

*NVC in Electrical Installation and Repair Work (Draft)*

**NATIONAL BOARD FOR TECHNICAL EDUCATION  
KADUNA**

**NATIONAL VOCATIONAL CERTIFICATE**

**IN**

**ELECTRICAL INSTALLATION AND REPAIR WORK**

**CURRICULUM AND COURSE SPECIFICATION**

**2007**

**PLOT 'B' BIDA ROAD, P.M.B 2239, KADUNA-NIGERIA**

**N B T E**

# **NATIONAL VOCATIONAL CERTIFICATE IN ELECTRICAL INSTALLATION AND REPAIR WORK**

## **1.0 Programme Nomenclature**

**National Vocational Certificate in Electrical Installation and Repair Work.**

### **Goal and Objectives**

**Goal:** The goal of the NVC in Electrical Installation and Repair work is to Produce Competent hands with job knowledge and practical skills for a successful career in electrical installation and repair work.

**Objectives:** On completion of course, a graduate of NVC in Electrical installation and Repair works should be able to:

- (i) To carry out with expertise domestic and industrial electrical installation works.
- (ii) Detect and repair faults in domestic/industrial appliances.
- (iii) Carry out the various tests on new and existing electrical installation.
- (iv) Install and rewind electrical machines and other portable electrical devices.
- (v) Interpret electrical working drawings and manuals.

## **2.0 Entry requirements for National Vocational Certificate in Electrical Installation and Repair work.**

The general entry requirements for the NVC programme are:

- i. Basic Education products (Post-JSS) students with requisite credits in Junior School Certificate (JSC) or NECO
- ii. Post-Secondary students who are unable to gain access to higher education or IEs, who may have less than 5 credits

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## CURRICULUM TABLE FOR NVC IN ELECTRICAL INSTALLATION AND REPAIR WORK

S/N	MODULE	CODE	YEAR 1						YEAR 2						YEAR 3						
			TERM 1		TERM 2		TERM 3		TERM 1		TERM 2		TERM 3		TERM 1		TERM 2		TERM 3		
			T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	
1	Technical drawing *	TD	1	2	1	2	1	2	1	2	1	2	1	2							216
2	General Metal Work*	GMW	1	3	1	3	1	3													144
3	Basic Electricity and Electronics	CEI 14	1	3	1	3	1	3													144
4	Introduction to Domestic Electrical Appliances	CEI 16							1	3	1	3	1	3							144
5	Domestic Installations	CEI 11	1	4	1	4	1	4	1	3	1	3	1	3							324
6	Industrial Installations	CEI 15							1	3	1	3	1	3	1	4	1	4	1	4	324
7	Cable Jointing	CEI 12													1	3	1	3	1	3	144
8	Winding of Electrical Machines	CEI 13							1	3	1	3	1	3	1	3	1	3	1	3	288
10	English & communication *	CSK*	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	216
11	Entrepreneurship *	ENT*													2	0	2	0	2	0	72
12	Physics *	PHY*	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	324
13	Introduction to Computer *	ICT*	1	2	1	2	1	2							1	2	1	2	1	2	216
14	Mathematics *	VMT*	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	216
15	Chemistry *	CHM*	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	324
			11	18	11	18	11	18	11	18	11	18	11	18	12	16	12	16	12	16	

\* See general studies curriculum

**NOTE:** Industrial attachment with minimum of **3 months/year**

**PROGRAMME:** NVC in Electrical Installation and Repair.

**COURSE:** Domestic Installation.

**CODE:** CEI 11

**DURATION:** 324 Hrs/term

**GOAL:** This module is intended to arm the trainee with the knowledge and skill necessary to carry out complete electrical installation in a building and its associated equipment.

**GENERAL OBJECTIVES:**

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

1. Know safety rules and regulation in electrical installation works.
2. Know the types of tools and their uses in domestic installation
3. Know how to interpret electrical working diagram in given situation.
4. Know the principle of operation of protective device in domestic installation
5. Understand the sequence of inspecting and testing domestic installation.
6. Know different types of surface and conduit wiring in domestic installation.
7. Understand the concept of illumination and the types of lamps for illumination.
8. Know the types electrical faults and how to rectify them.

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<b>PROGRAMME:</b> NVC in Electrical Installation						
<b>COURSE:</b> Domestic Installation		<b>COURSE CODE:</b> CEI 11			<b>CONTACT HOURS:</b> 324	
<b>GOAL:</b> : This module is intended to equip the trainee with the knowledge and skill necessary to carry out complete electrical installation in a building and its associated equipment						
<b>COURSE SPECIFICATION: Theoretical content</b>				<b>Practical Content</b>		
<b>General Objective: 1.0</b> Know safety rules and regulations in domestic electrical works.				<b>General Objective: 1.0</b> Know safety rules and regulations involved in domestic installation		
<b>WEEK</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
1	1.1 State common sources of hazard in electrical installation and ways of preventing them. 1.2 State rules and regulations in domestic electrical works. 1.3 Name safety equipment and wears essential in electrical installation works. 1.4 Explain the appropriate procedures in the event of a workshop accident 1.5 Explain the distribution system from a drawing.	<ul style="list-style-type: none"> <li>• Name the types of hazards</li> <li>• Explain briefly ways of preventing hazards in domestic installation</li> <li>• List the rules and regulations to observe in electrical installation</li> <li>• Assess the student</li> <li>• Explain the procedures involved in the event of workshop</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Flip chart.</li> </ul>	1.1 Demonstrate how to prevent electric hazard in a workshop. 1.2 Demonstrate how to wear safety equipment. 1.3 Demonstrate how to assist some one involved in workshop accident	<ul style="list-style-type: none"> <li>• Use the equipment to demonstrate.</li> <li>• One student to dramatise</li> </ul>	<ul style="list-style-type: none"> <li>• Chart</li> <li>• Safety equipment</li> </ul>

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		accident			
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	<b>General Objective: 2.0</b> Know types of tools and how to use them in domestic installation works.			<b>General Objective: 2.0</b> know the application of types of tools in domestic installation works		
<b>WEEK</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
2	2.1 List the various tools used in domestic installation 2.2 State the uses of each tool in carrying out domestic installation work 2.3 Explain how to maintain the tools	<ul style="list-style-type: none"> <li>• List the tools on the chalkboard</li> <li>• Explain with detailed notes the uses of listed tools</li> <li>• Explain ways of maintenance of the tools</li> <li>• Assess the student</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Flip chart.</li> </ul>	2.1 Identify the different types of tools used in domestic installation 2.2 Explain how the tools are used. 2.3 List the ways by which these tools can be maintained.	<ul style="list-style-type: none"> <li>• Show the different tools</li> <li>• Demonstrate the use of each tool</li> <li>• Demonstrate how to maintain the tools</li> </ul>	<ul style="list-style-type: none"> <li>• Tools</li> <li>• Flip chart</li> <li>• Audio-visual device</li> </ul>



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	<b>General Objective: 3.0</b> Know how to interpret electrical working diagram in given situation.			<b>General Objective:3.0</b> Know how to interpret electrical working diagram		
<b>WEEK</b>	<b>Specific Learning Outcome</b>	<b>Teacher’s Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>3</b>	3.1 Identify symbols used in electrical engineering drawing of an electrical installation. 3.2 Explain the scale used in working drawing. 3.3 Locate the position of the various accessories on a drawing. 3.4 List all the electrical accessories required for a job from working drawing 3.5 Explain the distribution system from a drawing	<ul style="list-style-type: none"> <li>• Give a detailed note and draw each standard symbol.</li> <li>• Explain the meaning of each symbol.</li> <li>• Give example of the scale-Rule.</li> <li>• Assess the student</li> <li>• Explain each item of accessories on the list.</li> <li>• Show with the aid of drawing, the appropriate position of the distribution units for single and polyphase</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Drawing Rule –scale</li> <li>• Working drawing</li> <li>• Flip chart</li> </ul>	3.1 Show the different symbols used in electrical drawing. 3.2 Demonstrate the scale-rule application on sample working drawing. 3.3 Show on the working drawing the position of symbols. 3.4 Demonstrate by placing symbol on working drawing plan. 3.5 Draw a wiring plan of a two bedroom apartment.	<ul style="list-style-type: none"> <li>• Draw each standard symbol.</li> <li>• Ask questions and use example to test student</li> <li>• Assess the student</li> <li>• Give student a simple working drawing to develop and interpret</li> <li>• Assess the student drawing</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Television, video M/C</li> <li>• Working drawing</li> <li>• Drawing Rule scale.</li> <li>• Flip chart.</li> <li>• Drawing paper</li> <li>• Marker pens</li> </ul>

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		<p>phases &amp; neutral.</p> <ul style="list-style-type: none"><li>• Use question and answer to determine the student understanding</li><li>• Assess the Students</li></ul>				
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	<b>General Objective: 4.0</b> Know the principle of operation of protective device in domestic installation			<b>General Objective: 4.0</b> Know the operations of protective device in domestic installation		
<b>W/K</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>4-5</b>	4.1 Identify common types of protective devices. 4.2 Explain the principle and application of circuit breaker and fuses in electrical installation. 4.3 Determine current rating of fuses. 4.4 Explain the concept of earthing, its function to electrical devices. 4.5 Explain the regulation relating to various types of protective devices. 4.6 Use current and voltage operated earth leakage circuit breaker, observing relevant regulations.	<ul style="list-style-type: none"> <li>List the common types of protective devices.</li> <li>Give detailed notes to emphasise the working principles and application of circuit breaker and fuses.</li> <li>Assess the students.</li> <li>Explain fuses current rating in respect of fusing factor and current.</li> <li>Explain the purpose of</li> </ul>	<ul style="list-style-type: none"> <li>Charts</li> <li>Single phase circuit breaker.</li> <li>Fuses</li> <li>3 phase breaker</li> <li>IEE Tables for current rating.</li> <li>Chalkboard</li> <li>Flip chart.</li> <li>ELCB and fuse link.</li> </ul>	<ul style="list-style-type: none"> <li>Identify common types of protective devices</li> <li>Describe working principles of circuit breaker.</li> <li>Demonstrate working principles of fuses</li> <li>Demonstrate working principles of ELCB</li> <li>Demonstrate how earthing is carried out</li> </ul>	<ul style="list-style-type: none"> <li>Show student the common types of protective such as circuit breaker and fuse e.t.c</li> <li>Describe how they protect electrical devices</li> <li>Show student how to carry out earthing system</li> </ul>	<ul style="list-style-type: none"> <li>Charts</li> <li>Single phase circuit breaker.</li> <li>Fuses</li> <li>3 phase breaker</li> <li>IEE Tables for current rating.</li> <li>Chalkboard</li> <li>Flip chart.</li> <li>ELCB and fuse link.</li> </ul>

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		<p>earthing installation and devices.</p> <ul style="list-style-type: none"><li>• Explain the regulations concerning breakers and fuses.</li><li>• Select earth leakage circuit breaker for single and three phase dwelling</li></ul>		<p>in domestic installation</p>		
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	<b>General Objective: 5.0</b> Understand the sequence of inspecting and testing in domestic installation.			<b>General Objective: 5.0</b> Understand inspecting and testing processes in domestic installation		
<b>W/K</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>6</b>	5.1 Apply statutory safety regulations for life, properties and environment. 5.2 Visually detect electrical and mechanical loose connections. 5.3 Explain three types of electrical installation test	<ul style="list-style-type: none"> <li>• Relate statutory regulations in electrical installation environment.</li> <li>• Explain how to inspect electrical and mechanical connections to avoid partial contact.</li> <li>• Prepare notes that will clearly explain the function of listed tools in (2.3).</li> <li>• Asses the student</li> </ul>	<ul style="list-style-type: none"> <li>• IEE Regulation</li> <li>• Chalkboard</li> <li>• Multimeter, bell, battery, test lamp.</li> </ul>	5.1 Explain polarity test. on an installation 5.2 Carry out insulation test 5.3 Carry out earth leakage test 5.4 Carry out continuity test	<ul style="list-style-type: none"> <li>• Demonstrate polarity test using bell and battery, test lamp, multimeter</li> <li>• Show the various test device and the way to take reading</li> <li>• Demonstrate insulation test</li> <li>• Demonstrate earth leakage test</li> <li>• Demonstrate continuity test</li> </ul>	<ul style="list-style-type: none"> <li>• Multimeter</li> <li>• Bell, battery</li> <li>• Test lamp</li> <li>• meggar</li> </ul>

