mould For the pattern made earlier (for week 4 and 5)</p>	<p>Recommended textbooks, lecture notes, Chalkboard, Chalk, etc.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 5.0: Know Mould and Core Making			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5	5.1 Describe different kinds of metal and wooden boxes. 5.2 Explain the use of facing and backing sands including venting and other applied techniques 5.3 Explain the techniques of mould drying. 5.4 Explain techniques of mould closure such as box location, core location, use of chaplets, parting powder. 5.5 Identify types of cores and their applications 5.6 Explain Specific precautions in core making operations, e.g. re-enforcement, venting, packing, etc. 5.7 Explain core baking, types of ovens used and core baking time and temperature.	<ul style="list-style-type: none"> • Ask students to compare wooden and metal moulding flasks. • Ask students to distinguish between facing and backing sands. • Ask students to explain why moulds are vented sometimes dried etc. • Ask students to explain what they understand by core • Distinguish between dry sand and green sand core. • Ask students to explain the necessity for venting, baking and reinforcement of cores • List types of ovens for core baking • Explain why baking time and temperature is controlled. • Assess the students 	Recommended textbooks, lecture notes, Chalkboard, Chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 6.0: Know the technology of melting and casting			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6	<p>6.1 List different fuels used in foundry melting processes e.g. gas, oil, coke, electricity</p> <p>6.2 Explain general properties of refractory materials.</p> <p>6.3 Give examples and applications of different types of refractory materials e.g. acidic, basic and amphoteric.</p> <p>6.4 Describe the melting practices and operation of the following foundry furnaces. Crucible furnace, pit furnace, cupola furnace, electric furnace.</p> <p>6.5 Distinguish between the melting techniques used in various foundries, e.g. cast-iron foundries, steel foundries.</p> <p>6.6 Describe the types and preparation of ladles in foundry</p>	<ul style="list-style-type: none"> • Ask students to classify fuels into solid, liquid, and gas. • Ask students to compare the types of fuel in terms of calorific value, cost, etc. • Ask students to distinguish between acid, basic and amphoteric refractories. • Ask students to write out the sequence of operation of - crucible, direct-arc, etc • Ask student s to explain the usefulness of ladles. 	<p>Standard component, chart, tables, drawing instrument.</p> <p>Various melting units.</p> <p>Transfer ladles.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 7.0: Know Post Casting Treatment			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7	7.1 Explain the function of fettling department 7.2 List the machines and tools used in fettling department, e.g. tumbling barrel, 7.3 Hydro-blasting hydro-sand blasting, sand blasting and shot blasting machines Sledge hammer, power saw, abrasive cut-off wheels, spine cutter, cutting torches	<ul style="list-style-type: none"> Ask students to underscore the importance of fettling. Ask students to identify the fettling tools and machines available in the foundry 	
	7.5 Explain the function of inspection department. 7.6 List the tools and machines used in inspection department	<ul style="list-style-type: none"> Ask students to describe how the fettling machines function 	Recommended textbooks, Lecture note
	7.7 Explain the functions of quality control departments and list the instruments used for quality control e.g. Sand testing instrument, Carbon Spectrographic equipment or metal analyse, Non-destructive testing techniques etc.	<ul style="list-style-type: none"> Ask students to underscore the importance of quality control department 	Chalkboard
	7.8 Discuss the function of complementary departments like machining, heat treatment Finishing	<ul style="list-style-type: none"> Ask students to explain the necessity for complementary department Assess the students 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 8.0: Know safety precautions in foundry work.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8	8.1 Explain factory safety precautions as regards foundry. 8.2 State safety rules and regulations relating to: <ul style="list-style-type: none"> - movement in the workshop - use of hand tools - clothes and clothing - use of equipment and machinery - adequate ventilation and lighting - use of other protective anti fit e.g. goggles, gloves, boots etc. 	<ul style="list-style-type: none"> • Ask students to underscore the necessity for safety rules and regulations in the workshop • State some of the basic safety rules and regulations to be observed in the foundry. • Assess the students 	Safety manuals, Chalkboard, Chalk, etc.
General Objective 9.0: Know the sources of Foundry Materials			
Week	Specific Learning Outcome:	Teachers Activities	Resources
9	9.1 State the locally available raw materials 9.2 State the imported raw materials 9.3 State the substitute for some imported raw materials.	<ul style="list-style-type: none"> • Ask the students to state sources of raw materials 	Recommended textbooks, Lecture notes,

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Foundry and Forging Operations		Course Code: MEC 215	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 10.0: Know the process of die casting			
Week	Specific Learning Outcome:	Teachers Activities	Resources
10-11	10.1 Know the difference between sand and permanent moulds. 10.2 List the uses of permanent moulds 10.3 List the various features of permanent moulds 10.4 Know the process of pressure die casting in a permanent mould 10.5 List similarities and dissimilarities of die casting of aluminium, zinc and other low melting metals.	<ul style="list-style-type: none"> Ask the students to prepare a comparative table of features and products of sand and permanent moulds Ask the students to list similarities and differences of die casting of aluminium zinc and other low melting metals. Assess the students. 	Chalkboard, Chalk, etc. -do- -do-
General Objective 11.0: Know the presses of Moulding Plastics			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12-13	11.1 Know the process of plastic injection moulding 11.2 Estimate the heat require to melt a given quantity of plastic material 11.3 List the parameters for classifying plastic injection moulding machines. 11.4 Describe the essential features of a plastic injection moulding. 11.5 Know the functions of cooling water in a mould. 11.6 Know the functions of compressed air in a mould	Ask the students to sketch the essential features of a plastic injection moulding machine. Illustrate with examples and make notes where necessary.	Plastic injection moulding machine Recommended textbooks, lecture notes, Chalkboard, Chalk, etc. Recommended textbooks, lecture notes, chalkboard, chalk, etc.
General Objective 12.0: Understand forging operation			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14-15	12.1 Know the functions of various tools used in forging. 12.1 Describe various forging operations involving bending, up-setting, twisting and punching	Illustrate with examples and diagrams and make notes where necessary	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Foundry and Forging Operations		COURSE CODE: MEC 215	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Demonstrate skills in pattern making		
	Special Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Identify factors that determine the selection of pattern materials. 1.2 Select materials for pattern making e.g wood, plaster, plastics etc. 1.3 Design and manufacture a pattern for a given product. 1.4 Identify the maintenance and repairs of pattern	Demonstrate the activities in 1.1 to 1.4 for the students to learn and ask them to practice all the activities. Assess the students	Complete equipment for making pattern strink rules, measuring tool, working tool.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Foundry and Forging Operations		COURSE CODE: MEC 215	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 2.0: Demonstrate skills in mould and core making			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-7	<p>2.1 Identify moulding sand/briners and its characteristics.</p> <p>2.2 Identify different types of metal and wooden moulding boxes</p> <p>2.3 Carry out setting of patterns, core assembly, reinforcement, listers, draggers, etc.</p> <p>2.4 Demonstrate the techniques of mould drying.</p> <p>2.5 Produce moulds by other methods e.g squeeze moulding machine.</p> <p>2.6 Cut down srue, runners and gates.</p> <p>2.7 Dress moulds and cores using the wet and dry methods.</p> <p>2.8 Demonstrate techniques of mould closure such as box location core location, use of chaplet parting powders.</p> <p>2.9 Identify the types of cores and it applications.</p> <p>2.10 Produce different types of cores e.g small cores, wan cores, skeleton cores, etc</p> <p>2.11 Apply special precautions in core making operations e.g reinforcement venting, baking. etc.</p> <p>2.12 Text finished cores e.g</p> <ul style="list-style-type: none"> - by permeability test - green and dry compression test - green and dry hot deformation. 	<p>Demonstrate the activities in 2.1 to 2.12 for the students to learn and ask them to carry out the activities.</p>	<p>Wooden flask, metal flasks, parting powder, chaplets, moulding sand and binders.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Foundry and Forging Operations		COURSE CODE: MEC 215	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 3.0: Demonstrate skills in melting and casting			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-10	3.1 Identify fuels used in foundry melting processes e.g gas, oil, coke, electric, etc. 3.2 Identify different furnaces. 3.3 Identify types and prepare ladles in foundry. 3.4 Perform melt treatment operation e.g purging, allying inoculating etc. 3.5 carry out pouring and casting.	Demonstrate activities 3.1 to 3.5 for the students to learn and ask them to carry out the activities. Assess the students	Various melting units. Transfer ladles.
General Objective 4.0: Demonstrate skills in fettling, cleaning and inspection			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-12	4.1 Identify fettling and inspection tools available in the foundry shop. 4.2 Carry out fettling operations e.g removal of gates and feeders using flame cutting sawing, grinding, etc. 4.3 Perform cleaning operations e.g tumbling, shot and hydro blasting, trimming, wire brushing, chipping by hand. 4.4 carry out destructive and non-destructive, inspection e.g ultrasonic, magnetic particle, x-ray, hardness, elongation, etc.	Demonstrate the activities in 4.1 to 4.4 for the students to learn and ask them to practice the activities. Assess the students	Fettling and inspection tools and machines.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Foundry and Forging Operations		COURSE CODE: MEC 215	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 5.0: Know how to apply safety precautions in foundry shop			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13	5.1 Identify and apply safety rules, precaution and regulations relating to:- <ul style="list-style-type: none"> - Movement in the workshop - Use of hand tools - Clothes and Clothing - Use of equipment and machinery - Use of personal protective equipment (PPE) e.g goggles, gloves, boots, etc. 	Demonstrate to learn and ask them to practice the activities	Coverall, goggles, gloves, books, first extinguishers, Safety manuals etc.
General Objective 6.0: Demonstrate skills in the process of die casting and forging operations			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14-15	6.1 Identify in the workshop components, which were made by die-casting 6.2 Install and dismantle a mould from the injection moulding machine and operate the machine. 6.3 Select various hand forging tools and equipment for gorge work. 6.4 Carry out forging operations involving coging, bending, up-setting twisting and punching. 6.5 Carry out exercises involving the following - (i) hardening (ii) annealing (iii) tempering (iv) normalising and (v) case hardening 6.6 Carry out test on the heat treated internals.	Demonstrate the activities in 6.1 to 6.6 for the students to learn and ask them to practice the activities	Plastic injection moulding, machine, Blacksmith forge, Anvil and stand Blacksmith hammer. (Slage hammer)