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W/K	<b>General Objective: 6.0</b> Know the different types of surface and conduit wiring in domestic installation.			<b>General Objective: 6.0</b> Know the application of different types of surface and conduit wiring in domestic installation		
7-9	6.1 Explain the concept of surface wiring. 6.2 State the types and sizes of cables used for domestic installation. 6.3 Explain the relevant statutory regulations regarding surface wiring 6.4 State tools used for carrying out domestic installation. 6.5 Apply the regulation of PHCN on domestic wiring. 6.6 Explain the meaning of conduit 6.7 State the advantage and disadvantage of conduit installation. 6.8 Identify types of conduits; steel conduit, flexible conduit and PVC conduit.	<ul style="list-style-type: none"> <li>• Give detailed notes and explanations on surface and conduit wiring.</li> <li>• Asses the student by asking questions</li> <li>• Explain regulations with respect to surface wiring.</li> <li>• Use chart to explain conduit wiring.</li> <li>• Discuss advantages and disadvantages of conduit wiring.</li> <li>• Assess the student.</li> <li>• Explain</li> </ul>	<ul style="list-style-type: none"> <li>• Video and Television including cassettes on production process, textbook, chalk, board, chart.</li> <li>• Surface wiring material and basic tools</li> <li>• Cable display board</li> <li>• IEE Regulation</li> <li>• Steel</li> </ul>	<ul style="list-style-type: none"> <li>• Identify cable types and sizes used for domestic installation.</li> <li>• Use cable, basic tools and surface wiring material to demonstrate surface wiring.</li> <li>• Surface wire an installation of two lighting points controlled by independent</li> </ul>	<ul style="list-style-type: none"> <li>• Show clips, gimlet, raw plug and drill. Explain how to use these tools</li> <li>• Show assorted types of cables sizes.</li> <li>• Guide student to carry out surface wiring and allow student to try until they become competent.</li> <li>• Guide student to mark out cable runs on wire board</li> <li>• Cut PVC twin core cable to specification</li> <li>• Assemble cables and accessories on</li> </ul>	<ul style="list-style-type: none"> <li>• Surface wiring material and basic tools</li> <li>• Cable display board.</li> <li>• Megger</li> <li>• Transparency sheet</li> <li>• Drawing instrument, tape</li> <li>• Accessories, PVC twin core 110mm, nails, wooden board, ruler</li> <li>• Hack saw</li> <li>• Taps and dies</li> <li>• Reamer</li> <li>• Saddles</li> </ul>

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	<p>6.9 State the application of stuck and dice, hacksaw etc.</p> <p>6.9 Explain appropriate procedures for preparing conduit installation.</p> <p>6.10 Explain the use of running coupler, conduit boxes, bend elbows, tees, and other accessories for conduit work</p> <p>6.11 Determine set and bend permissible radial length.</p>	<p>regulations guiding conduit installation.</p> <ul style="list-style-type: none"> <li>• Show how to do continuity test, insulation test and polarity test.</li> <li>• Describe how to maintain tools and equipment for conduit installation.</li> </ul>	<p>conduit</p> <ul style="list-style-type: none"> <li>• PVC conduit</li> <li>• Flexible conduit</li> <li>• Running coupler set</li> <li>• Bends</li> <li>• Set 90 degrees, 45 degrees and bend.</li> <li>• Conduit length, fish wire.</li> <li>• Multimeter &amp; meggar</li> <li>• Hand tools e.t.c</li> </ul>	<p>switches using PVC cable.</p> <ul style="list-style-type: none"> <li>• Identify types of conduits; steel, flexible, PVC etc.</li> <li>• State the application of stuck and dice, hacksaw etc</li> <li>• Using steel conduit wire a lighting point, controlled by two-2way switches</li> <li>• Determine the permissible radial length of bend.</li> <li>• Draw in cable using fish -wire</li> <li>• Test the installation</li> </ul>	<p>the wiring board</p> <ul style="list-style-type: none"> <li>• Show assorted conduit pipes</li> <li>• Guide student to cut conduit pipes with hacksaw to given specification and dimensions</li> <li>• Clean burs at the end of each conduit pipe length-using reamer.</li> <li>• Assemble prepared conduit pipes &amp; cables with all accessories on wiring board.</li> <li>• Conduct polarity, continuity and insulation tests.</li> </ul>	<ul style="list-style-type: none"> <li>• Screw</li> <li>• PVC vice</li> <li>• Conduit accessories</li> </ul>
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				as stipulated by statutory regulations		
				<ul style="list-style-type: none"><li>• Maintain tools and equipment used in conduit installation.</li></ul>		



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	<b>General Objective: 7.0</b> Understand the concept of illumination and the types of lamps for illumination			<b>General Objective: 7.0</b> know the application lamps for illumination		
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
10	7.1 Define the following terms in respect of illumination: a. Luminous intensity (symbol I) b. Luminous flux c. Illumination (symbol E) 7.2 Define the following terms: a. Coefficient of utilization b. Repair factor 7.3 Explain spacing/mounting height ratio. 7.4 State the different types of lamps 7.5 Name different types of fluorescent lamps. 7.6 Explain Emergency lighting, Shades, and Reflectors.	<ul style="list-style-type: none"> <li>• Give notes and assess the student on illumination</li> <li>• Explain luminous intensity and flux with respect to types of lamps.</li> <li>• Explain Coefficient of Utilization and Repair factor.</li> <li>• List the types of lamps.</li> <li>• List different types of fluorescent lamps</li> <li>• Show the emergence light, shades and reflectors</li> </ul>	<ul style="list-style-type: none"> <li>• Lesson notes</li> <li>• Diagram and charts.</li> <li>• Incandescent lamp</li> <li>• Fluorescent lamp</li> <li>• Illumination charts</li> <li>• Flip charts</li> <li>• Chalkboard</li> <li>• Calculator</li> <li>• Lamps</li> </ul>	Identify different types of lamps Assemble fluorescent fittings	<ul style="list-style-type: none"> <li>• Assess the students</li> <li>• Describe using sketches the incandescent lamp, tungsten filament lamp, gas filled tungsten filament lamp, Neon tube, hot &amp; cold cathode.</li> </ul>	<ul style="list-style-type: none"> <li>• Materials for project</li> <li>• Flip chart</li> <li>• Various lamps</li> <li>• Chalkboard</li> </ul>

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	<b>General Objective:</b> 8.0 Know the types of Electrical faults and how to rectify them.			<b>General Objective:</b> 8.0 Know how to detect electrical faults and ways to rectify them		
<b>WEEK</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>11-12</b>	8.1 Explain types of electrical fault in domestic Installation.  8.2 Explain earth leakage fault.  8.3 Explain short circuit faults.  8.4 Explain	<ul style="list-style-type: none"> <li>• List common type of fault.</li> <li>• Give notes to explain earth leakage fault.</li> <li>• Explain with the aid of detailed notes the effect of short circuit.</li> </ul>	<ul style="list-style-type: none"> <li>• Audio/visual.</li> <li>• Chart.</li> <li>• Demonstration board.</li> <li>• Cable board</li> <li>• Graph diagram</li> </ul>	<ul style="list-style-type: none"> <li>• Carry out test to demonstrate earth leakage fault.</li> <li>• Carry out test to demonstrate short circuit fault</li> <li>• Carry out test to demonstrate over loading faults</li> <li>• Carry out test to</li> </ul>	<ul style="list-style-type: none"> <li>• Show with the aid of demonstration board how to detect earth leakage faults.</li> <li>• Show with the aid of demonstration board how to detect               <ul style="list-style-type: none"> <li>(a) Short circuit fault.</li> <li>(b) Over loading fault</li> <li>(c) Insulation break down fault.</li> </ul> </li> <li>• Show student earthing terminal.</li> </ul>	<ul style="list-style-type: none"> <li>• Audiovisual.</li> <li>• Circuit breakers.</li> <li>• ELCB</li> <li>• MCB</li> <li>• Audio/visual</li> <li>• Charts.</li> </ul>

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	<p>over loading faults.</p> <p>8.5 Explain insulation break down faults.</p> <p>8.6 Explain earth continuity conductor earthing lead and earthing rod</p>	<ul style="list-style-type: none"> <li>• Explain the causes of over loading and the effect.</li> <li>• Explain the causes of insulation breaking down.</li> <li>• List three conductors for earthing .</li> </ul>		<p>demonstrate break down faults.</p> <ul style="list-style-type: none"> <li>• Demonstrate how to earth an Installation</li> </ul>		
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**EVALUATION GUIDE**

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To pass this module the student must be able to successfully carry out/perform domestic electrical installation

**ALLOMENT OF MARKS**

**THEORY**     **20%**

**PRACTICAL (practice)**     **80%**

<b>PROGRAMME:</b> NVC IN Electrical Installation and Repair work
<b>COURSE:</b> Cable jointing
<b>CODE:</b> CEI 12

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**DURATION: 144Hrs/term**

**GOAL:** The course is designed to provide trainee with the basic knowledge and skill to apply various methods of cable jointing and terminations in an electrical installation and repair work.

**GENERAL OBJECTIVES:**

On completion of this module, the student should:

- 1.0 Know the types of joints, terminations of cable and the safety precautions involved.
- 2.0 Know various types of armoured cables and their applications.
- 3.0 Know the installation of underground cables
- 4.0 Know the installation of overhead conductor for distribution/transmission system.

<b>PROGRAMME:</b> NVC in Electrical Installation		
<b>COURSE:</b> Cable jointing	<b>COURSE CODE:</b> C EI 12	<b>CONTACT HOURS:</b> 144
<b>GOAL:</b> : The course is designed to provide trainee with the basic knowledge and skill to carry out various methods of cable jointing and terminations		

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<b>COURSE SPECIFICATION: Theoretical content</b>				<b>Practical Content</b>		
	<b>General Objective: 1.0 Know</b> the different types joints, terminations of cable and the safety precautions involved.			<b>General Objective: 1.0 Know</b> how to carry out different types of joints and termination in cables		
<b>WEEK</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
1-2	1.1 Identify the tools and materials related to cable jointing. 1.2 Explain the use of tools and materials related to cable jointing and termination such as soldering bit, blow lamp e.t.c 1.3 Recognize different types of insulating materials e.g PVC cables e.t.c. 1.4 Identify different types of conductors e.g Copper, Aluminium, e.t.c 1.5 State the advantages and disadvantages of different conducting materials 1.6 Show how to connect appliances and accessories into their terminal correctly. 1.7 Explain the safety regulation involved in joints and termination operations	<ul style="list-style-type: none"> <li>• Explain and show tools and equipment used in joints and soldering</li> <li>• Describe the procedure for cable joint. Highlight the sizes and uses</li> <li>• Show insulating materials</li> <li>• Display and explain different insulating materials. Show conductors.</li> <li>• Explain the advantages and</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Tools</li> <li>• Equipment</li> <li>• Materials</li> <li>• Different sizes of cables</li> <li>• PVC cables</li> <li>• Conductors</li> <li>• Insulators</li> <li>• Lugs</li> <li>• Cables</li> <li>• Glands</li> <li>• Cables</li> </ul>	1.1 Show the different tools and materials for cable jointing. 1.2 Show on the working drawing. 1.3 Prepare PVC taped and braided cables for termination. 1.4 Join two lengths of cables with related materials for joints e.g soldering bit, lamp 1.5 Prepare cable joints for insulation using rubber tape and PVC. 1.6 Make different types of joints using prepared cable end 1.7 Melt the solder and skin any impurity from the surface and warm the ladle 1.8 Fill the socket with problem solder and tip it out quickly	<ul style="list-style-type: none"> <li>• Demonstrate how to use the tools and materials</li> <li>• Show student the different types of cables as well as insulators.</li> <li>• Ask questions and use examples to test student</li> <li>• Assess the student</li> <li>• Show how to make married and tee joints.</li> <li>• Demonstrate how to prepare PVC taped and braided cables for termination.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Cable</li> <li>• Tools</li> <li>• Materials</li> </ul>

*NVC in Electrical Installation and Repair Work (Draft)*

		<p>disadvantages of conductors displayed</p> <ul style="list-style-type: none"> <li>• Describe how to prepare cable joint.</li> <li>• Demonstrate shaping of conductor</li> <li>• Show how to fix accessories to terminals</li> <li>• Explain the selection of lugs and glands used for termination</li> </ul>		<p>1.9 Select the right size of cable lugs and glands.</p> <p>2.0 Test for electrical continuity, short circuit and insulation resistance.</p>	<ul style="list-style-type: none"> <li>• Show how to join length of cable and the related materials for joints i.e soldering bit, lamp etc.</li> <li>• Prepare different cable joints for insulation using rubber tape and PVC</li> <li>• Prepare different types of joints using appropriate cable end</li> <li>• Demonstrate how to melt the solder skin and any impurity from surface and warm the ladle.</li> <li>• Show how to</li> </ul>	
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*NVC in Electrical Installation and Repair Work (Draft)*

					<p>fill the socket with molten solder and cable</p> <ul style="list-style-type: none"><li>• Demonstrate how to test for electrical continuity, short circuit and insulation resistance by using necessary instruments</li></ul>	
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*NVC in Electrical Installation and Repair Work (Draft)*

		<b>General Objective: 2.0</b> Know various types of armoured cables and their applications.		<b>General Objective: 2.0</b> Know the application of various types of armoured cables.		
<b>W/K</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>3-4</b>	2.1 Explain the safety rules and regulations involved in cable jointing. 2.2 Explain why armouring is necessary 2.3 Determine current rating of fuses. 2.4 Explain the application of armouring cable. 2.5 Describe with the aid of a diagram the constructional features of armoured cable. 2.6 Recognise the types of armouring materials	<ul style="list-style-type: none"> <li>• List safety rules and regulations in cable jointing.</li> <li>• Explain the usefulness of armouring</li> <li>• Give the application of armoured cable.</li> <li>• Draw and show the constructional parts of armoured cable</li> <li>• Demonstrate how to terminate armoured cable.</li> </ul>	<ul style="list-style-type: none"> <li>• Charts</li> <li>• Armoured cable</li> <li>• Chalkboard</li> <li>• Raychem kit</li> </ul>	2.1 Observe safety rules and regulations involved in cable jointing 2.2 Select and prepare different types of armoured cable ends 2.3 Join and terminate armoured cables at intermediate positions	<ul style="list-style-type: none"> <li>• Asses the student</li> <li>• Guide student to prepare different types of armoured cable ends ready for termination.</li> <li>• Demonstrate how to join and terminate armoured cables at intermediate positions.</li> <li>• Demonstrate how to amend wounded armoured cable</li> </ul>	<ul style="list-style-type: none"> <li>• Charts</li> <li>• Cable</li> <li>• Material</li> <li>• Tools</li> <li>• Measuring instrument</li> </ul>

*NVC in Electrical Installation and Repair Work (Draft)*

<b>General Objective: 3.0</b> Know the installation of underground cables				<b>General Objective: 3.0</b> Know how to install underground cables.		
<b>W/K</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>5-9</b>	3.1 Select appropriate types of cables for underground electrical installation works e.g Heeled cable, Screwed or H – type cable, HSL – type cable, (screwed lead), single and three core 132KV oil filled cable, external gas pressure impregnated cable PVC armoured. 3.2 Identify various materials and tools used for joints and termination in underground cables 3.3 Make cables joints/termination e.g tee, straight, final terminations 3.4 Identify types of insulation used in underground cable 3.5 Apply IEE regulation relevant to underground cable works	<ul style="list-style-type: none"> <li>• Explain factors affecting underground cables and the type of cable needed for underground system</li> <li>• Ask question on above</li> <li>• Demonstrate how to prepare trench depth for cable laying</li> <li>• Show how to lay cable in trench using Jacks, rollers etc</li> <li>• Show tools and equipment used in terminating underground cable</li> <li>• Explain all safety precaution and regulations.</li> <li>• Solder a joint. Show different types used in underground cable.</li> </ul>	<ul style="list-style-type: none"> <li>• IEE Regulation</li> <li>• Chalkboard</li> <li>• Materials for preparing trench</li> <li>• Glands boxes</li> <li>• Gas</li> <li>• Jack and rollers</li> </ul>	3.1 Dig and prepare ground for laying underground cable 3.2 Show how to use pot and ladle in joining/soldering underground cable 3.3 Demonstrate how to repair damaged underground armoured cable 3.4 Use Megger to test for continuity, insulation resistance etc. 3.5 Lay cable in prepared trench using appropriate method. 3.6 Student to visit an underground cable installation activity	<ul style="list-style-type: none"> <li>• Show how to dig and prepare ground for laying underground cable.</li> <li>• Demonstrate how to use pot and ladle in soldering/jointing underground armoured cable</li> <li>• Show how to repair damaged underground armoured cable</li> <li>• Demonstrate how to use Megger to</li> </ul>	<ul style="list-style-type: none"> <li>• Tools</li> <li>• Instrument</li> <li>• Cable</li> <li>• Materials</li> <li>• Site</li> <li>• Damaged underground armoured cable.</li> <li>• Digger</li> <li>• shovel</li> </ul>

*NVC in Electrical Installation and Repair Work (Draft)*

		<p>Explain fully all IEE regulation guiding underground. Use Megger to test conformity of cable and insulation assistance.</p> <ul style="list-style-type: none"> <li>• Explain the principle of operation of instruments used in testing underground work of bridge Megger slide wire etc</li> </ul>			<p>test for continuity, insulation resistance etc.</p> <ul style="list-style-type: none"> <li>• Show how to lay cable in prepared trench using appropriate method.</li> </ul>	
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<b>General Objective: 4.0</b> Know the installation of overhead conductor for distribution/transmission system.	<b>General Objective: 4.0</b> Know how to install overhead conduct for distribution/transmission system.
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*NVC in Electrical Installation and Repair Work (Draft)*

W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
10-11	<p>4.1 Identify conductor, tools and equipment used in overhead Distribution/transmission e.g. draw vices, safety belt, ladder and insulators.</p> <p>4.2. Explain the erection of poles to specification e.g. erect at appropriate poles span and firmly in the ground.</p> <p>4.3 Explain the function of stay wire</p> <p>4.4 Explain the uses, and types of cross-arms used in high tension transmission.</p> <p>4.5 Explain the types and uses of insulator on overhead lines.</p>	<ul style="list-style-type: none"> <li>• Give detailed notes and explanations Asses the student.</li> <li>• Explain transmission and distribution stating tools and equipment used in the two systems.</li> <li>• Describe stay wire and its function</li> <li>• Show and demonstrate cross-arms used in transmission line</li> </ul>	<ul style="list-style-type: none"> <li>• Draw vice</li> <li>• Safety belt</li> <li>• Ladder</li> <li>• Stay wire</li> <li>• Pole</li> <li>• Pole stay wire</li> <li>• Pole, cross arm</li> <li>• Cables</li> <li>• Stay block</li> <li>• Stay insulator</li> </ul>	<ul style="list-style-type: none"> <li>• Select conductor and tools used in overhead transmission and distribution system.</li> <li>• Describe how to dig and erect poles with stay.</li> <li>• Draw lines with appropriate tools</li> <li>• Make proper joints and termination where applicable.</li> <li>• Identify various sizes of overhead conductors</li> <li>• Identify types of insulators</li> <li>• Carry out installation of overhead conductor</li> </ul>	<ul style="list-style-type: none"> <li>• Guide student to select conductor and tools used in overhead transmission and distribution system.</li> <li>• Show how to dig and erect poles with stay</li> <li>• Demonstrate how to draw lines with appropriate tools e.g. vice etc</li> <li>• Show how to make proper joints and terminations where applicable.</li> <li>• Show different sizes of overhead conductor and where to apply them.</li> </ul>	<ul style="list-style-type: none"> <li>• Poles</li> <li>• Tools</li> <li>• Vice</li> <li>• Materials</li> <li>• Conductor</li> <li>• Insulator</li> <li>• Ladder</li> <li>• Safety boot</li> <li>• Safety belt</li> <li>• Hamlet etc</li> </ul>

*NVC in Electrical Installation and Repair Work (Draft)*

					<ul style="list-style-type: none"><li>• Show different types of insulators and their usage.</li></ul>	
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## **EVALUATION GUIDE**

To pass this module the student must be able to successfully join and terminate cable both for underground and overhead system.

### **ALLOMENT OF MARKS**

**THEORY**      **20%**

**PRACTICAL (practice)**      **80%**

<b>PROGRAMME:</b> NVC IN Electrical Installation and Repair work
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*NVC in Electrical Installation and Repair Work (Draft)*

**COURSE:** Winding of electrical machines

**CODE:** CEI 13

**DURATION:** 288

**GOAL:** The module is aimed at providing the trainee with the knowledge and skill necessary to carry out wind or rewind of AC and DC machines up to 10 KVA

**GENERAL OBJECTIVES:** On completion of this module, the student should:

- 1.0 Understand the concept and application of all statutory regulations during electrical winding work
- 2.0 Know the appropriate tools and equipment for winding jobs
- 3.0 Acquire skills for preparing and interpreting winding drawing.
- 4.0 Acquire skills for dismantling and rewinding electrical machines
- 5.0 Know how to rewind faulty and burnt electrical machines
- 6.0 Know the skimming/undercutting of armature, commutator and slip rings
- 7.0 Know how to inspect rewound electrical machines and equipment and test for continuity, insulation, correct rotating voltage.

**PROGRAMME:** NVC in Electrical Installation

*NVC in Electrical Installation and Repair Work (Draft)*

COURSE: Winding of electrical machines		COURSE CODE: CEI 13		CONTACT HOURS 288		
GOAL: The module is aimed at providing the trainee with the knowledge and skill necessary to carry out wind or rewind of AC and DC machines up to 10 KVA						
COURSE SPECIFICATION: Theoretical content				Practical Content		
General Objective: 1.0 Understand the concept and application of all statutory regulations during electrical winding work				General Objective: 1.0 Know the application of all statutory regulations in electrical winding work.		
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
1-2	1.1 Apply general safety precaution in an electrical workshop. 1.2 Apply the prevailing statutory regulation as it concerns: The use of conductors, Soldering of joints, Setting of winding machines, Handling of cable drums and Use of liquid varnish and oven	<ul style="list-style-type: none"> <li>• Explain relevant regulations on the use of conductors, soldering, winding drums, varnish and oven.</li> <li>• Explain the relevant safety precautions in an electrical workshop</li> <li>• Assess the student</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Relevant statutory regulations</li> <li>• Chart</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to apply the regulation in setting of winding machines, soldering termination</li> </ul>	<ul style="list-style-type: none"> <li>• use flip chart to illustrate soldering of joints, setting of winding machines, the use of conductors</li> </ul>	<ul style="list-style-type: none"> <li>• Chart</li> </ul>

General Objective: 2.0 Know the appropriate tools and equipment for winding	General Objective: 2.0 Know the application of tools and
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***NVC in Electrical Installation and Repair Work (Draft)***

		jobs		equipment used for winding jobs.		
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
3	2.1 Identify the following tools: hammers, screwdrivers, spanners, crimping tools, hacksaws, knives, mallets, growlers, work benches, winding machines etc. 2.2 Explain what manual winding machine is. 2.3 Explain what electric winding machine is.	2.1 List tools used in winding work and enumerate their applications. 2.2 Analyse manual and electric winding machines	<ul style="list-style-type: none"> <li>• Charts</li> <li>• Mechanical tool box</li> <li>• Electrical tool box</li> <li>• Chalkboard</li> <li>• Manual winding machine</li> <li>• Electric winding machine.</li> </ul>	2.1 Display basic tools and equipment used in machine winding work. 2.2 Demonstrate how the two machines works	<ul style="list-style-type: none"> <li>• Asses the student</li> <li>• Procure requisition and display basic tools</li> <li>• Itemize label and state application of tools</li> </ul>	<ul style="list-style-type: none"> <li>• Charts</li> <li>• Electrical tools</li> <li>• Mechanical tools</li> <li>• Manual winding machine</li> <li>• Electric winding machine</li> </ul>
<b>General Objective: 3.0</b> Acquire skills for preparation and interpretation of winding drawing.				<b>General Objective: 3.0</b> Know how to interpret winding drawing		
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
4	3.1 Prepare and interpret simple wave winding, drawings. 3.2 Prepare and interpret lap winding drawings 3.3 State the application of each type of winding drawing 3.4 Determine coil span per pitch, per phase, per pole	<ul style="list-style-type: none"> <li>• Draw and explain the procedure for making winding</li> <li>• Demonstrate how to carry out lap and wave windings</li> <li>• Explain the applications of lap and wave windings</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Charts, drawing</li> <li>• Starter</li> <li>• Coil</li> <li>• Exploded view of a motor</li> </ul>	3.1 Draw out on the board some segment of half wave windings 3.2 Draw on the board coli ends position on commutator and slip-rings	<ul style="list-style-type: none"> <li>• Draw and label diagrams of lap and wave windings</li> <li>• Draw and label diagrams of coils end position on</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk board</li> </ul>