Technical Report Writing

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Technical Report Writing		CODE: MEC 217	CONTACT HOURS: 2 HRS/WK
Course Specification: THEORY AND PRACTICE			
Week	General Objective: 1.0 Content of a Technical Report		
	Specific Learning Outcome	Teachers Activities	Resources
1-2	1.1 Explain the meanings of technical reports	<ul style="list-style-type: none"> • Use questions and answer techniques • Give examples 	Chalkboard, Chalk, Duster
	1.2 Identify the purpose of technical reports		
1.3 Explain types and uses of technical reports			
	1.4 Understand the methodology and sequence of writing technical report		

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Technical Report Writing		CODE: MEC 217	CONTACT HOURS: 2 HRS/WK
Course Specification: THEORY AND PRACTICE			
Week	General Objective: 1.0 Content of a Technical Report		
	Specific Learning Outcome	Teachers Activities	Resources
2-7	1.5 Discuss the methods of determining the following in technical reports. <ul style="list-style-type: none"> - determination of topic and title - justification of title - abstract or synopsis of the report - aim and objectives of the report - classification of data - scope and limitation of project - data analysis (graphical method, tabular method descriptive method) - presentation of data (use of appendices) clear - explain how it should be made and correct 	<ul style="list-style-type: none"> • Illustrate activities 2.1 and give a topic to the students to apply the illustrated methods • Assess the students 	Recommended textbooks, lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: Technical Report Writing		CODE: MEC 217	CONTACT HOURS: 2 HRS/WK
Course Specification: THEORY AND PRACTICE			
General Objective 2.0: Understand the information that is required in technical report writing			
Week	Specific Learning Outcome:	Teachers Activities	Resources
8-11	2.1 Explain the various types of information that would be required in Reports 2.2 Determine the factors that influence solutions 2.3 Advance Civil Engineering conclusions arising from factors 2.4 Select criteria required in case studies	<ul style="list-style-type: none"> Illustrate 2.1 to 2.14 with good examples and ask the students to pick a topic as assignment to demonstrate the illustrated techniques. Assess the students 	
12-15	2.5 Determine critical analysis of case studies 2.6 Produce summary 2.7 Make propositions (Author' s propositions) 2.8 Develop conclusion to a technical report 2.9 Write a bibliography in standard format 2.10 Explain terms of reference in report 2.11 Explain the difference between facts and opinions 2.12 Explain how facts and opinions may be distinguished in writing report 2.13 Write reports on selected technical matters 2.14 Rewrite the abstract.		Recommended textbooks, lecture notes, chalkboard, chalk, duster, etc.

Supervisory Management

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Supervisory Management		Course Code: ME 221	Contact Hrs: 2HRS W/K
Course Specification: THEORY AND PRACTICE			
Week	General Objective 1.0: Carry out Job Analysis		
	Specific Learning Out come:	Teachers Activities	Resources
1-5	Analyse job under aspects of tasks carried out, responsibilities, reporting relationships, decisions made, risks involved to plant, product, self and others, measures of Output and Quality	<ul style="list-style-type: none"> Ask students to carry out a job analysis and Assess the students 	Paper, Pen, Blackboard, Chalk, Duster. Recommended textbooks, Lecture notes, etc.
General Objective 2.0: Carry out recruiting activities			
Week	Specific Learning Outcome:	Teachers Activities	Resources
4-6	2.1 Prepare personal application for job 2.2 Decide on source for recruitment 2.3 Carry out an interview and select	<ul style="list-style-type: none"> Ask students to prepare personal application, apply for a different job and carry out interviews. Assess the students performance 	-do-
General Objective 3.0: Prepare and implement training plan			
Week	Specific Learning Outcome:	Teachers Activities	Resources
7-10	3.1 Prepare breakdown of skills, knowledge, methods/procedures and exceptions procedure 3.2 Prepare training plan for each aspect 3.3 Carry out training	<ul style="list-style-type: none"> Ask students, to analyse the training needs and produce a training plan for a task. Train another student for the task Assess the students 	-do-
General Objective 4.0: Understand human motivation			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-12	4.1 Understand human needs 4.2 Understand rewards systems	<ul style="list-style-type: none"> Ask students to analyse a job to determine human needs met and suggest improvements. Assess the students 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Supervisory Management		Course Code: ME 221	Contact Hrs: 2HRS W/K
Course Specification: THEORY AND PRACTICE			
General Objective 5.0: Plan and control activities			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-15	5.1 Determining time and skill requirements to match task Requirement 5.2 Allocate staff to tasks 5.3 Schedule staff to maximise utilisation	<ul style="list-style-type: none"> Ask students to prepare a skills matrix for a group. Then develop the time and skills required for a range of tasks. Allocate staff initially on basis of skill match then re-schedule, to achieve maximum staff utilisation. Assess the students. 	-do-

Strength of Materials

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Strength of Materials		COURSE CODE: MEC 222	CONTACT HOURS 4HRS/WK
Course Specification: THEORETICAL CONTENT			
Week	General Objective 1.0: Understand various types of stress and strain		
	Specific Learning Outcome:	Teachers Activities	Resources
1-5	<p>1.1 Differentiate between the following:</p> <ul style="list-style-type: none"> a. Tensile and compressive stresses. b. Tensile and compressive rotary isolation. <p>1.2 Draw and explain stress and strain curves for:</p> <ul style="list-style-type: none"> i. Brittle materials ii. Ductile materials. <p>1.3 Describe with illustration the elastic and plastic behaviour of common structural materials.</p> <p>1.4 Explain proof stresses, direct stresses, load factors, and lateral strain, strain due to direct stresses.</p> <p>1.5 Describe strength properties of some engineering materials e.g cast iron, concrete, glass fibre, carbon fibre etc.</p>	<p>Illustrate activities in 1.1 to 1.5 with examples and diagrams makes notes, prepare assignments for the students from the illustrated topics.</p> <p>Assess the students</p>	<p>Chalk, chalk board, recommended text books, duster, chinks etc.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Strength of Materials		COURSE CODE: MEC 222	CONTACT HOURS 4HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 2.0: Understand shears force and bending moment			
Week	Specific Learning Outcome:	Teachers Activities	Resources
6-10	2.1 Define shearing force and bending moments. 2.2 Establish the relationship between the shearing force and bending moment. 2.3 Write expressions for shearing force and bending moment at a section of a loaded beam. 2.4 Draw bending moment and shearing force diagrams for any loaded beam. 2.5 Calculate the points of contraflexure. 2.6 Calculate the neutral axis, the second moment of area of cross section, the moment of resistance. 2.7 Compute flexural and shear stresses each separately at a given point on a section. 2.8 Draw stress distribution diagrams at the section	Explain and illustrate with diagrams activities 2.1 to 2.8, giving examples for some of the calculations and make notes where necessary. Ask the students to: <ul style="list-style-type: none"> - Draw bending moment and shearing force diagrams for loaded beams. - Calculate the points of contraflexure. Assess the students	Recommended textbooks, chalks, chalk, chalkboard, duster, lecture notes, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Strength of Materials		COURSE CODE: MEC 222	CONTACT HOURS 4HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Know shear stress and forgue in circular shafts			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11-12	3.1 Describe the forsion of the following circular sections: <ul style="list-style-type: none"> a. thin tube b. solid shaft c hollow shaft. 3.2 Compute the following for a circular rigid and hollow sections. <ul style="list-style-type: none"> a. angle of twist b. torsional stress c torsional stiffness 	Explain and illustrate with diagrams and examples the activities in 3.1 and 3.2 and make notes where necessary. Ask the students to compute the following for a circular rigid and hollow sections <ul style="list-style-type: none"> a angle of twist b torsional stress c torsional stiffness. Assess the students.	Chalk, Chalk board duster Recommended text books, Lecture notes, Charts, etc.
General Objective 4.0: Understand the use of Mohr' s circle.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13-15	4.1 Describe mohr' s circle of (a) stress (b) strain. 4.2 Compute stresses and strain by mohr' s circle	Explain and illustrate with diagrams the activities in 4.1 and 4.2 and make notes accordingly. Ask the students to compute stresses and strain using mohr' s circle. Assess the students.	Chalk, Chalk board duster Recommended text books, Lecture notes, Charts, etc.