*NVC in Electrical Installation and Repair Work (Draft)*

	3.5 Draw the position of coil ends on commutators and slip rings for fixed brush in a developed winding diagram	<ul style="list-style-type: none"><li>• Define and explain span and pitch as used in winding.</li><li>• Show on the chalkboard/chart coil ends position on commutator and slip- rings</li></ul>			commutator and slip rings	
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***NVC in Electrical Installation and Repair Work (Draft)***

	<b>General Objective: 4.0</b> Acquire skills for dismantling and rewinding of electrical machines			<b>General Objective: 4.0</b> Know how to dismantle and carry out rewinding operations in electrical machines.		
<b>W/K</b>	<b>Specific Learning Outcome</b>	<b>Teacher's Activities</b>	<b>Learning Resources</b>	<b>Specific Learning objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
5-7	4.1 Take and record the necessary data from nameplate 4.2 Identify front and back shields 4.3 Dismantle machines systematically: Note this includes the use of extractors 4.4 Determine types of winding/connections: gauge of winding conductor, pole pitch, number of slots, front and back winding factor 4.5 Set the position of brushes	<ul style="list-style-type: none"> <li>• Describe how to properly record information on machine nameplate before dismantling</li> <li>• Show how to identify shields</li> <li>• Practical demonstration of dismantle electric machines using core</li> <li>• Demonstrate how to notice winding connections, pitch, cross sectional area of winding conductor</li> <li>• Show how to fix and replace the brush</li> </ul>	<ul style="list-style-type: none"> <li>• Electric motor</li> <li>• Nameplate</li> <li>• Shields</li> <li>• Rotor circuit</li> <li>• Stator core</li> <li>• Carbon brushes</li> <li>• Chalk board</li> </ul>	<ul style="list-style-type: none"> <li>• Display a typical machine nameplate to the class               <ul style="list-style-type: none"> <li>• Display shields to the class</li> </ul> </li> <li>• Workshop session: dismantle a machine, using extractors</li> <li>• Demonstrate the procedure for determining winding connections pitch, cross sectional area of conductor, number of turns of old winding (burnt or bad) before commencing rewinding</li> <li>• Workshop session:</li> </ul>	<ul style="list-style-type: none"> <li>• Procure, itemize and describe name plate data</li> <li>• Show shields to the class</li> <li>• Demonstrate procedure</li> <li>• Guide student to dismantle of a machine using extractors</li> </ul>	<ul style="list-style-type: none"> <li>• Nameplate, shields, chalk and board</li> <li>• An electric machine</li> <li>• Carbon brushes</li> </ul>

***NVC in Electrical Installation and Repair Work (Draft)***

				Remove and replace worn-out brushes	
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	<b>General Objective: 5.0</b> Know how to rewind faulty and burnt electrical machines		<b>General Objective: 5.0</b> Know how to rewind burnt static/rotating machines.			
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
<b>6-9</b>	5.1 Identify types of conductor used in winding 5.2 Describe winding insulation materials 5.3 Explain classes of insulation materials commonly used in winding. 5.4 Prepare or construct winding formers 5.5 Prepare winding coil 5.6 Fix the winding coil in the slots ensuring that the slots are properly insulated. 5.7 Connect the winding using the prepared data 5.8 Test for continuity and earthing 5.9 Apply varnish and dry in oven 5.10 Test the completed work	<ul style="list-style-type: none"> <li>• Display different conductors used in winding work.</li> <li>• Show different insulation materials</li> <li>• Explain the classification/application of insulation materials</li> <li>• Demonstrate how to construct a winding former.</li> <li>• Show how winding coils are properly fixed in slots</li> <li>• Prepare simple winding coil</li> <li>• Show how to connect the winding: series/parallel (shunt) for wave/lap winding.</li> <li>• With a megger test set, show how to test</li> </ul>	<ul style="list-style-type: none"> <li>• Various conductors</li> <li>• Various insulators</li> <li>• Laminated Iron core</li> <li>• Iron formers</li> <li>• Megger test set</li> <li>• Avometer (multimeter)</li> <li>• Varnish</li> <li>• Thinner</li> <li>• Chalk board</li> <li>• Gauge wire</li> <li>• Motor</li> </ul>	5.1 Display to the class different conductors used in winding work 5.2 Identify different insulation materials used in winding work 5.3 Describe the procedures for constructing a winding former 5.4 Prepare a winding coil for a demonstration session 5.5 Demonstrate the connections/terminations for series and parallel (shunt) arrangements 5.6 Demonstrate by experiment the use of a Megger test set	<ul style="list-style-type: none"> <li>• Assess the students</li> <li>• Itemize, label and state applications</li> <li>• Itemize, label and state applications</li> <li>• Demonstrate the procedure</li> <li>• Demonstrate the procedure</li> <li>• Demonstrate how various instruction are made on a motor</li> </ul>	<ul style="list-style-type: none"> <li>• Various conductors</li> <li>• Various gauge wire</li> <li>• Various gauge wire</li> <li>• Various former cores</li> <li>• Motor</li> <li>• Megger test set</li> </ul>

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		for continuity and insulation resistance. <ul style="list-style-type: none"> <li>• Demonstrate the application of varnish</li> <li>• Carry out final test on the job before recommissioning.</li> </ul>		to determine insulation resistance etc		
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	<b>General Objective: 6.0</b> Know the skimming/undercutting of armature, commutator and slip rings	<b>General Objective: 6.0</b> Know the skimming/undercutting of armature, commutator and slip rings.
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*NVC in Electrical Installation and Repair Work (Draft)*

W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
10	6.1 Determine the effectiveness of a commutator, Skin armature commutator, Skin slip ring and Under cut commutator	<ul style="list-style-type: none"> <li>Using bar to bar test, test good commutation</li> <li>Identify various parts of a motor</li> </ul>	<ul style="list-style-type: none"> <li>Commutator: rotor</li> <li>Carbon brushes</li> <li>Glass paper</li> <li>Chalk board</li> </ul>	6.1 Demonstrate by experiment the test for good commutation	<ul style="list-style-type: none"> <li>Assess the students</li> <li>Demonstrate procedure of experiment</li> </ul>	<ul style="list-style-type: none"> <li>Commutator</li> <li>Carbon brushes</li> <li>Glass paper</li> </ul>
<b>General Objective: 7.0</b> Know how to inspect rewound electrical machines and equipment and test for continuity, insulation, and correct rotating voltage.				<b>General Objective: 7.0</b> Know how to inspect rewound electrical machines , equipment and carry out the relevant test.		
W/K	Specific Learning Outcome	Teacher's Activities	Learning Resources	Specific Learning objective	Teachers Activities	Learning Resources
11	7.1 Inspect ball bearing and other parts of machine. 7.2 Assemble systematically: ensure end shields are in position: apply grease to appropriate parts. 7.3 Test for continuity and insulation resistance using megger or bridge megger. 7.4 Test- run the machine ensuring correct rotation 7.5 Test for voltage and current with Avometer (multimeter) 7.6 Test for speed with	<ul style="list-style-type: none"> <li>Show how to conduct visual inspection of ball bearing.</li> <li>Demonstrate how to assemble machine and apply grease.</li> <li>Demonstrate how to test for continuity and insulation resistance using a megger test set</li> <li>Show how to test- run machine</li> <li>Carry out all necessary pre-commissioning tests,</li> </ul>	<ul style="list-style-type: none"> <li>Arbor press</li> <li>Bearing pullers</li> <li>Hydraulic press</li> <li>Grease</li> <li>Greaser</li> <li>Motors</li> <li>Tachometer</li> <li>Multimeter</li> <li>Avometer</li> </ul>	7.1 Demonstrate by experiment the assembling and greasing of machine parts. 7.2 Carry out testing of re-wound electric machine	<ul style="list-style-type: none"> <li>Demonstrate Procedure.</li> <li>Assist the students to test</li> </ul>	<ul style="list-style-type: none"> <li>Grease, greasers and machine parts.</li> <li>Electric machine</li> <li>multimeter</li> </ul>

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	Tachometer, ensuring conformity to manufacturer's specification	to conform to manufacturer's specifications • Demonstrate how to measure the speed of a motor using Tachometer .				
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**EVALUATION GUIDE**

*NVC in Electrical Installation and Repair Work (Draft)*

To pass this module the student must be able to successfully dismantle a small electric motor, rewind it, reassemble and test

**ALLOMENT OF MARKS**

**THEORY      20%**

**PRACTICAL (practice)      80%**

**PROGRAMMES: NVC IN ELECTRICAL INSTALLATION AND REPAIR**



*NVC in Electrical Installation and Repair Work (Draft)*

<b>COURSE: BASIC ELECTRICAL/ELECTRONICS</b>
<b>CODE: EI 14</b>
<b>DURATION: 144 Hrs/term</b>
<b>GOAL: The module is intended to provide the trainee with the fundamental knowledge of basic Electrical Electronics</b>

**GENERAL OBJECTIVES:** On completion of this module, the trainee should:

- 1.0 Understand the structure of matter and its relevance to electricity
- 2.0 Understand the chemical sources of electromotive force
- 3.0 Know the construction of resistors, inductors, capacitor and their functions.
- 4.0 Know the values of resistors.
- 5.0 Understand Ohm's law and its application
- 6.0 Understand the difference between AC and DC current and voltage
- 7.0 Understand the principles of transformer, its construction and operation.
- 8.0 Understand basic electronic system and symbol.

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- 9.0 Understand the operation, uses and limitation of indicating instruments.
- 10.0 Know the principles of soldering in various electric and electronic connections
- 11.0 Know the various types of diode used in electronics circuits.
- 12.0 Understand the various connections and importance of resistors, capacitors and inductors.

<b>PROGRAMME:</b> NVC IN ELECTRICAL INSTALLATION		
<b>COURSE:</b> BASIC ELECTRICITY	<b>COURSE CODE:</b> BE II	<b>CONTACT HOURS:</b> 144
<b>GOAL:</b> The module is intended to provide the trainee with the fundamental knowledge of basic Electricity/Electronics		
<b>COURSE SPECIFICATION:</b> Theoretical Contents:	<b>Practical Contents:</b>	

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	<b>General Objective: 1.0</b> Understand the structure of matter and its relevance to electricity		<b>General Objective: 1.0</b> Know the basic structure of matter and its relevance to electricity			
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
1	1.1 Explain the concept of molecule, electron, Atom, electric charge, electric current, coulomb 1.2 Explain the difference between positive and negative charges 1.3 Explain the concept of Electricity, Insulators and conductors.	<ul style="list-style-type: none"> <li>• Give detailed notes and define atom, electron, proton molecule, Electric charge, electric current and coulomb</li> <li>• Give full explanation on the difference between positive and negative charge</li> <li>• Give detailed notes and explain how electricity flows</li> <li>• Explain insulators and conductors with examples.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Text books</li> </ul>	1.1 Demonstrate with dry and wet cell the concept of electricity 1.1 Demonstrate the effect of passing electric current through insulator and conductor	<ul style="list-style-type: none"> <li>* Use fully charged car battery to show concept of electricity flow</li> <li>* Identify the positive and negative terminal of battery. Connect to light a bulb.</li> <li>* Use a touch to illustrate the point.</li> </ul>	<ul style="list-style-type: none"> <li>* Car battery</li> <li>* Touch battery</li> <li>* Bulb.</li> </ul>

	<b>GENERAL OBJECTIVE: 2.0</b> Understand the chemical source of Electro motive force			<b>GENERAL OBJECTIVE: 2.0</b> Know the chemical source of Electromotive force.		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>