COURSE: STRENGTH OF MATERIALS		COURSE CODE: MEC 222	CONTACT HRS: 4HRS/WK
COURSE SPECIFICATION: PRACTICAL CONTENT			
Week	General Objective: Carry out experiments on tensile & compressive test, Izod and charpy tests and Brinell hardness Test		
	Specific Learning Out come:	Teachers Activities	Resources
1-14	<ol style="list-style-type: none"> 1. Conduct tensile and compressive test on ductile and brittle materials 2. Conduct Izod and Charpy tests on different materials 3. Conduct Brinell hardness test 4. Conduct tests to determine the moment of inertia of discs and rotors 5. Conduct torsion tests 6. Verify Maxwell' s theorem for simply supported beams 	<ul style="list-style-type: none"> • Ask students to conduct tensile and compressive test on ductile and brittle materials. • Ask students to conduct Izod and Charpy test on different materials. • Ask student to conduct Brinell hardness tests. • Ask students to conduct tests to determine the moments of inertia of discs to rotors. • Ask students to conduct torsion tests • Ask students to verify Maxwell' s theorem for simply supported beams. • Assess the students 	<p>Tensile and compressive testing machine</p> <p>Young' s modulus apparatus, tensometers.</p> <p>Izod/Charpy testing apparatus</p> <p>Micro hardness testing machine vickers, Brinell and roundness.</p> <p>Gyroscope apparatus</p> <p>Tensometers, strain gauge</p> <p>Polygon of forces apparatus</p>

Properties of Materials

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS		Course Code: MEC 224	Contact Hours: 2HRS/WK
Course Specific: THEORETICAL CONTENT			
Week	General Objective: 1.0 Understand the Structural Arrangement of atoms and their influence on the properties of materials.		
	Specific Learning Out come:	Teachers Activities	Resources
1	1.0 Distinguish between the various types of atomic bonding in materials such as covalent, ionic, metallic, etc. 1.2 Explain the structural arrangement of materials in 1.1 above	<ul style="list-style-type: none"> • Ask students to distinguish between Ionic and covalent bonding, Covalent and metallic bonds. • Ask students to give typical examples of ionic, covalent bonds using typical example. 	Recommended textbooks, Lecture notes, Chalkboard, Chalk.
General Objectives 2.0: Appreciate the elementary crystal structure of materials.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
2	2.3 Describe the elementary crystal structural of materials 2.4 Explain the seven crystal systems in metals.	<ul style="list-style-type: none"> • Ask students to distinguish between crystalline and amorphous solids. • Ask students to define the crystal systems in terms of their axial lengths and angles. 	Pictures and drawings of crystal structure
2	2.3 Illustrate types of crystal patterns. For example, body centred cubic (BCC), Face centred cubic (FCC), close packed hexagonal (CPH), etc.	<ul style="list-style-type: none"> • Ask students to distinguish the BCC, FCC and CPH Crystal lattices • Ask students to give examples of metals crystallising in these patterns. 	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
	General Objective 3.0: Understand phase transformations		
Week	Specific Learning Outcome:	Teachers Activities	Resources
3	<p>3.1 Explain thermal equilibrium diagrams.</p> <p>3.2 Describe on phase diagrams in the following transformations: Eutectic, Eutectoid, Peritectic reaction</p> <p>3.3 Apply the lever rule given an equilibrium diagram to calculate the relative amounts of phases present in an alloy at a given temperature.</p> <p>3.4 Examine the microstructure of various alloys</p>	<ul style="list-style-type: none"> • Ask students to define phase • Ask students to state the importance of equilibrium diagrams • Ask students to explain the peritectic reaction • Ask students to use the lever rule to establish the percent proportion of phases co-existing in an alloy of given composition at a given temperature • Assess the students 	<p>Emery clothes, Echants, Metallurgical microscope, alloy specimens, furnaces. Phase diagrams</p>
	General Objective 4.0: Understand the process of metal solidification		
Week	Specific Learning Outcome:	Teachers Activities	Resources
4	4.1 Describe the process of nucleation and grain growth in metals	<ul style="list-style-type: none"> • Ask students to explain why all metals are classified as crystalline solids. • Ask students to explain why temperature retardation or arrest is observed in the cooling curves of metals and alloys • Ask students to explain dendritic crystallisation • Ask students to explain the relationship between rate of nucleation and rate of linear crystal growth 	<p>Recommended textbooks, Lecture notes, Chalkboard, Chalk.</p>
4	4.2 Describe the structure of ingots.	<ul style="list-style-type: none"> • Ask students to identify the zones in a slowly cooled metal • Ask students to explain the relationship between heat removal and the structure of the ingot in the various zones. 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
General Objective 5.0: Understand the structural arrangements of atoms of non-metals			
Week	Specific Learning Outcome:	Teachers Activities	Resources
5-6	5.1 Describe non-crystalline atomic structure 5.2 Explain the structure of: clay, glass & plastics 5.3 List the properties and applications of the non-metals in 5.2.	<ul style="list-style-type: none"> • Ask students to measure and draw cooling curve of a non-metallic material • Ask students to explain why non-metals are classified as amorphous solids • Ask students to distinguish between organic metallic and polymer glasses. • Ask students to explain how glasses are formed. • Ask students to distinguish between thermosets and thermoplastics • Ask students to list properties of some plastics, to mention some applications of glass, clay and plastics. • Assess the students 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
	General Objective 6.0: Understand the process of obtaining metals from ores		
Week	Specific Learning Outcome:	Teachers Activities	Resources
7	6.1 Classify various ores 6.2 Explain the crushing and grinding of ores	<ul style="list-style-type: none"> • Ask students to say what they understand by ore • Ask students to classify ores according to chemical composition • Ask students to explain why we crush/grind ores and crush some ores. • Ask students to list machines used for crushing/grinding 	-do-
8	6.3 Describe the various processes for concentration of ores 6.4 Describe the processes of refining metals by electro chemical, carbonthermic, electrolytic and reduction processes	<ul style="list-style-type: none"> • Ask students to explain the usefulness of ore concentration • Ask students to describe (i) flotation (ii) magnetic separation and its limitation (iii) Gravity separation • Ask students to distinguish between electro-chemical and carbonthermic methods of ore refinement • Ask students to separate with hand seives and magnets Assess the students 	Recommended textbooks, Lecture notes, Chalkboard, Chalk, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
	General Objective 7.0: Understand various types of ferrous metals considering the properties & limitations.		
Week	Specific Learning Outcome:	Teachers Activities	Resources
9-10	<p>7.1 Describe the production of iron through: (i) the blast furnace (ii) direct reduction.</p> <p>7.2 Explain the composition of the final product of PIG IRON and DRI produced</p> <p>7.3 Describe the following steel making processes (i) the Bessemer process (ii) the open hearth process (iii) the LD process (iv) Kaldo process (v) spray steel making, etc.</p>	<ul style="list-style-type: none"> Ask students to write out the physico-chemical reactions accompanying the blast furnace process Ask students to distinguish between the blast furnace and direct reduction processes. Ask students to distinguish between the Bessemer pig and the foundry pig. Ask students to distinguish between iron and steel Ask students to compare the Bessemer, open-hearth, LD Kaldo, etc processes. Assess the students 	-do-
11	<p>7.4 Describe the various types of plain carbon steels, their properties and limitations.</p> <p>7.5 Classify various types of their properties and limitations</p> <p>7.6 Classify various types of alloy steels, their properties and limitations</p>	<ul style="list-style-type: none"> Ask students distinguish between plain carbon and alloy steels Ask students to classify plain carbon steels, stating their properties and limitations. Ask students (i) classify alloy steels (ii) state their properties, uses and limitations. 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
General Objective 8.0: Understand the common types of non-ferrous metals.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12	8.1 Explain the basic properties and uses of common non-ferrous metals like tin, nickel, titanium magnesium, zinc, copper, aluminum and their alloys	<ul style="list-style-type: none"> • Ask students to give the properties of the common non-ferrous metals and their alloys. • Ask students to list the properties of the common non-ferrous metals and their alloys. • Ask students to state their application. 	-do-
General Objective 9.0: Understand hot working and cold working processes			
Week	Specific Learning Outcome:	Teachers Activities	Resources
13	9.1 Describe hot working and cold working processes 9.2 Differentiate hot working from cold working processes 9.3 List hot working and cold working processes 9.4 State the effect of hot working and cold working on mechanical properties, dimensional accuracy and surface finish	<ul style="list-style-type: none"> • Ask students to say what they understand by hot working and cold working • Ask students to list (i) hot working and cold working processes (ii) describe the various hot working and cold working processes. • Ask students to state the advantages and disadvantages of hot and cold working processes. 	Recommended textbooks, Lecture notes, Chalkboard, Chalk.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PROPERTIES OF MATERIALS	Course Code: MEC 224	Contact Hours: 2HRS/WK	
Course Specific: THEORETICAL CONTENT			
General Objective 10.0: Understand the non-metallic materials in engineering applications.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
14	<p>10.1 Classify common plastics materials</p> <p>10.2 State the properties, uses and limitations of plastics in 10.1</p> <p>10.3 Describe the composition and application of glass and rolled Specific glass</p> <p>10.4 Explain the properties and uses of other non-metallic materials such as ceramics, wood, rubber and concrete</p>	<ul style="list-style-type: none"> • Ask students to distinguish between thermosets and thermoplastics • Ask students to state the properties, uses and limitations of plastics. • Ask students to: (I) describe the raw materials for glass manufacture (ii) state the forming processes for glass (iii) give the applications of glass • Ask students to list the properties of these non-metallic materials i.e. ceramics, wood, rubber and concrete • Ask students to state their applications. Assess the students 	-do-
General Objective 12.0: Understand the basic principles of heat treatment as applied to steels.			
Week	Specific Learning Outcome:	Teachers Activities	Resources
15	<p>12.1 Explain the Iron-carbon equilibrium diagram</p> <p>12.2 Describe the procedures for hardening, annealing, normalising and tempering of steel.</p> <p>12.3 Describe different types of heat furnaces</p> <p>12.4 List the procedures for carburising.</p>	<ul style="list-style-type: none"> • Ask students to draw the Iron carbon equilibrium diagram • Annotate 11- completely • Ask students to describe the common heat-treating procedures. • Ask students to describe the common heat treatment furnaces • Ask students to say what they understand by surface hardening. • Ask students to describe the various carburising methods. • Assess the students. 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Properties of Materials		COURSE CODE: MEC 124	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Comprehend phase transformation		
	Specific Learning Outcome:	Teachers Activities	Resources
1-5	1.1 Construct thermal equilibrium diagrams for the following: (i) complete solid solubility (ii) complete solid insolubility (iii) limited solid solubility (iv) formation of chemical compound (v) limited solid solubility accompanied by peritectic. 1.2 Identify solidus and liquidus lines. 1.3 Distinguish between:- Eutectic and eutectoid, solidus and solvus lines. 1.4 Examine the micro-structure of alloy specimens and make sketches of the structure	Demonstrate a activities 1.1 to 1.4 for the students to learn and ask them to carry out the activities. Assess the students.	Metallurgical microscope, alloy specimens, furnaces, phase diagrams etc.
General Objective 2.0: Identify nucleation, crushing/grind machines and separation techniques			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	6-9	2.1 View nucleation growth of metals under metallurgical microscope. 2.2 Identify machines used for crushing/grinding 2.3 Carry out simple separation by: (i) floatation, (ii) magnetic, (iii) gravity and (iv) hand serives.	Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to carry out the activities.
General Objective 3.0: Demonstrate Skills in hot and cold working processes			
Week	Specific Learning Outcome:	Teachers Activities	Resources
	10	3.1 Carry out hot and cold working processes on a given metal specimen.	Demonstrate for the students to learn and ask them to perform the activity

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: Properties of Materials		COURSE CODE: MEC 124	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 4.0: Identify the non-metallic materials in engineering application			
Week	Specific Learning Outcome:	Teachers Activities	Resources
11	4.1 Identify non metallic materials such as plastic, ceramics, wood, rubber and concrete, its composition and properties.	Demonstrate for the students to learn and ask them to practice	Non-metallic materials.
General Objective 5.0: Demonstrate basic heat treatment on steel			
Week	Specific Learning Outcome:	Teachers Activities	Resources
12-15	5.1 Construct iron-carbon equilibrium 5.2 Carry out some heat treatment exercise e.g hardening, annealing, normalising and tempering.	Demonstrate activities 5.1 and 5.2 for the students to learn and ask them to perform the activities. Assess the students	furnaces, steel specimen etc.

Refrigeration and Air-conditioning

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
Week	General Objective 1.0: Understand the basic principles of refrigeration		
	Specific Learning Out come	Teacher Activities	Resources
1	1.1 Describe reversed cannot cycle 1.2 Explain the basic concepts of refrigeration 1.3 Define the terms: (1) Refrigerating effect (2) Coefficient of performance (3) dew point, dry bulb, and wet bulb temperatures, humidity and relative humidity. 1.4 Describe the functions of each component	<ul style="list-style-type: none"> • Ask students to: explain the reversed carnot cycle, explain the basic concepts of refrigerator, define the terms • describe the functions of each component. • Assess the students 	Recommended textbooks, Lecture notes, Chalkboard, Chalk.
General Objective 2.0: Know the basic tools and equipment used in refrigeration practice			
Week	Specific Learning Out come	Teacher Activities	Resources
2	2.1 List common hand tools used in refrigeration workshop 2.2 Explain the use of each tool named in 2.1 2.3 List common equipment used in refrigeration workshop e.g. manifold gauge, leak detecting instruments etc 2.4 Explain the use of each of the items name in 2.3	<ul style="list-style-type: none"> • Ask students to: • List common hand tools used in refrigeration workshop • Explain the use of each hand tool • List common equipment used in refrigeration workshop • Explain the use of each equipment listed • Carryout appropriate operations using the tools and equipment. Assess the students 	Hand cutting tools flaring tools, gas welding equipment

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Understand the various types of practical refrigeration cycles			
Week	Specific Learning Out come	Teacher Activities	Resources
3-4	<p>3.1 List the various types of refrigeration cycles</p> <p>3.2 Describe cycles in 3.1</p> <p>3.3 Describe the principles of absorption system</p> <p>3.4 Explain the functions of the basic components of absorption system.</p>	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - List the various types of refrigeration cycles. - Describe the cycles listed - Describe the principles of absorption system - Explain the functions of the basic components of absorption system. Assess the students 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 4.0: Understand the various types of practical refrigeration cycles and know the functions and properties of refrigerants			
Week	Specific Learning Out come	Teacher Activities	Resources
5	4.1 Define refrigerant 4.2 List common refrigerants 4.3 State the applications of refrigerants in 3.2 4.4 State the properties of a refrigerant 4.5 Explain the differences between primary and secondary refrigerants 4.6 Describe visibility and phase separation. 4.7 Describe the pressure temperature relationships of common refrigerants 4.8 Describe the effects of refrigerants on piping materials 4.9 State the safety precautions in the storage of refrigerants 4.10 Explain the suitability of each refrigerant for application in (i) domestic refrigerator (ii) cold room for food preservation (iii) air conditioning unit. (iv) the refrigerant /absorbent combinations in the vapour absorption	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Define refrigerant - List common refrigerants - State the application of listed refrigerant - State properties of refrigerant - Explain the difference between primary and secondary refrigerant - Describe the effects refrigerant on piping materials - The merits of each refrigerant for particular applications. - List refrigerant absorbent pairs used in vapour absorption systems. - Explain the relationship of common refrigerant - Assess the students 	Recommended textbooks, Lecture notes, Chalkboard, Chalk.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 5.0: Know the reasons for and the methods of lubrication in refrigeration			
Week	Specific Learning Out come	Teacher Activities	Resources
6	5.1 List the required properties of compressor oil 5.5 Explain the term pouring point, close point and dielectric strength for lubricants 5.3 Describe methods of lubrication and the mechanism of oil pumps	<ul style="list-style-type: none"> • Ask student to: <ul style="list-style-type: none"> - List required properties of compressor oil - Explain the terms as applied to lubrication - Describe lubrication methods in refrigeration systems. Assess the students 	Recommended textbooks, Lecture notes, Chalkboard, Chalk.
General Objective 6.0: Know the procedure of recharging refrigeration circuit			
Week	Specific Learning Out come	Teacher Activities	Resources
7	6.1 Describe safe methods of transferring refrigerants to service cylinders. 6.2 Describe correct storage conditions 6.3 Describe correct storage methods, identifying when liquid charging is permissible and when vapour charging is advisable 6.4 State the circumstances when (i) toxic products may be produced (ii) there is the risk of an explosion.	Ask students to: Describe safe methods of handling refrigerants Explain when liquid charging is required Explain when vapour charging is required Explain the service cylinder positions in both charging techniques.	