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2	<p>2.1 Explain the Concept of electric power and energy.</p> <p>2.2 Explain the concepts and differentiate between emf and potential difference (pd).</p> <p>2.3 Explain the concept of cell and type of cell (Primary &amp; secondary cells)</p> <p>2.4 Explain the concept of battery and test for condition of a cell.</p> <p>2.5 Explain with diagram concept of Cell connected in series Cell connected in parallel Series – parallel connection</p> <p>2.6 Explain the concept of internal resistance on battery voltage output.</p>	<ul style="list-style-type: none"> <li>• Give detailed notes and explain electric power and energy stating their units, symbol and formula.</li> <li>• Solve problems and work problems based on power and energy.</li> <li>• Distinguish between emf and Pd.</li> <li>• Show primary and secondary cell and describe their construction</li> <li>• Give detailed notes and use instrument and visual observation to show how to test cell condition.</li> <li>• Show how</li> </ul>	<ul style="list-style-type: none"> <li>• Check board</li> <li>• Text book</li> <li>• Primary cell</li> <li>• Battery cell</li> <li>• Primary cell</li> <li>• Chalkboard</li> <li>resistance box,</li> </ul>	<p>Demonstrate the connection of cell in series and in parallel and read the output using a voltmeter or ammeter.</p>	<p>Connect cell (touch battery) in series, parallel and study the effect with the students.</p>	<ul style="list-style-type: none"> <li>• A car battery</li> <li>• A touch batter.</li> <li>• Ammeter</li> <li>• Voltmeter</li> <li>• Dry cell (battery)</li> </ul>
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		<p>cells can be connected in series, parallel and series parallel connections</p> <ul style="list-style-type: none"> <li>• Explain with calculations how resistance affect battery Voltage</li> </ul>				
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	<b>GENERAL OBJECTIVE 3.0</b> Know the construction of resistors, inductors, capacitors and explain their functions.			<b>GENERAL OBJECTIVE: 3.0</b> Know the construction of resistors, inductors, capacitors and explain their functions.		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
<b>3</b>	3.1 Explain and identify the	<ul style="list-style-type: none"> <li>• Define and</li> </ul>	<ul style="list-style-type: none"> <li>• Capacitors</li> </ul>	3.1 Demonstrate by	<ul style="list-style-type: none"> <li>• Guide</li> </ul>	<ul style="list-style-type: none"> <li>• DC</li> </ul>

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	<p>various types and sizes of the following resistors, Capacitors and inductors.</p> <p>3.2 Identify the following resistors:</p> <p>a) Composition type resistor</p> <p>b) Wire wound types of resistor</p> <p>c) Variable resistors</p> <p>d) Fired resistors.</p> <p>3.3 State the function of the following Resistor, capacitor and inductor in a circuit.</p> <p>3.4 Describe the constructional detail of the following resistors, capacitors and inductors.</p> <p>3.5 Explain the meaning of power rating of a resistor.</p> <p>3.6 Identify the power rating of different resistance types.</p> <p>3.7 Explain the practical application of various types of resistors.</p> <p>3.8 Identify the working voltage of a capacitor.</p>	<p>show resistor, capacitors and inductors. State their unit and symbols</p> <ul style="list-style-type: none"> <li>• Show students various types of resistors and how they can be connected</li> <li>• Explain power rating of resistors and show how to identify the power rating of each resistor</li> <li>• Explain the application of resistor in a circuit</li> <li>• Explain the maximum working voltage of</li> </ul>	<ul style="list-style-type: none"> <li>• Inductors</li> <li>• Resistors</li> <li>• Indicators</li> <li>• Chalkboard</li> </ul>	<p>experiment resistors in series and in parallel</p> <p>3.2 Demonstrate by experiment the effect of connecting capacitors in series and in parallel</p> <p>3.3 Demonstrate by experiment ohms law <math>R=V/I</math></p>	<p>student to perform experiment on circuit resistors in series and then in parallel with meters and power supply</p> <ul style="list-style-type: none"> <li>• Current capacitor in series an in parallel.</li> <li>• Measure current and voltage.</li> </ul>	<p>Ammeter</p> <ul style="list-style-type: none"> <li>• DC Voltage</li> <li>• Resistors power supply unit</li> <li>• Capacitor</li> <li>• Chalkboard</li> <li>• Tools and equipment</li> <li>• Power supply</li> </ul>
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		capacitors.			
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	<b>GENERAL OBJECTIVE 4.0:</b> Know the values of resistors			<b>GENERAL OBJECTIVE: 4.0</b> Know the values of resistors		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
4	4.1 Explain the colour of coding system used in	<ul style="list-style-type: none"> <li>• Explain how to identify colour</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Text books</li> </ul>	4.1 Demonstrate by showing the types of	<ul style="list-style-type: none"> <li>• Show the different</li> </ul>	<ul style="list-style-type: none"> <li>• Resistors</li> <li>• Capacitors</li> </ul>

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	<p>resistors and capacitors.</p> <p>4.2 Identify the tolerance of a resistor and capacitors.</p> <p>4.3 Calculate the following</p> <p>a. Resistance of a resistor using colour codes</p> <p>b. Capacitance of a capacitor using colour codes</p> <p>4.4 Calculate the value of the tolerance of any:</p> <p>a) Resistors using colour codes</p> <p>b) Capacitor using colour codes</p>	<p>coding of resistor.</p> <ul style="list-style-type: none"> <li>• Illustrate with examples calculations involving in 4.3 and 4.4</li> </ul>	<ul style="list-style-type: none"> <li>• Calculator</li> <li>• Colour coded resistors</li> </ul>	<p>resistor and the colour code applied</p>	<p>colours for resistors and capacitor.</p> <ul style="list-style-type: none"> <li>• Show student ways of identifying Catron</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> </ul>
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	<b>GENERAL OBJECTIVE 5.0:</b> State ohm's law and apply it to calculate resistance voltage and current			<b>GENERAL OBJECTIVE: 5.0</b> Know ohm's law and its application		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
5	5.1 Define Ohm's Law 5.2 Calculate resistance, Voltage or current using Ohm, law e.g $R = V/I$ 5.3 Describe how to connect a) Resistors in series b) Resistors I parallel c) Series and parallel connection. 5.4 Describe how to connect a) Batteries in series b) Batteries in parallel c) Batteries in series and parallel connect. 5.5 Connect capacitors in series and parallel and state the implication of the different form of connection. 5.6 Calculate the inductance, capacitance connected in series and parallel. 5.7 Define kirchoff laws: - a) Current law b) Voltage law. 5.8 Solve simple numerical	<ul style="list-style-type: none"> <li>• Define Ohms law</li> <li>• Work some calculations on Ohm,s law</li> <li>• Show how a resistor can be connected in series, parallel and series – parallel and perform calculators.</li> <li>• Refer students to batteries connected in the three modes by asking question.</li> <li>• Show capacitor in series, parallel and series – parallel and the implication.</li> <li>• Work examples of capacitors and</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Batteries</li> <li>• Resistors</li> <li>• Capacity</li> <li>• Textbooks</li> </ul>	5.1 Demonstrate by experiment ohm's law. 5.2 Demonstrate by experiment kickoff's law. 5.3 Demonstrate by experiment superposition theorem.	<ul style="list-style-type: none"> <li>• Current capacitor in</li> <li>• Series</li> <li>• Parallel</li> <li>• Measure current and voltage.</li> </ul>	<ul style="list-style-type: none"> <li>• Kirchoff's law unit voltmeter</li> <li>• Ammeter</li> </ul>

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	<p>problem involving kickoff's law.</p> <p>5.9 Define superposition theorem</p> <p>5.10 Solve simple numerical problem to illustrate superposition theorem.</p>	<p>inductors in series parallel, series parallel.</p>				
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	<b>GENERAL OBJECTIVE 6.0:</b> Understand the difference between AC and DC current and voltage			<b>GENERAL OBJECTIVE: 6.0</b> Know the basic difference AC and DC current and voltage		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
6	<p>6.1 Explain in detail AC and DC.</p> <p>6.2 Explain the difference between AC and DC.</p> <p>6.3 Explain the characteristics of AC.</p> <p>6.4 Explained the following</p> <p>a) Peak value</p> <p>b) Mean value</p>	<ul style="list-style-type: none"> <li>• Describe with the aid of diagram the difference between AC and DC</li> <li>• Draw diagrams to explain AC</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard assigned Generator</li> <li>• Resistor</li> <li>• Inductor</li> <li>• Capacitor</li> </ul>	<p>6.1 Demonstrate by experiment R &amp; L in series in AC circuit</p> <p>6.2 Demonstrate by experiment RLC in series in AC circuit, R and L in parallel AC circuit, R and C in parallel</p>	<ul style="list-style-type: none"> <li>• Show the effect of AC on R,L,C, in parallel i.e voltage and current relationship</li> </ul>	<ul style="list-style-type: none"> <li>• AC voltmeter</li> <li>• AC micrometer</li> <li>• Component , signal</li> <li>• Generator</li> </ul>

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	<p>c) RMS value  d) Frequency of wave</p> <p>6.5 Calculate</p> <p>a) Peak value from RMS value of current  b) Peak value from RMS value of voltage</p> <p>6.6 Describe the simple treatment of R.L.C. in AC circuit.</p> <p>6.7 Explain the concept of resistance in AC circuit.</p> <p>6.8 Calculate inductive and capacitive reactance  <math>X_L = 2 \pi fL</math>  <math>X_C = \frac{1}{2 \pi fc}</math></p>	<p>variables like RMS, mean value e.t.c</p> <ul style="list-style-type: none"> <li>• Work examples on how to calculate the variables above.</li> <li>• Explain the effect of AC on R, L, C, in parallel i.e voltage and current relationships.</li> <li>• Explain the effects of resistor in AC circuit.</li> <li>• Explain inductive and capacitive reactance and work calculation on <math>X_L</math> and <math>X_C</math></li> </ul>		<p>AC circuit.</p>	<ul style="list-style-type: none"> <li>• Asses the student</li> </ul>	
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	<b>GENERAL OBJECTIVE 7.0:</b> Understand the principles of transformer, its construction and operations.			<b>GENERAL OBJECTIVE: 7.0</b> Know the principles of transformer, its construction and operations.		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
7	7.1 Explain the principles of magnetism, temporary and permanent magnets 7.2 Explain the concept of magnetic field and	<ul style="list-style-type: none"> <li>State the principle of magnet with reference to temporary</li> </ul>	<ul style="list-style-type: none"> <li>Chalk, board</li> <li>Coil</li> <li>Soft iron</li> <li>Copper coil</li> </ul>	7.1 Demonstrate magnetic field effect  7.2 Demonstrate and	<ul style="list-style-type: none"> <li>Show and explain magnetic fields</li> </ul>	<ul style="list-style-type: none"> <li>Chart</li> <li>Transformer</li> <li>Text book</li> <li>Transformer</li> </ul>

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	<p>magnetic poles</p> <p>7.3 Explain the law of attraction and repulsions, the effect of field as applied to electro magnetism.</p> <p>7.4 Explain the concept of transformer winding</p> <p>7.5 Describe with the aid of sketches the principles of operation of a simple phase, double wound transformer.</p> <p>7.6 State the types of transformer losses and ways to reduce them</p> <p>7.7 Explain the concept of transformer efficiency and calculate transformer efficiency.</p> <p>7.8 Construct a simple single phase double wound transformer</p> <p>7.9 List the common types of transformer and their uses. (Auto – transformer, C-core transformer, B – phase transformer, current transformer, Audio transformer, Ridoif transformer e.t.c</p>	<p>permanent and natural magnet.</p> <ul style="list-style-type: none"> <li>• State the law of magnet</li> <li>• Define magnet fields</li> <li>• Explain the winding of transformer</li> </ul> <p>• Explain</p> $\frac{V_p}{V_2} = \frac{N_p}{N_s}$ <ul style="list-style-type: none"> <li>• Explain the reason for Lamination</li> <li>• Explain in details iron and copper losses and how to reduce them</li> <li>• Explain the efficiency of transformer</li> <li>• Explain the concept of double wound in transformer.</li> </ul>	<ul style="list-style-type: none"> <li>• Compass</li> <li>• Transformer</li> <li>• Transformer component</li> <li>• A chart</li> <li>• Different types of transformer</li> </ul>	<p>show lamination</p> <p>7.3 Demonstrate how to construct double wound</p>	<ul style="list-style-type: none"> <li>• Show lamination and state reasons</li> <li>• Show an example of double wound transformer.</li> </ul>	<p>r component</p> <ul style="list-style-type: none"> <li>• Different types of transformer</li> </ul>
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	<b>GENERAL OBJECTIVE 8.0:</b> Understand basic electronic system and symbol			<b>GENERAL OBJECTIVE:</b>		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
8	8.1 Explain and state common abbreviation used in electrical/electronic circuit.	<ul style="list-style-type: none"> <li>• Explain the term units and various abbreviations used in circuits</li> </ul>	<ul style="list-style-type: none"> <li>• Text books</li> <li>• Chart note</li> </ul>			