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 7.0: Know the various applications of refrigeration			
Week	Specific Learning Out come	Teacher Activities	Resources
8	<p>7.1 Explain the use of a refrigerating unit in an air-conditioning system</p> <p>7.2 List examples of other common refrigeration systems for industrial applications</p> <p>7.3 Describe a typical layout for cold rooms</p> <p>7.4 List the safety requirements for industrial ammonia plants</p>	<ul style="list-style-type: none"> • Ask student to: <ul style="list-style-type: none"> - Explain the use of refrigeration in Air-conditioning - List common refrigeration systems that have industrial application - Sketch a layout for cold room - Explain safety needs for industrial ammonia plants. - Assess the students 	<p>Recommended textbooks, Lecture notes, Chalkboard, Chalk.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND AIR-CONDITIONING		CODE: MEC 225	CONTACT: 1HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 8.0: Know the function of an air-conditioning system for a building			
Week	Specific Learning Out come	Teacher Activities	Resources
9 - 14	<p>8.1 Define the term air-conditioning.</p> <p>8.2 List the reasons why air-condition may be provided in a building.</p> <p>8.3 Differentiate between comfort and industrial air-conditioning system.</p> <p>8.4 Distinguish between package, unit and central air-conditioning systems.</p> <p>8.5 Sketch the cycle and list the main components of a unit air-condition</p> <p>8.6 Sketch the equipment used in an air-conditioning system e.g. cooler, batteries, humidifier, fan etc.</p> <p>8.7 State the functions of each item of equipment named in 7,6.</p> <p>8.8 Describe typical layouts of central air-conditioning central air-conditioning system.</p> <p>8.9 Explain the source of various load imposed on the air-conditioning plant like solar heat gain, filtration etc.</p> <p>8.10 List the techniques by which some of the loads imposed on air-conditioning plant may be reduced.</p>	<ul style="list-style-type: none"> • Ask students to <ul style="list-style-type: none"> - Define air-conditioning - State reasons for providing air-conditioning in buildings. - Explain the difference between air-conditioning for comfort and air conditioning for industrial purpose. - Explain the difference between package unit air conditioner and central air-conditioning system. - Make a sketch of package air-conditioning unit and indicate the components by proper labeling - Make sketches of the different components - Explain the functions of each equipment listed - Make a sketch of the layout of a central air condition system - List the sources of cooling load - Explain some of the ways by which heat gains may be reduced 	<p>Recommended textbooks, Lecture notes, Chalkboard, Chalk.</p> <p>Recommended textbooks, Lecture notes, Chalkboard, Chalk.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND A/C		COURSE CODE: MEC 225	CONTACT HOURS HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Identify component parts and working of refrigeration system		
	Specific Learning Outcome:	Teachers Activities	Resources
1-4	1.1 Identify component parts of refrigeration system. 1.2 Demonstrate the functioning of the component parts.	Demonstrate the activities in 1.1 and 1.2 and ask the students to perform the activities.	A refrigerator
General Objective 2.0: Carry out repairs and services in a refrigerator			
Week	Specific Learning Out come	Teacher Activities	Resources
5-7	2.1 Identify the equipment used in refrigeration workshop e.g manifold gauge, leak detecting instruments, etc. 2.2 Perform cutting, flaring bending and joining of tubes using appropriate tools and equipment. 2.3 Identify vapour absorption system and its requirements	Demonstrate activities 2.1 to 2.3 for the students to learn and ask them to practice Assess the students.	Hand cutting tools, flaring tools, gas weigh equipment
General Objective 3.0: Demonstrate refrigeration cycles and properties of refrigerant			
Week	Specific Learning Out come	Teacher Activities	Resources
8-10	3.1 Identify various refrigerant and its applications. 3.2 Use refrigeration and air air condition demonstration unit to illustrate the effect of: (i) pressure on temperature (ii) cooling water rate on condenser and evaporator temperatures. 3.3 Observe safety precaution in the workshop and in the storage of refrigerants	Demonstrate the activities in 3.1 to 3.3 for the students to learn and ask the students to practice. Assess the students	Refrigerants, Refrigeration/Air conditioning demonstration unit
General Objective 4.0: Demonstrate skills in lubrication of refrigerator			
Week	Specific Learning Out come	Teacher Activities	Resources
11	4.1 Identify the lubrication points in a refrigerator 4.2 Carry out lubrication operation in a refrigerator using appropriate equipment e.g oil pumps.	Demonstrate the activities in 4.1 and 4.2 for the students learn and allow the students to practice. Assess the students	Lubricants, Oil pumps Refrigerator, etc

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: REFRIGERATION AND A/C		COURSE CODE: MEC 225	CONTACT HOURS HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 5.0: Demonstrate the procedures of recharging refrigeration circuit			
Week	Specific Learning Out come	Teacher Activities	Resources
12	5.1 Conduct leakage detection tests. 5.2 Purge charge and re-charge domestic refrigeration and window air-conditioning units. 5.3 Dismantle, service and assemble a frigerator.	Demonstrate the activities in 5.1 to 5.3 for the students to learn and allow them to practice.	Halide torch, Manifold gauge, Hoses, connector, vacuum pump, Hand tools, etc
General Objective 6.0: Demonstrate skills in the overhaul of an - air conditioner			
Week	Specific Learning Out come	Teacher Activities	Resources
13-15	6.1 Dismantle, service and reassemble a window type air-conditioner. 6.2 Dismantle, service, reassemble and test a compressor unit of an air-conditioner.	Demonstrate activities 6.1 and 6.2 for the students to learn and allow them to practice. Assess the students	Complete tool box, Text equipment etc.

Plant Services and Maintenance

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
Week	General Objective 1.0: Know the general Safety Rules for maintenance		
	Specific Learning Outcome	Teachers Activities	Resources
1 - 2	<p>1.1 Describe, install, use and maintain the following: Ropes and Chains, Collars and Kate' s Tripod and shear legs, Forklift and pulley block, Mobile and overhead cranes, Derrick and gantry.</p> <p>1.2 List and explain the safety rules for maintenance.</p>	<p>1.3 Ask the students to inspect workshops and write reports of their safety aspects.</p> <p>1.4 Ask the students to describe, install, use and maintain the following: (i) Ropes and Chains, (ii) Collars and Kate' s, (iii) Tripod and shear legs, (iv) Forklift and pulley block, (v) Mobile and overhead cranes, (vi) Derrick and gantry,) Ropes and chains</p> <p>1.5 Illustrate with examples and diagrams and make notes</p>	<p>Chalk, Blackboard</p> <p>Manuals,</p> <p>Recommended textbooks, Lecture notes, Ropes and Chairs pulley boice.</p>
General Objective 2.0: Know installation and commissioning of machinery			
Week	Specific Learning Outcome	Teachers Activities	Resources
3 - 4	<p>2.1 State factors affecting plant installation such as weight; size Stability, rigidity, and running speed.</p> <p>2.2 State properties of concrete wood and bricks for plant installation</p> <p>2.3 Describe typical machine foundations</p>	<p>1.6 Ask the students to state properties of concrete, wood and bricks for plant installation</p> <p>1.7 Ask the students to describe typical machine foundation</p> <p>1.8 Ask the students to identify the different foundation bolts</p> <p>1.9 Ask the students to state the use of vibration isolation</p> <p>1.10 Ask the students to check leveling of</p> <p>1.11 Machines with block level and inclinometer</p> <p>1.12 Ask the students perform alignment tests for machine parts using straight edge, autocollimator e.t.c</p> <p>1.13 Assess the studentst</p>	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 3.0: Know how to install and maintain different types of bearings			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-6	3.1 Explain the functions of a bearing inclinometer 3.2 State different types of bearing 3.3 State the applications of the bearings listed in 3.2 3.4 Explain common bearing faults 3.5. State causes of bearing failure 3.6 Explain the effects of lubrication systems 3.7 Describe typical lubrication system 3.8 Know common fault in lubrication system	Ask the students to explain the functions of bearing. Ask the students to state the applications of the bearings 3.2 Ask the students to explain common bearing fault. Ask the students to explain the effects of lubrication system. Assess the students. Ask the students to draw schematic diagram of a lubrication system and identify where problems and what type of problems may arise. Assess the students	Chalkboard Recommended textbooks, Manuals, lecture notes, etc. Dusters
General Objective 4.0: Understand the application of different methods of power transmission			
Week	Specific Learning Outcome	Teachers Activities	Resources
7 - 8	4.1 Describe belt, chain, gear and shaft transmission 4.2 Explain the working principles of each of the transmission system in 4.1 4.3 Describe the working principles of rigid, flexible, disc and universal coupling. 4.4 Describe different coupling e.g key, spline etc. 4.5 Describe the maintenance procedure for various transmission systems.	Ask the students to describe belt, chain, gear and shaft transmission. Ask the students to explain the working principles of each of the transmission 4.1 Ask the students to describe the working principles of rigid, flexible, disc and universal coupling Assess the students	- do -