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	<p>I = circuit  A = Ampere  C = Capacitor  V = Voltage  R = Resistor  I = Inductor</p> <p>8.2 Draw the graphical symbols for components, units and systems used in electrical/electronic s system (transistors, amplifiers switch, socket out ld e.t.c)</p>	<ul style="list-style-type: none"> <li>Assess the student</li> </ul>				
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	<b>GENERAL OBJECTIVE 9.0:</b> Understand the operation uses and limitation of indicating instruments.			<b>GENERAL OBJECTIVE: 9.0 Know</b> the operation, uses and limitation of indicating instruments.		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
<b>9</b>	9.1 List some common measuring devices used in electrical/electronic	<ul style="list-style-type: none"> <li>Describe the parts, operation and uses of</li> </ul>	<ul style="list-style-type: none"> <li>Multimeter (digital and analogue)</li> </ul>	9.1 Demonstrate how to use the instrument (multimeter) in	<ul style="list-style-type: none"> <li>Show student how to</li> </ul>	<ul style="list-style-type: none"> <li>Multimeter</li> <li>Ohm meter</li> </ul>

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	system 9.2 Describe the functional parts of the multi-meter 9.3 Explain the concept of AC and DC voltage measurement, Resistance measurement, AC and DC current measurement 9.4 Use the Ohm-meter to test semi-conductor 9.5 Recognize a fault condition of meter	multimeter <ul style="list-style-type: none"> <li>Explain how to identify fault and how to rectify such fault</li> <li>Asses the Student</li> </ul>	<ul style="list-style-type: none"> <li>Ohm meter</li> <li>Chalkboard</li> </ul>	measuring current, voltage and resistance both on AC and DC.	regulate and read a multimeter <ul style="list-style-type: none"> <li>Show how to use the multi meter to test diode, transistors e.t.c.</li> </ul>	
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	<b>GENERAL OBJECTIVE 10:0</b> Know the principle of soldering in various electric and electronics connections			<b>GENERAL OBJECTIVE: 10.0</b> Know how to carry out soldering on joints.		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
10	10.1 Explain soldering and its application in electrical/electronics	<ul style="list-style-type: none"> <li>Give detailed notes to explain the concept of</li> </ul>	<ul style="list-style-type: none"> <li>Soldering iron</li> <li>Solders</li> </ul>	10.1 Demonstrate soldering process	<ul style="list-style-type: none"> <li>Carryout soldering exercise</li> </ul>	<ul style="list-style-type: none"> <li>Soldering iron</li> <li>Solder</li> </ul>



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	<p>circuit</p> <p>10.2 List the materials necessary to carry-out soldering process</p> <p>10.3 Explain the processes involved in soldering</p>	<p>soldering</p> <ul style="list-style-type: none"> <li>List the material used when carrying out soldering</li> <li>Describe the process of soldering</li> </ul>	<ul style="list-style-type: none"> <li>Chalkboard</li> <li>Note book</li> </ul>	<p>10.2 Demonstrate to the student the process involve in soldering</p>	<p>and allow the student to try until they become competent.</p>	
	<b>GENERAL OBJECTIVE 11.0:</b> Know the various types of diodes used in electronics circuit.			<b>GENERAL OBJECTIVE: 11.0</b> Know diodes types and transistors used in electronic circuit		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
11	<p>11.1 Explain diode</p> <p>11.2 List the types of diode and describe in details a diode</p> <p>11.3 Explain the importance of diode in electrical/electronics circuit.</p> <p>11.4 Explain a transistor and the types (Give examples)</p> <p>11.5 Explain the function of transistors in electronic circuits</p> <p>11.6 Describe in detail using diagrams a typical transistor</p>	<ul style="list-style-type: none"> <li>Give detailed notes to explain the work principles of diode and its importance to electrical/electronics circuit</li> <li>State the importance of diode in electrical electronic circuit</li> <li>Give detailed notes to explain the component of a transistor, its functions in electronic</li> </ul>	<ul style="list-style-type: none"> <li>Diodes</li> <li>Chalkboard circuit component</li> <li>Charts</li> <li>Measuring instrument.</li> <li>A sample transistor.</li> <li>Circuit component</li> <li>Chalk</li> <li>Board</li> <li>Chart</li> </ul>	<p>11.1 Demonstrate by experiment the working principles of diode</p> <p>11.2 Describe a simple diode and its function in an electrical/electronic circuit.</p>	<ul style="list-style-type: none"> <li>Guide student to identify a diode in any electronic circuit</li> <li>Remove/add a diode to any electronic circuit.</li> <li>Allow the student to practice until they became competent in testing, adding Removing a</li> </ul>	<ul style="list-style-type: none"> <li>Soldering iron, diode circuit component</li> <li>Charts</li> <li>Instrument</li> <li>Testing instrument</li> <li>Transistors</li> <li>Charts</li> </ul>

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		circuit <ul style="list-style-type: none"> <li>• Give notes on the type or brand of transistor</li> <li>• Asses the student</li> </ul>	<ul style="list-style-type: none"> <li>• Measuring instruments</li> </ul>		transistor	
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	<b>GENERAL OBJECTIVE: 12.0</b> Understand the various connections and importance of resistors, capacitors and inductors			<b>GENERAL OBJECTIVE: 12.0</b> Know the various connections and importance of resistors, capacitors and inductors		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
12	12.1 Explain the term circuit	<ul style="list-style-type: none"> <li>• Give detailed</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk</li> </ul>	12.1 Demonstrate by experiment the	<ul style="list-style-type: none"> <li>• Guide</li> </ul>	<ul style="list-style-type: none"> <li>• Resistors</li> </ul>

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	<p>(Electrical)</p> <p>12.2 Explain a circuit in a) Series b) Parallel</p> <p>12.3 Calculate the total resistance in series DC circuit and parallel DC circuit (compare)</p> <p>12.4 Calculate the voltage drop across each resistor of a series circuit and that of parallel circuit.</p> <p>12.5 Calculate the current in each arm of a parallel circuit</p> <p>12.6 Calculate the voltage and current in series and parallel connected cells</p> <p>12.7 Calculate the voltage and current in a series and parallel circuit</p> <p>12.8 Calculate impedance in an AC circuit</p> <p>12.9 Explain the meaning of resonance in series and parallel circuit.</p> <p>12.10 Explain the simple meaning of Q factor,</p>	<p>notes to explain electric circuit and state the differences between series and parallel circuits.</p> <ul style="list-style-type: none"> <li>• Give student calculation, work out examples and</li> <li>• Request student to work some calculation.</li> <li>• Show how to calculate the current in each arm</li> <li>• Define voltage and current in series and in parallel cells</li> <li>• Calculate voltage and current in series and parallel circuit</li> <li>• Define impedance, give the symbols, unit and formula</li> </ul>	<ul style="list-style-type: none"> <li>• Board</li> <li>• Textbooks</li> <li>• Calculator</li> <li>• Notes</li> <li>• Resistors</li> <li>• DC power supply</li> <li>• multimeter</li> <li>• Chalk board</li> <li>• Note</li> <li>Textbook</li> <li>Calculator</li> <li>Chalk, board</li> <li>Chart</li> <li>Circuit</li> <li>Component</li> <li>Calculator</li> </ul>	<p>effect of resistor in series and in parallel</p> <p>12.2 Demonstrate by experiment the effect of capacitor I an electric circuit</p> <p>12.3 Investigate by experiment the current and voltage relationship in inductive circuit, capacitive circuit and the combination of capacitance and inductance in series parallel</p> <p>12.4 Demonstrate by experiment series resonance in AC and parallel resonance in AC</p> <p>12.5 Plot graphs for both series and parallel resonance</p> <p>12.6 Determine the Q factor by experiment</p>	<p>student to carry out experiment to show the effect of resistor in series and in parallel</p> <ul style="list-style-type: none"> <li>• Ask questions on connection of capacitor</li> <li>• Ask questions on connection</li> <li>• Show the relationship by setting up the different circuit.</li> <li>• Connect the circuit and demonstrate variations of frequency at constant voltage</li> </ul>	<p>of different resistance</p> <ul style="list-style-type: none"> <li>• Chart</li> <li>• Circuit component.</li> <li>• Capacitor</li> <li>• Chalkboard</li> <li>• Circuit component</li> <li>• Capacitor</li> <li>• Inductor</li> <li>• Circuit component</li> <li>• Chalk, board</li> <li>• Chart</li> <li>• AC micrometer</li> <li>• AC voltmeter</li> <li>• Capacitor</li> <li>• Signal Generator</li> <li>• Chalk, board.</li> </ul>
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	Bandwidth. And calculate resonant frequency.	and calculate impedance <ul style="list-style-type: none"><li>• Draw and explain Resonance in series and parallel and simple calculation</li><li>• Give detailed notes to explain the concepts and state their relationship do some calculation.</li></ul>				
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**EVALUATION GUIDE**

*NVC in Electrical Installation and Repair Work (Draft)*

To pass this module the student must be able to successfully demonstrate knowledge of the theory of basic electricity

**ALLOMENT OF MARKS**

**THEORY 20%**

**PRACTICAL (practice) 80%**

<b>PROGRAMMES:</b> NVC IN ELECTRICAL INSTALLATION AND REPAIR WORK
<b>COURSE:</b> INDUSTRIAL INSTALLATION
<b>CODE:</b> CEI 15
<b>DURATION:</b> 324
<b>GOAL:</b> This module is intended to provide the trainee with the knowledge and skill

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necessary to carry out all types of industrial electrical installations and Repairs.

**GENERAL OBJECTIVES:** On completion of this module, the trainee should:

1. Know different types of industrial installations.
2. Know the installation of different types of ducts and trunkings applying all relevant regulation and safety precautions.
3. Understand the principles of operation of AC and DC machines and their applications.
4. Know the installation of all types of electrical machines and equipment.
5. Understand various methods of controlling electrical machines and equipment.
6. Know methods of maintaining electrical machines and equipment.
7. Know faults in machines, equipment, installations and their remedies.
8. Know the installation of MICC cable.

<b>PROGRAMME:</b> NVC IN ELECTRICAL INSTALLATION AND REPAIR WORK		
<b>COURSE:</b> INDUSTRIAL INSTALLATION	<b>COURSE CODE:</b> CEI 13	<b>CONTACT HOURS:</b> 324
<b>GOAL:</b> This module is intended to provide the trainee with the knowledge and skill necessary to carry out all types of industrial electrical installations and repairs.		
<b>COURSE SPECIFICATION: Theoretical Contents:</b>		<b>Practical Contents:</b>
<b>General Objective:</b> 1.0: Know the different type of Industrial Installations.		