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 5.0: Describe and use different types of flow equipment			
Week	Specific Learning Outcome	Teachers Activities	Resources
9	5.1 Explain the functions of different components in a typical hydraulic system. 5.2 Describe causes and methods of preventing contamination of fluids. 5.3 Explain the principles of operation of valves 5.4 List and explain fluid flow control valves. 5.5 Describe different packing seals. 5.6 Explain constructional details and requirements of different hydraulic pumps	1.14 Ask the students to explain the functions of different components in a typical hydraulic system. 1.15 Ask the students to describe causes and methods of preventing contamination of fluids. 1.16 Ask the students to explain the principles of operation of valves. 1.17 Assess the students 1.18 Ask the students to describe fluid flow control values 1.19 Ask the students to explain constructional details and requirements of different hydraulic pumps. 1.20 Illustrate with diagrams and make notes.	Chalkboard Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 6.0: Understand boiler operation steam generation, steam distribution, and use and maintain boiler system			
Week	Specific Learning Outcome	Teachers Activities	Resources
10	6.1 Explain the functions of a maintenance group. 6.2 Distinguish between corrective, preventive and breakdown maintenance. 6.3 Explain the planned maintenance and permit-to-work systems. 6.4 Describe the following stores procedures: 1.1 Ordering of spare parts 1.2 Raising of Local Purchase Order (LPO) 1.3 Storing of spare parts 1.4 Requisitioning of stores 6.5 Explain the significance of materials handling in maintenance.	Illustrate and explain the activities in 6.1 to 6.5 and ask the students to do the following 1.21 to explain the functions of a maintenance group and distinguish between corrective and preventive maintenance. 1.22 to explain the planned maintenance and 1.23 permit-to-work systems, and describe all the stores procedures. 1.24 explain the significance of material handling in maintenance.	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective 7.0: Understand the principles of maintenance planning			
Week	Specific Learning Outcome	Teachers Activities	Resources
11-12	7.1 Discuss the different types of pumps. 7.2 Explain the main features of centrifugal and submersible pump 7.3 Describe the common pump problems and their remedies 7.4 Describe a typical water distribution system.	1.25 Ask the students to discuss the different types of pumps. 1.26 Ask the students to explain the main feature of centrifugal pumps. 1.27 Ask the students to describe the common pumps problems and their remedies. 1.28 Ask the students to describe a typical water distribution system. 1.29 Ask the students to explain the use of drainage and enlarged main branch supply lines. 1.30 Assess the students	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, Pipes, etc.
General Objective: 8.0: Understand boiler operation, steam generation, steam distribution, and use and maintain boiler system			
Week	Specific Learning Outcome	Teachers Activities	Resources
13	8.1 Explain the operation boiler. 8.2 Explain the use of steam separators and reducing valves. 8.3 Explain the color codes in piping practice 8.4 Explain the arrangement of steam supply for process heating. 8.5 Explain the use of (i) providing drainage expansion joint and (ii) Enlarge main and branch supply lines.	1.31 Illustrate activities in 8.1 to 8.5 with diagrams and make notes where necessary.	Boilers Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster Sore for solid fuel, liquid fuel and gaseous fuel Chalkboard, duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
Course: PLANT SERVICES AND MAINTENANCE		Course Code: MEC 226	Contact Hours: 2HRS/WK
Course Specification: THEORETICAL CONTENT			
General Objective: 9.0: Understand the operation, construction and maintenance of compressors			
Week	Specific Learning Outcome	Teachers Activities	Resources
14-15	9.1 Explain constructional details of compressor. 9.2 List maintenance requirements of compressors. 9.3 Describe problems of air storage and distribution. 9.4 Explain types of air receiver and mixture separator. 9.5 State and explain the common types of pneumatic safety and control systems.	1.32 Ask the students to prepare a sketch of layout pipes for distribution. 1.33 Ask the students to explain the use of steam separators and reducing valves. 1.34 Ask the students to identify the colours codes in piping practice. 1.35 Ask the students to explain the arrangement of steam supply for process heating. 1.36 Ask the students to explain the constructional details of compressor. 1.37 Ask the students to list maintenance requirements of compressor. 1.38 Ask the students to describe problems of air storage and distribution. 1.39 Ask the students to explain types of air receivers and mixture separator. 1.40 Ask the students to describe the common of pneumatic safety and control systems. 1.41 Illustrate with diagrams and make notes accordingly. - Assess the students	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: PLANT SERVICES AND MAINTENANCE		COURSE CODE: MEC 226	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Demonstrate skills in installation and maintenance machinery		
	Special Learning Outcome:	Teachers Activities	Resources
1-3	1.1 Install use and maintain the following ropes and chains, collers and shear legs, forklift and pulley block, mobile and overhead cranes, Retick and gantry. 1.2 Observe safety rules. 1.3 Identify the different foundation boilts isolations. 1.4 Check leveling of machines with block level and clinometer. 1.5 Perform alignment tests for machine parts using straight edge auto collimator, etc. 1.6 Prepare plans for installing some machines like lathe, drilling machine, compressor, etc.	Demonstrate activities 1.1 to 1.6 for the students to learn and ask them to carry out the activities. Assess the students	Block level, chnometer, straight edge, machine part, Autocollimator etc, Cement and concrete making materials and tools.
General Objective 2.0: Demonstrate skills in the installation and maintenance of bearing			
Week	Specific Learning Outcome	Teachers Activities	Resources
4-5	2.1 Identify different types of bearing. 2.2 Install bearing 2.3 Identify causes of bearing failure 2.4 Carry out lubrication of bearing	Demonstrate activities 2.1 to 2.4 for the students to learn and allow them to practice. Assess the students	Bearings, Lubricants, etc

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: PLANT SERVICES AND MAINTENANCE		COURSE CODE: MEC 226	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 3.0: Demonstrate skills in maintenance of power transmission system			
Week	Specific Learning Outcome	Teachers Activities	Resources
6-8	3.1 Identify belt, chain, gear and shaft transmission. 3.2 Assemble and maintain belt, chain, gear and shaft transmission. 3.3 Dismantle and assemble rigid, flexible, disc and universal coupling. 3.4 Identify different couplings e. key, spline etc 3.5 Use appropriate lubricants for various transmission systems. 3.6 Diagnose transmission fault.	Bearing extractor Puller Bearings Complete' Tools box Diagnose and inspection equipment.	Chalkboard Recommended textbooks, Lecture notes, Manuals, etc.
General Objective 4.0: Demonstrate skills in the application of fluid flow equipment			
Week	Specific Learning Outcome	Teachers Activities	Resources
9	4.1 Identify and maintain fluid flow control valves. 4.2 Identify different packing seals 4.3 Dismantle and assemble various valves. 4.4 Dismantle hydraulic pumps and examine inerant	Demonstrate activities in 4.1 to 4.4 for the students to learn and ask them to carry out the activities. Assess the students	Compute tool box Valves Hydraulic pumps.
General Objective 5.0: Demonstrate skill in the installation and maintenance of pumps			
Week	Specific Learning Outcome	Teachers Activities	Resources
10-11	5.1 Identify different types of pumps. 5.2 Install and maintain pumps 5.3 Identify common pump problems and solutions 5.4 Design a typical water distribution system. 5.5 Select pipes and pipe joints for water supply. 5.6 Dismantle and rebuild centrifugal and submersible pumps	Demonstrate 5.1 to 5.6 for the students to learn and allow them to practice Assess the students.	Pumps Complete tool box Centrifugal pump Submersible Pumps.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: PLANT SERVICES AND MAINTENANCE		COURSE CODE: MEC 226	CONTACT HOURS 2HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 6.0 Demonstrate skills in use, maintenance and operation of boiler/piping			
Week	Specific Learning Outcome	Teachers Activities	Resources
12	6.1 Operate boilers 6.2 Repair and maintain boiler and its accessories. 6.3 Store solid, liquid and gaseous fuel as per specification. 6.4 Select correct pipe size and lay out for distribution. 6.5 Install pipe fittings and laggings. 6.6 Identify the colour codes in piping practice.	Demonstrate activities in 6.1 to 6.6 for the students to learn and allow them to practice the activities. Assess the students	Boiler and accessories Complete tool box Pipe fittings and lagging, etc.
General Objective 7.0 Demonstrate skills in the maintenance and operation of compressor			
Week	Specific Learning Outcome	Teachers Activities	Resources
13-15	7.1 Identify types and constructional details of compressor 7.2 Observe common types of pneumatic safety and control system 7.3 Select correct sizes of pipes for compressed air distribution with provision for inspection and drainage. 7.4 Lay out pipes in 7.3 7.5 Install ring-main type distribution of compressed air 7.6 Operate air supply and distribution systems 7.7 Dismantle and assemble reciprocating, rotary, and axial flow compressor. 7.8 Repair pneumatic tools	Demonstrate the activities in 7.1 to 7.8 for the students to learn and ask the students to perform the activities. Assess the students	Compressors, Pipe tools Pneumatic tools, etc.

Automotive Technology and Practice

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
Week	General Objective: 1.0: Understand historical and technical developments of the motion vehicle and the emergence of the piston type Internal combustion engines.		
	Specific Learning Outcome:	Teachers Activities	Resources
1	<p>1.1 Discuss the development of the motor vehicle</p> <p>1.2 Know the various prime movers e.g. (i) the steam engine (ii) the electric motor (iii) internal combustion engine.</p> <p>1.3 State the advantages and disadvantages of 1.2.</p> <p>1.4 Know the role of the automotive engineering technologist and the set-up in the automotive industry.</p>	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Explain the development of the motor vehicle from the point of view of the need of man to travel over long distance. - Describe the evolution of prime movers in chronological order stating the deficiencies of one leading to the development of the other. - Describe the various arms of the automotive industry - Automotive services, - Auto dealers. - Auto spare parts, Auto fleet garages. • Assess the students 	<p>Charts and pictures of the chronological evolution of the vehicles.</p> <p>Standard automobile workshop.</p> <p>(A visit to existing workshop is recommended).</p> <p>Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 2.0: Understand the fundamental cycles of operation of the petrol, diesel and other internal combustion engines.			
Week	Specific Learning Outcome	Teachers Activities	Resources
2	2.1 Know the features of the 4 stroke petrol engine and describe its cycles of operation of 2.1 2.2 Know the features of the 4-stroke diesel engine and describe its cycle of operation. 2.3 Compare the advantages and disadvantages of 2.1 and 2.2. 2.4 Know the features of the 2-Stroke petrol engine and describe its cycle of operation. 2.5 Know the features of the 2-stroke diesel engine and describe its cycle of operation 2.6 Compare the advantages and disadvantages of 2.4 and 2.5.	<ul style="list-style-type: none"> • Ask students to write a convincing recommendation for requisition of a particular type of automobile for a particular purpose. • Ask students to match features/projections of an auto-engine to service requirement. • Assess the students 	Sectioned 4-stroke diesel engine. Sectioned 2-stroke diesel engine Sectioned 4-stroke petrol engine Sectioned 2-stroke petrol engine. Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 3.0: Understand the component parts of an auto engine			
Week	Specific Learning Outcome	Teachers Activities	Resources
3	<p>3.1 Know the following terms</p> <ul style="list-style-type: none"> - top dead centre - piston stroke and piston displacement - cylinder bore - bottom dead centre - swept volume - mean effective pressure - engine torque - engine compression and compression ratio - indicate brake power <p>3.2 Describe the main functions of the components of the fuel system of a petrol engine.</p> <p>3.3 Describe the main function of the components of the fuel system of a diesel engine.</p> <p>3.4 Describe the main functions of the components of the fuel system of a petrol engine.</p> <p>3.5 Describe the main function of the components of the fuel system of a diesel engine.</p>	<ul style="list-style-type: none"> • Ask students to explain and show or demonstrate the following: <ul style="list-style-type: none"> - top dead centre - piston stroke and piston displacement - cylinder bore - bottom dead centre - swept volume • Derive mathematical equations for swept volume, mean effective pressure, engine torque, engine compressor ratio • Show mathematically that indicated power is directly proportional to swept volume. • Ask the students to distinguish amongst the various engine components. • Illustrate with diagrams and make notes • Assess the students 	<p>Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.</p>