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WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
1	1.1 Explain the points that make up an electrical working diagram.	<ul style="list-style-type: none"> <li>Using electrical layout drawings of a small and large factory, illustrate the key features e.g. feeder cables, HV/LV transformers, metering, main and sub-switch boards, main cable/bus duct runs, etc.</li> <li>Visit factories and identify key elements of the electrical installation.</li> </ul>	<ul style="list-style-type: none"> <li>Chalkboard</li> <li>Layout diagrams</li> <li>Textbooks.</li> </ul>	1.1 Interpret electrical working diagram of a factory. 1.2 Design a simple working diagram	<ul style="list-style-type: none"> <li>Show a typical Working diagram. Study working diagram with students</li> <li>Guide student to design a simple working diagram``</li> </ul>	<ul style="list-style-type: none"> <li>Chalk</li> <li>Layout diagrams</li> </ul>

COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
General Objective: 2.0: Know the installation of different types of ducts and trunkings applying all relevant regulations and safety precautions.						
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
2-3	2.1 Explain: a. Simple surface wiring for	<ul style="list-style-type: none"> <li>Demonstrate on wiring Board</li> </ul>	<ul style="list-style-type: none"> <li>Conduit and its accessories</li> </ul>	2.1 Carry out simple surface	<ul style="list-style-type: none"> <li>Guide the student to</li> </ul>	<ul style="list-style-type: none"> <li>MICC cable, wiring board</li> </ul>

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	<p>industrial installation</p> <p>b. Conduct wiring for industrial installation</p> <p>2.2 Explain the safety measures as provided for by the prevailing statutory regulations in carry the above.</p> <p>2.3 Describe ducts and trunking systems.</p> <p>2.4 State the advantages and disadvantages of ducts and trunking in industrial electrical installation.</p> <p>2.5 Explain the different types of ducts and trunking .</p> <p>2.6 Identify, select and maintain tools and equipment used for ducts and trunking systems.</p> <p>2.7 Explain the types of bus-bar trunking.</p>	<p>conduits wiring.</p> <ul style="list-style-type: none"> <li>● Explain duct and Trunking.</li> <li>● * List the advantages and disadvantages of ducting and trunking.</li> <li>● List the different types of ducts and trunking.</li> </ul> <p>* List tools and equipment used on duct and trunking.</p> <p>* List types of bus-bar trunking and explain methods of marking out when employing trunking system of wiring.</p> <p>* Explain accessories used on duct and trunking.</p> <p>* List the use of tools and accessories used in ducting and trunking.</p> <ul style="list-style-type: none"> <li>● Demonstrate how to join a ducts and trunkings.</li> </ul> <p>* Explain the importance of earth</p>	<ul style="list-style-type: none"> <li>● Wiring Board</li> <li>● Short lengths of ducts and</li> <li>● Trunking.</li> <li>● Chalkboard.</li> <li>● Chart</li> <li>● Tools and equipment.</li> <li>● Rivet machine &amp; IEE Regulations.</li> </ul>	<p>wiring for industrial installation.</p> <p>2.2 Conduct a prototype wiring for industrial installation.</p> <p>2.3 Carry out the duct and trunking wire system on a wiring board.</p> <p>2.4 Identify different types of duct and trunking.</p> <p>2.5 Apply and maintain tools and equipment</p>	<p>carryout simple installation of cable and test.</p> <ul style="list-style-type: none"> <li>● Conduct polarity, continuity and insulation tests on completed job.</li> <li>● Connect to supply and test.</li> <li>● Show the different types of duct and trunking</li> <li>● Guide student to identify the working tools used</li> <li>● Guide student to apply the necessary safety measures as provided for by the prevailing statutory regulations.</li> </ul>	<p>hammer, hacksaw, Switch light fitting, megger</p>
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	<p>2.8 Explain how to bend, Set, Shape, File and fabricate accessories used in connection with ducts and trunkings using the appropriate tools and equipment.</p> <p>2.9 Explain how to join lengths of ducts and trunking.</p> <p>2.10 State the importance of earth continuity and ensure its provision on all types of ducts and trunking.</p>	<p>continuity on ducting and trunking. * Analyse relevant regulations guiding the installation of ducting and trunking.</p>		<p>used for ducts trunking system.</p> <p>2.6 Identify types of bus-bar trunking and recognise the necessity for accurate marking out when cutting holes.</p> <p>2.7 Carry out the process of joining ducts and trunking using rivets, screw or adhesives.</p>		
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<b>COURSE SPECIFICATION: Theoretical Contents:</b>				<b>Practical Contents:</b>		
	<b>General Objective:</b> 3.0: Understand the principles of operation of AC and DC machines and their applications.					
<b>WEEK</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>4-5</b>	3.1 Describe the principle of operation of each of	<ul style="list-style-type: none"> <li>• Explain the principles of operation of</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Examples of motors.</li> </ul>	3.1 Dismantle a faulty AC motor &	<ul style="list-style-type: none"> <li>• Guide student to dismantle the generator</li> </ul>	<ul style="list-style-type: none"> <li>• Rivet machine,</li> <li>• Tools</li> </ul>

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	<p>the following machines:</p> <ol style="list-style-type: none"> <li>a. DC motor</li> <li>b. DC generator</li> <li>c. AC motor (Single phase)</li> <li>d. AC generator (Single phase).</li> </ol> <p>3.2 Describe the constructional features of:</p> <ol style="list-style-type: none"> <li>a. DC machines</li> <li>b. AC machines (Single phase)</li> </ol> <p>3.3 Differentiate between:</p> <ol style="list-style-type: none"> <li>a. DC and AC motors</li> <li>b. DC and AC generators</li> </ol> <p>3.4 Identify types of DC motors and generators e.g. motor (Series shunt and compound), generator- separately and self excited (Series, Shunt, or compound).</p> <p>3.5 State the application of the machines</p>	<p>generators and motors.</p> <ul style="list-style-type: none"> <li>• Explain the difference between motor and generator.</li> <li>• With the aid of a diagram or chart, explain the functions of AC and DC machines.</li> <li>• Explain the difference between AC and DC motors and generators.</li> <li>• List DC motors (Series, Shunt, compound)</li> <li>• Explain the operation of each motor stated in 3.4.</li> <li>• Explain types of</li> </ul>	<ul style="list-style-type: none"> <li>• Charts. AC and DC motors and generators</li> <li>• DC Motors – series, shunt and compound</li> <li>• AC Motors – series, shunt and compound</li> <li>• AC motors: Single phase and 3-phase</li> <li>• Chalkboard</li> </ul>	<p>generators for the purpose of studying the components</p> <p>3.2 Dismantle a faulty DC motor &amp; generators for the purpose of studying the components.</p> <p>3.3 grease and lubricate bearings of both the AC and DC dismantled above.</p>	<ul style="list-style-type: none"> <li>• Assess the student</li> <li>• Guide student to grease and lubricate bearings of the generator dismantled above</li> </ul>	<ul style="list-style-type: none"> <li>• Chart</li> </ul>
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	<p>stated in 3.4 above.</p> <p>3.6 Identify types of AC motors: Single and 3-phase) e.g. Squirrel cage motor, wound rotor motor, inductor motor, AC commutator synchronous motors, etc.</p> <p>3.7 State the application of each of the motors listed in 3.5 above.</p> <p>3.8 Describe the principle of operation of polyphase machines.</p>	<p>AC Motor – Single phase and 3-phase.</p> <ul style="list-style-type: none"> <li>• Explain the application of AC motors listed in (3.5).</li> <li>• Describe the principle of operation of polyphase machine.</li> </ul>				
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<b>COURSE SPECIFICATION: Theoretical Contents:</b>				<b>Practical Contents:</b>		
<b>General Objective:</b> 4.0: Know the installation of all types of electrical machines and equipment.						
<b>WEEK</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>

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<p><b>6-8</b></p>	<p>4.1 Identify types of enclosures and their application e.g. totally enclosed, water proof and semi-enclosed, etc.</p> <p>4.2 Describe the construction of a good foundation for mounting machines and equipment.</p> <p>4.3 Describe how to mount properly AC and DC machines and equipment.</p> <p>4.4 Select the correct size of cable for the appropriate machine installations.</p> <p>4.5 Select flexible conduit correctly for machine terminations.</p> <p>4.6 State the principle of operation of a Starter.</p>	<ul style="list-style-type: none"> <li>• Explain different ways by which machines can be enclosed.</li> <li>• Demonstrate how to construct foundation for mounting a machine.</li> <li>• Explain how to mount machines.</li> <li>• Describe types of connections: Star-Delta, delta-star.</li> <li>• Explain how to calculate current rating of cable.</li> <li>• Demonstrate the use of flexible conduit in connecting a motor.</li> <li>• Explain the operation and uses of starters for motors.</li> <li>• Describe the principle of operation of each Starter.</li> <li>• Demonstrate</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Chart</li> <li>• Gravel, Sand, Cement, water, spade, etc.</li> <li>• Chart</li> <li>• Chalkboard</li> <li>• Chart</li> <li>• Chalkboard</li> <li>• Short length of flexible Conduit.</li> <li>• Direct – on – line starter, star – delta, auto transformer starters.</li> <li>• * Direct-on-line starter, star-delta, autotransformer starters.</li> <li>• *Tachometer</li> <li>• Growler.</li> <li>• Bar to bar tester.</li> </ul>	<p>4.1 Mount electric machines</p> <p>4.2 Carry out insulation resistance test and inspection on DC machines, AC induction motor, AC round rotor motor.</p> <p>4.3 Mount properly the AC and DC machines.</p>	<ul style="list-style-type: none"> <li>• Guide student to construct a foundation; allow setting, mounting the machine.</li> <li>• Inspect machines &amp; test machines</li> <li>• Carry out phase rotation, short circuit and earth fault test.</li> <li>• Apply all relevant safety measures as provided for by the prevailing statutory regulations.</li> </ul>	<ul style="list-style-type: none"> <li>• Gravel, sand, cement, water, spade.</li> <li>• megger</li> </ul>
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		<p>how to test machines.</p> <ul style="list-style-type: none"><li>• Explain regulations guiding choice, installation and Repair of machines.</li></ul>				
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<b>COURSE SPECIFICATION: Theoretical Contents:</b>	<b>Practical Contents:</b>
<b>General Objective:</b> 5.0 Understand various methods of controlling electrical machines and equipment	

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WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
<b>9</b>	5.1 Explain the different levels of controlling machine e.g. direct –on – line, autotransformer, star – delta, capacitor start, root resistance starters. 5.2 Describe an electrical control circuit consisting of a start/stop station, overloads, two-3phase motors (which have isolating switches). One of the motors is attached to a pump, and the other is driving a pressure tank that has a high pressure switch. 5.3 Identify types of connection e.g Star – Delta, Delta – Star, etc	<ul style="list-style-type: none"> <li>• Various starters should be used to demonstrate the speed of motor</li> <li>• Prepare teaching notes and diagrams</li> <li>• Set up a demonstration.</li> <li>• Prepare teaching notes using a machine manual</li> <li>• Work through the topics</li> <li>• Set up a demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• Various starters</li> <li>• Chalk board</li> <li>• Materials for demonstration</li> </ul>	<ul style="list-style-type: none"> <li>• 5.1 set up a 3-phase AC motor control system, which will include a 3-phase motor, contactor, overloads, stop/start station, pressure switch and limit switch. The motor will have a 3-phase isolating switch.</li> </ul>	<ul style="list-style-type: none"> <li>• Guide student on how to carry out the following connections:                          Star – Delta                          Direct – on –line                          Auto transformer                          Delta – Star                          Capacitor start</li> </ul>	<ul style="list-style-type: none"> <li>• Items as listed.</li> </ul>

<b>COURSE SPECIFICATION: Theoretical Contents:</b>				<b>Practical Contents:</b>		
<b>General Objective:</b> 6.0 Know methods of maintaining electrical machines and equipment						
WEEK	Specific Learning	Teachers Activities	Learning Resources	Specific Learning	Teachers Activities	Learning

***NVC in Electrical Installation and Repair Work (Draft)***

	<b>Objective</b>			<b>Objective</b>		<b>Resources</b>
<b>10</b>	<p>6.1 Describe the types of repair, e.g. routine repair, corrective, e.t.c</p> <p>6.2 Provide repair procedure for each item and types equipment and machine.</p> <p>6.3 Identify types and grades of lubricants e.g. grease, oil, and coolant e.t.c.</p> <p>6.4 State the application of each type of lubricant.</p> <p>6.5 Identify and operate various types of tools and equipment used for Repair: grease gum, oilcan, screwdriver, pulley extractors, wrench, and blower, filler gauge.</p>	<ul style="list-style-type: none"> <li>• Explain repair, types, and why it is necessary.</li> <li>• Explain procedure for maintaining machines and equipment.</li> <li>• List lubricants used on machines</li> <li>• State the uses of lubricants and demonstrate how to apply each type.</li> <li>• List tools and equipment used for Repair of machines</li> <li>• Demonstrate the use of each item</li> <li>• With the aid of diagram, explain the working principles of cooker, heater and iron.</li> <li>• Explain how to make use of data and</li> </ul>	<ul style="list-style-type: none"> <li>• Chalkboard</li> <li>• Chart</li> <li>• Lubricant (grease, Oil, coolant).</li> <li>• Tools and equipment</li> <li>• Cooker, iron, heater</li> <li>• Old motor</li> <li>• Used motor</li> <li>• Notebook</li> </ul>	<p>6.1 Maintain equipment or machines following repair procedure specified by manufacturers ensuring that:</p> <p>Ventilating holes are cleared of dirt; Dead or worn out bearings are replaced; Belt tension is adjusted where necessary; Alignments are checked and worn out machines part e.g. brushes, holder and spring and machines guide are replaced.</p> <p>6.2 Test to ensure that the maintained parts</p>	<ul style="list-style-type: none"> <li>• Teacher organize compulsory excursion to relevant industry for student to observe these repair procedure</li> <li>• Show how to carry out test on machine</li> <li>• Describe how records are kept</li> </ul>	