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 4.0: Understand the fuel system of petrol and diesel engine			
Week	Specific Learning Outcome	Teachers Activities	Resources
4	4.1 Draw the line diagram for the fuel system for petrol & diesel engines. 4.2 Describe the functions of the exhaust system.	Ask the students to draw the line diagram for the fuel system for petrol/diesel engines	- do -
General Objective 5.0: Understand engine cooling and lubrication			
Week	Specific Learning Outcome	Teachers Activities	Resources
5	5.1 Describe the operation and identify the component parts of air-cooling. 5.2 Describe the operation and identify the component parts of pressurized cooling system 5.3 Draw the flow diagram in 5.1 & 5.2. 5.4 State the function and identify the components parts of a lubricating system 5.5 Use line diagram to explain the operation of the free-flow by-pass lubricating systems. 5.6 State common lubricants and their uses.	<ul style="list-style-type: none"> Ask students to describe engine-cooling system with well-labelled diagrams. Ask students to describe engine lubrication emphasizing the importance of lubrication in maintenance 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 6.0: Know the minor electrical components of a vehicle and describe their functions.			
Week	Specific Learning Outcome	Teachers Activities	Resources
6	6.1 List the major electrical components of a vehicle. 6.2 Explain the purpose of the battery 6.3 Explain the constructional details of the lead-acid battery. 6.4 Explain the constructional details of the alkaline battery. 6.5 Describe the charging and discharge processes of the two types of battery. 6.6 State the functions of the alternator. 6.7 Describe a simple starting system.	<ul style="list-style-type: none"> Ask students to do all the Specific Learning Out come. Illustrate with examples and diagrams and make notes. Assess the students 	-do-
General Objective 7.0: Know the major electrical components of a vehicle and describe their functions.			
Week	Specific Learning Outcome	Teachers Activities	Resources
7	7.1 Describe a simple starting system. 7.2 Describe a simple coil ignition system. 7.3 Describe the function of the following electrical components: (i) Lights (ii) Trafficators (iii) Windscreen wipers 7.4 Distinguish between +ve and -ve earth systems.	<ul style="list-style-type: none"> Ask students to describe, lighted electrical parts. Ask students to distinguish between the various electrical parts 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 8.0: Understand the general principles of the transmission systems.			
Week	Specific Learning Outcome	Teachers Activities	Resources
8	8.1 List/draw in block diagrams the component parts of the transmission system. 8.2 State the functions and identify the following components parts of the transmission system: - the clutch - the gear box	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Lst/draw in block diagrams the component parts of the transmission system. - state the functions and identify the following components parts of the transmission system (:i) the clutch (ii) the gear box • Illustrate with diagrams and make notes 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.
General Objective 9.0: Understand the general principles of the transmission systems.			
Week	Specific Learning Outcome	Teachers Activities	Resources
9	9.1 Describe the transmission layout of the front and rear wheel drives. 9.2 State the need for: (i) differential unit (ii) propeller shaft, (iii) drive shaft (iv) axles.	Illustrate with diagrams and make notes	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 10.0: Know the construction processes of vehicle bodies			
Week	Specific Learning Outcome	Teachers Activities	Resources
10	10.1 List the component parts of the vehicle body and identify. 10.2 Describe the main types of body construction such as: (i) composite (ii) preformed section (iii) pressed steel (iv) reinforced plastics (v) wood. 10.3 Describe the truss structures of a typical vehicle body. 10.4 Describe the sub-assemblies of a typical custom-built body structure. 10.5 Describe the processes involved in the work of: <ul style="list-style-type: none"> - the vehicle body filler - the panel beater/sheet metal worker - painter - trimmer 	<ul style="list-style-type: none"> • Ask the students to: <ul style="list-style-type: none"> - List the component parts of the vehicle body and identify. - Describe the main types of body construction such as: (i) composite (ii) preformed section (iii) pressed steel (iv) reinforced plastics (v) wood. - Explain the truss structures of a typical vehicle body. - Describe the sub-assemblies of a typical custom-built body structure. - Describe the processes involved in the work of: <ul style="list-style-type: none"> - the vehicle body filler - the panel beater/sh eet metal worker - painter - trimmer. 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 11.0: Understand the principles of steering mechanisms			
Week	Specific Learning Outcome	Teachers Activities	Resources
11	11.1 Describe the steering gear layout of (a) rack and opinion (b) worm and worm wheel. 11.2 State the Ackerman principles as applied to steering linkage 11.3 State the need for correct front-wheel alignment 11.4 Describe “ toe in” and “ toe out” of front wheels. 11.5 State the principles underlying caster and camber angles and kingpin inclination.	<ul style="list-style-type: none"> • Ask the students to: <ul style="list-style-type: none"> - Describe the steering gear layout of (a) rack and opinion (b) worm and worm wheel. - State the Ackerman principles as applied to steering linkage - State the need for correct front-wheel alignment - Describe “ toe in” and “ toe out” of front wheels. - State the principles underlying caster and camber angles and kingpin inclination. 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.
General Objective 12.0: Know types of tyres and its care			
Week	Specific Learning Outcome	Teachers Activities	Resources
12	12.1 Describe various types of tyres used in motor vehicle e.g. (i) tube and tubeless tyres (ii) cross-ply and radial ply. 12.2 State the safety precautions in tyre servicing. 12.3 Know how to measure tyre pressure sizes. 12.4 Know acceptable safe tyre conditions.	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Describe various tyres - State tyre sizes Illustrate with diagrams and make notes. 	vehicle tyres/tubes. Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 13.0: Know the braking systems and their operating principles			
Week	Specific Learning Outcome	Teachers Activities	Resources
13	<p>13.1 Describe with the aid of sketches the layout of a single line hydraulic braking system.</p> <p>13.2 Describe with the aid of sketches the action of a hydraulically operated: (i) drum brake assembly with leading and trailing shoe (ii) Disc-brake assembly.</p> <p>13.3 Describe with the aid of sketches, the layout and operation of a hand brake mechanism together with its means of compensation.</p>	<ul style="list-style-type: none"> • Ask students to: <ul style="list-style-type: none"> - Describe with the aid of sketches the layout of a single line hydraulic braking system. - Describe with the aid of sketches the action of a hydraulically operated: (i) drum brake assembly with leading and trailing shoe (ii) Disc-brake assembly. - Describe with the aid of sketches, the layout and operation of a hand brake mechanism together with its means of compensation. 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc.
General Objective 14.0: Know the braking systems and their operating principles			
Week	Specific Learning Outcome	Teachers Activities	Resources
14	<p>14.1 State the reasons for the use of hydraulically operated brakes on vehicles.</p> <p>14.2 List the safety precautions related to a hydraulic brake system.</p> <p>14.3 State the functions of a servo unit.</p> <p>14.4 Identify 4-wheel drive vehicles and their distinct features</p>	<ul style="list-style-type: none"> • Ask the students to: <ul style="list-style-type: none"> - State the reasons for the use of hydraulically operated brakes on vehicles. - List the safety precautions related to a hydraulic brake systems • State the functions of a servo unit. • Illustrate with examples and diagrams and make notes. 	Recommended textbooks, Lecture notes, Manuals, Chalkboard, Chalk, Duster, etc. Electronic fuel

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		Course Code: MEC 227	Contact Hours: 1HRS/WK
Course Specification: THEORETICAL CONTENTS			
General Objective 15.0: Know the modern features of the automobile			
Week	Specific Learning Outcome	Teachers Activities	Resources
15	<p>15.1 Explain the Electronic fuel injector (EFI) system as it replaces the carburetor</p> <p>15.2 State and explain the component parts of power steering.</p> <p>15.3 Describe the features of the electronic spark ignition as it replaces the contact-breaker unit.</p>	<ul style="list-style-type: none"> • Ask students to identify and compare and contrast the advantages and disadvantages in the modern evolutions in vehicles • Assess the students 	-do-

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		COURSE CODE: MEC 227	CONTACT HOURS 21HRS/WK
Course Specification: PRACTICAL CONTENT			
Week	General Objective 1.0: Understand the basic engine dimensions that influence the engine power rating		
	Special Learning Outcome:	Teachers Activities	Resources
1	1.1 Identify engine components such as crank case, cylinder head, crank shaft, camshaft, piston, connecting rod, sump, piston rings, timing chain, gudgeon pin, push rods, etc. 1.2 Examine each components and determine wear and tear visually and by using measuring instruments and gauge. 1.3 Observe safety rules.	Demonstrate the activities in 1.1 to 1.3 for the students to learn and ask them to carry out the activities. Assess the students	Vernier calipers, Micrometer screw gauge, torque wrench, etc. Complete knocked down (CKD) engine component Engine test bed Inspection fit.
General Objective 2.0: Demonstrate skills in the service and maintenance of fuel system.			
Week	Specific Learning Outcome	Teachers Activities	Resources
2	2.1 Perform the following auto workshop activities: <ul style="list-style-type: none"> - Replace fuel filter - Replace faulty fuel pump and adjust carburetor. - Bleed the fuel system - Adjust valve for correct clearance - Carry out a compression test - Service fuel injectors and filter 	Demonstrate all the activities for students to learn and ask them to practice. Assess the students	Complete tool box Live vehicle.

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		COURSE CODE: MEC 227	CONTACT HOURS 21HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 3.0: Demonstrate skills in service and maintenance of engine cooling and lubrication system			
Week	Specific Learning Outcome	Teachers Activities	Resources
3	3.1 Perform the following auto workshop activities: <ul style="list-style-type: none"> - Change engine oil and oil filter - Adjust fan belt tension - Change radiator water hose - Flush radiator. 	Demonstrate the activities for the students to learn and ask them to carry out the activities. Assess the students	Engine test bed Complete tools box Live vehicle
General Objective 4.0: Demonstrate skills in the service and maintenance auto electrical components			
Week	Specific Learning Outcome	Teachers Activities	Resources
4	4.1 Perform the following auto workshop activities: <ul style="list-style-type: none"> - Check battery' s state of charge using hydrometer. - Clean and/or replace battery terminals. - Charge battery. - Remove and replace alternator assembly. - Clean and set contact breaker point - Remove wiper and starter motor and replace the brushes. - Replace fuses in electrical system - Set spark plug with feeler gauge and - Check and adjust ignition timing 	Demonstrate the activities for the students to learn and allow them to perform the activities. Assess the students.	Test rings for electrical components

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		COURSE CODE: MEC 227	CONTACT HOURS 21HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 5.0: Demonstrate skills in the service and maintenance of transmission system			
Week	Specific Learning Outcome	Teachers Activities	Resources
5	5.1 Identify the clutch and the gear box 5.2 Perform the following activities: - Adjust clutch pedal clearance for mechanically controlled clutches - Check transmission oil level and top up for a gear box - Check transmission oil level and top-up for a differential gear box unit.	Demonstrate the activities in 5.1 and 5.2 for the students to learn and ask them to carry out all the activities. Assess the students.	Complete tool box Engine service pit Complete test bed Live vehicle.
General Objective 6.0: Demonstrate skills in the service and maintenance of steering mechanism			
Week	Specific Learning Outcome	Teachers Activities	Resources
6	6.1 Perform the following auto workshop activities: - Wheel alignment and balancing. - Adjust from wheel tapered roller bearings - Refill and replace shock absorbers	Demonstrate the activities in 6.1 for the students to learn and allow them to practice the activities. Assess the students	Steering gear box, Steering rack and pinion Wheel alignment machine Wheel balancing machine Old and new shock absorber
General Objective 7.0: Demonstrate skills in service and maintenance of tyres			
Week	Specific Learning Outcome	Teachers Activities	Resources
7	7.1 Perform the following auto workshop activities: - Check linkages for near and tear and carry out necessary repairs. - Check for correct tyre pressure - Check for tyre wear - Vulcanizer a punctured tube	Demonstrate the activities in 7.1 for the students to learn and ask them to perform all the activities. Assess the students.	Type pressure gauge Suspension link Tyre tread depth gauge Tyre remover equipment Tie level Vehicle tyres/tubes Tool box

PROGRAMME: NATIONAL DIPLOMA IN MECHANICAL ENGINEERING			
COURSE: AUTOMOTIVE TECHNOLOGY & PRACTICE		COURSE CODE: MEC 227	CONTACT HOURS 21HRS/WK
Course Specification: PRACTICAL CONTENT			
General Objective 8.0: Demonstrate skills in the service and maintenance of braking system			
Week	Specific Learning Outcome	Teachers Activities	Resources
8-9	<p>8.1 Perform the following auto workshop activities:</p> <ul style="list-style-type: none"> - Identify the braking system components - Bleed the brake system - Check for leakages in the brake system and carry out repairs. - Replace brake lining and pads <p>8.2 Carry out the following:</p> <ul style="list-style-type: none"> - Rekit a brake master cylinder - Rekit a brake master pot - Replace a hydraulic brake pipe <p>8.3 Identify 4-wheel drive vehicle and its features.</p>	<p>Demonstrate the activities in 8.1 to 8.3 for the students to learn and ask them to carry out all the activities</p> <p>Assess the students</p>	<p>Live vehicles</p> <p>Brake pads and lining</p> <p>Brake oil</p> <p>Complete tool box</p>
General Objective 9.0: Master the features of modern automobile			
Week	Specific Learning Outcome	Teachers Activities	Resources
10-15	<p>9.1 Identify the component parts of power steering</p> <p>9.2 Identify the features of the electronic spark ignition as it replaces the contact breaker unit.</p>	<p>Demonstrate activities in 9.1 to 9.2 for the students to learn and allow them to practice.</p> <p>Assess the students.</p>	<p>Electronic spark ignition (ESI) kits.</p> <p>Electronic fuel injector (EFI)</p> <p>A modern vehicle.</p>
<p>Assessment Profile: = PRACTICAL 40%</p> <p>TEST 10%</p> <p>EXAMINATION 50%</p>			

OUTCOMES

On completion of the module, the students should be able to:

1. Understand the practical constructional requirements of the project undertaken
2. Understand the standard format for project report writing

Course: PROJECT AND PROJECT REPORT WRITING		Course Code: MEC 200	Contact Hours: 45hrs/wks
Course Specification: Theoretical Content			
Week	General Objective 1.0: Understand the practical constructional requirements of the project undertaken		
	Specific Learning Outcome:	Teachers Activities	Resources
1-4	1.1 Identify all the components in a given circuit 1.2 Explain the functionality of a schematic/block diagram given for the project. 1.3 Plan the layout for the execution of the project on stage-by-stage basis. 1.4 Carry out the execution of the project as scheduled in (1.3) 1.5 Test the functionality of the completed project. 1.6 Carry out correction of any detected error/faults	• Teacher should give every necessary assistance to students during supervision	Chalk, board, circuit diagrams, layout and textbooks

Course: PROJECT AND PROJECT REPORT WRITING		Course Code: MEC 200	Contact Hours: 45hrs/wks
Course Specification: Theoretical Content			
General Objective 2.0: Understand the standard format for project report writing			
Week	Specific Learning Outcome	Teachers Activities	Resources
5-8	<p>2.1 Explain the purpose of each of the following sections of a project report.</p> <ol style="list-style-type: none"> Cover page Title page Approval page Declaration page Table of contents Acknowledgements Abstract/Summary List of symbols/abbreviations List of tables List of figures Body of the project report, divided into chapters References Appendices <p>2.2 Explain the standard format of writing items (i) - (x) in 2.1 above. Arrange the body of the project report, according to the following chapters:</p> <p>2.3 Explain the standard format of writing references in regards to the following:</p> <ol style="list-style-type: none"> textbooks journals past students' projects lecturer notes newspapers/magazine seminars/workshops, etc <p>2.4 Explain the standard format of presenting appendices in the form of</p> <ol style="list-style-type: none"> tables diagrams parts list, graphs, etc 	<ul style="list-style-type: none"> Explain to the students the approved format of writing technical reports <p>Show samples of project reports in the standard format</p>	-do-

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Week	Specific Learning Outcome	Teachers Activities	Resources
9-15	<p>Chapter 1 Introduction: Purpose and scope of the project, principle of operation, limitation</p> <p>Chapter 2 Literature Review: Review of theory relating to the project topic, review previous studies, methods or works done by other authors or previous students' projects.</p> <p>Chapter 3 Construction: State-by-stage procedure for the construction, (including well-labelled working diagrams and pictures (if need be).</p> <p>Chapter 4 Testing, Results and Discussion: Test procedures (including safety precautions), Presentation of results (including where necessary, tables graphs, calculators etc)</p> <p>Chapter 5 Conclusion & Recommendation: Compare results with theory, stating reasons for difference(s), recommendations for further work, if need be.</p>	<ul style="list-style-type: none"> • Guide the students to present their project reports in format of technical report 	-do-
Assessment: The project, report writing and project defence will be awarded 100% of the total score.			