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		manufacturer's specifications in Repair of machines.		of the machine or installation are in good condition. 6.3 Keep record of repair and make use various lubricants on the electric machines and equipments.		
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COURSE SPECIFICATION: Theoretical Contents:				Practical Contents:		
	<b>General Objective:</b> 7.0 Know faults in machines, equipment, installations and their remedies.					
WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
11	7.1 Identify causes of	<ul style="list-style-type: none"> <li>Demonstrate</li> </ul>	<ul style="list-style-type: none"> <li>Megger</li> </ul>		<ul style="list-style-type: none"> <li>Organize</li> </ul>	

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	<p>breakdown e.g. short circuit, open circuit, worn out parts, insulation breakdown, incorrect use, and overload, ageing, e.t.c</p> <p>7.2 Explain the causes of faults e.g. fuse melting, circuit breaker tripping, e.t.c.</p> <p>7.3 Determine fault by noise symptoms.</p> <p>7.4 Interpret circuit diagram</p>	<p>how to detect faults and causes of breakdown on machines and how to rectify such faults</p> <ul style="list-style-type: none"> <li>• Ask questions on fault finding, causes and remedies</li> <li>• Explain how to detect fault by noise</li> <li>• Show and explain circuit diagrams</li> <li>• Demonstrate how to diagnose faults by visual inspection, and using voltmeter and ammeter.</li> <li>• Show with normal tools how to repair and replace faulty parts</li> <li>• Demonstrate how to carry out final test on machine before it is connected.</li> </ul>	<ul style="list-style-type: none"> <li>• 3-phase</li> <li>• Voltmeter</li> <li>• Ammeter</li> <li>• Typical installation</li> <li>• Ball bearing</li> <li>• Electric iron</li> </ul>	<p>7.1 Disassemble a circuit breaker</p> <p>7.2 Apply trouble shooting techniques to diagnose faulty item e.g. Visual I inspection, Voltage test using meters, Current test using meters, Continuity test using meters</p> <p>7.4 Apply the appropriate tools and equipment to effect the repair of faulty part.</p> <p>7.5 Test for correct performance of the machines/equipment or installation after repairs.</p>	<p>excursion to the industry for the student to have first hand experience.</p> <ul style="list-style-type: none"> <li>• Using a faulty appliance to demonstrate these techniques.</li> <li>• Show using practical example how to trouble shoot by way of both visual testing in order to diagnose faults.</li> </ul>	
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<b>COURSE SPECIFICATION: Theoretical Contents:</b>				<b>Practical Contents:</b>		
	<b>General Objective:</b> 8.0 Know the installation of MICC cable					
<b>WEEK</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>	<b>Specific Learning Objective</b>	<b>Teachers Activities</b>	<b>Learning Resources</b>
<b>12</b>	8.1 Explain MICC cable and its	<ul style="list-style-type: none"> <li>Describe</li> </ul>	<ul style="list-style-type: none"> <li>MICC</li> </ul>	8.1 Show how to install	<ul style="list-style-type: none"> <li>Install</li> </ul>	<ul style="list-style-type: none"> <li>MICC</li> </ul>

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	<p>application</p> <p>8.2 Select tools and materials for MICC installation</p> <p>8.3 State regulations relevant to MICC installation work</p> <p>8.4 State the advantage and disadvantage of MICC cable.</p>	<p>MICC cable and how to identify it</p> <ul style="list-style-type: none"> <li>• Explain the uses of MICC cable.</li> <li>• List basic tools and materials for MICC installation work</li> <li>• Discuss regulations in respect of MICC installation.</li> </ul>	<p>sample</p> <ul style="list-style-type: none"> <li>• Hand tools and MICC materials</li> <li>• IEE Regulation</li> </ul>	<p>MICC cable.</p> <p>8.2 Identify the component of MICC cable i.e Copper conduct Magnesium oxide (MgO) Copper sheath</p> <p>8.3 Carry out termination of MICC cable</p>	<p>MICC cables system including a switch controlling a single light</p> <ul style="list-style-type: none"> <li>• Guide student to install the cable</li> <li>• Guide student to terminate MICC cable</li> </ul>	<p>cable</p> <ul style="list-style-type: none"> <li>• Tools</li> <li>• Gland</li> <li>• Hand glove</li> <li>• Hacksaw</li> </ul>
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**EVALUATION GUIDE**

*NVC in Electrical Installation and Repair Work (Draft)*

To pass this module the student must be able to successfully connect a 3-phase motor control system.

**ALLOMENT OF MARKS**

**THEORY 20%**

**PRACTICAL (practice) 80%**

**COURSE: Introduction to domestic electrical appliance**

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<b>CODE: CEI 15</b>
<b>DURATION: 144</b>
<b>GOAL: This module is intended to provide the trainee with the knowledge and skill necessary to install and repair domestic appliance</b>

**General Objectives:** On completion of this module, the trainee should:

- 1. Know various types of domestic appliances.**
- 2. Know the Installation of the domestic appliance**
- 3. Know the common faults and repairs of domestic appliances.**
- 4. Know the various methods of testing domestic appliances**
- 5. Know statutory regulation concerning domestic appliances.**

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<b>GENERAL OBJECTIVE : 1.0</b> Know various types of domestic appliances				<b>GENERAL OBJECTIVE: 1.0</b>		
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
1	1.1 Discuss various types of domestic appliances e.g. Electric Iron, Cooker, Heater, AC. 1.2 Explain function of common domestic appliances. 1.3 State application of some domestic appliances.	<ul style="list-style-type: none"> <li>• Describe with examples domestic appliances.</li> <li>• Identify various domestic appliances.</li> </ul>	<ul style="list-style-type: none"> <li>• Charts.</li> <li>• Electric iron.</li> <li>• Electric Cattle.</li> <li>• Electric Cooker. Etc.</li> </ul>			
<b>General Objective: 2.0</b> Know the Installation of domestic appliances						
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
2-3	2.1 Explain how to install common domestic appliances. 2.2 Explain the necessary tools used in installing domestic appliances. 2.3 State safety precautions to be taken when installing domestic appliances	* Describe how to install the following: - Ceiling fan, - Water heater etc. - Apply safety precautions. - Give detailed notes on safety tools.	* Ceiling fan. * Air condition. * Cooker. * Heater	2.1 Install the following domestic appliances. - Ceiling fan. - Water heater. - Electric cooker. - Air conditioner. 2.2 List the necessary tools for domestic Installation.	<ul style="list-style-type: none"> <li>• Guide the students to install the devices/ appliances using necessary tools.</li> </ul>	<ul style="list-style-type: none"> <li>• Tools</li> <li>• Drawing</li> </ul>

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<b>GENERAL OBJECTIVE : 3.0 Know common faults and repairs of domestic appliances</b>						
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
<b>4-6</b>	3.1 Explain the common faults in domestic appliances e.g. <ul style="list-style-type: none"> <li>• Open circuit</li> <li>• Earth leakage</li> <li>• Short circuit</li> <li>• Insulation break down.</li> </ul> 3.2 Explain how to remedy the fault.	<ul style="list-style-type: none"> <li>• List common faults in domestic appliances.</li> <li>• Explain process of trouble shooting of domestic appliances</li> </ul>	<ul style="list-style-type: none"> <li>• Working drawing.</li> <li>• Chalk Board.</li> </ul>	3.1 Detect faults on the following items: Iron, Heater, Fan Etc.  3.2 Demonstrate the process of trouble shooting.	<ul style="list-style-type: none"> <li>• Guide students to examine faults detected.</li> <li>• Explain ways of correcting them</li> <li>• Guide students Carry out repairs on appliances.</li> </ul>	<ul style="list-style-type: none"> <li>• Screw driver.</li> <li>• Pliers</li> <li>• Cutler</li> <li>• Test meter</li> <li>• Manufactur es manual.</li> <li>• Megger</li> <li>• Soldering iron.</li> </ul>
<b>General Objective: 4.0 Know statutory regulations concerning domestic appliances</b>						
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
7-8	4.1 Explain rules and regulations of Installing domestic appliances. 4.2 Explain IEE regulations concerning installation of domestic appliances	<ul style="list-style-type: none"> <li>* Give notes on IEE regulations.</li> <li>* Explain other rules and regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Text books</li> <li>• Chalk Board</li> <li>• Audio/Visual</li> </ul>			



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<b>General Objective: 5.0 Know the various methods of testing the appliance</b>						
<b>W/K</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>	<b>Specific Learning Objective</b>	<b>Teacher Activities</b>	<b>Learning Resource</b>
<b>9-10</b>	5.1 Explain types of test to be carried out.  5.2 Explain methods of testing domestic appliances. 5.2 Discuss instruments used in testing domestic appliances. 5.3 Explain the reasons of testing.	<ul style="list-style-type: none"> <li>• Know the various methods of testing domestic appliances.</li> <li>• List types of test.</li> <li>• Identify methods of testing appliances.</li> <li>• List Instruments for appliances.</li> </ul>	<ul style="list-style-type: none"> <li>• Chalk Board.</li> <li>• Audio/visual</li> </ul>	5.1 Carry out Visual Inspection on some appliances e.g. Fan Heater, Iron Etc.  5.2 Use Instruments to test appliances	<ul style="list-style-type: none"> <li>• Guide students to carry out visual inspection.</li> <li>• Guide students to use instrument to test appliance</li> </ul>	<ul style="list-style-type: none"> <li>• Megger AVO meter</li> <li>• Multi meter test lamp.</li> </ul>

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**LIST OF BOOKS AND REFERENCES**

1. Electric Power Transmission System Engineering: Analysis and Design by Turan Gonen.
2. Electric Engineers Reference Book 14<sup>th</sup> Edition by Laughton Say.
3. A Textbook of Electrical Technology 22<sup>nd</sup> Edition by B.L. Theraja A. K. Theraja
4. Electrical Installation by A. O. Akintate and J. M. Hyde
5. Electrical Safety Engineering 2<sup>nd</sup> Edition by Fordham Cooper
6. A Handbook of the 16<sup>th</sup> Edition of the Regulation for Electrical Installation
7. Electrical Technology 6<sup>th</sup> Edition by Hughes
8. Electrical Installation Technology Volume 2 and 3 by Thompson
9. A manual of laboratory Experiments in Electronics by C. O. Orege
10. (Published by Clemol publishers Kaduna 1999)

**LIST OF LABORATORIES**

1. Chemistry Lab.
2. Physics Lab

**LSIT OF WORKSHOP**

1. Metal workshop
2. Electrical Installation workshop

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**LIST OF EQUIPMENT, INSTRUMENTS AND TOOLS FOR ELECTRICAL INSTALLATION AND MAINTENANCE EQUIPMENT**

1. Work bench.
2. Crowber
3. Conduit Bending Machine
4. Stock and dies
5. Conduit Vice
6. Clamp
7. Winding Machine
8. Battery charger
9. Grease Gum
10. Wiriing Board's
11. Oil Can
12. Ladder
13. Scaffolding
14. Blow Lamp
15. Pot and Laddle
16. Goggle
17. Soldering Iron

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18. Soldering Bit
19. Welding and Brazing Equipment
20. Handgloves
21. First Aid Box
22. Fractional Distillation Set
23. Heater (Oven)
24. Boots
25. Helmet
26. Safety belt
27. Overall Uniform

**INSTRUMENTS**

1. AC and DC Ammeter
2. AC and DC Voltmeter
3. AC and DC Avoemeter
4. Wattmeter
5. Megger
6. Technometer
7. Energy Meter (Single Phase, 3 – phase)
8. Neon tester, Voltage tester
9. Steel rule
10. Oscilloscope
11. Hydrometer
12. Ohmmeter
13. Spirit Level
14. Micrometer
15. Growler
16. Bridge Meggar
17. Measuring tape

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18. Signal Generator

**TOOLS**

1. Screw drivers
2. Allen Keys
3. Strippers
4. Hammers
5. Pliers
6. Cutters
7. Hacksaws
8. Mallets
9. Spanners (flat, ring, socket)
10. files
11. Chisels
12. Taps, dies
13. Drills (manual, electric)
14. Reamers
15. Extractor
16. Knives

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17. Rawl plug
18. Pipe wrenches
19. Gim let
20. Centre punch
21. Bell and battery set
22. compressing tool
23. Ringing tool
24. Crimping tools
25. Resistors
26. Rheostat
27. Inductors
28. Capacitors
29. Transformers (various types)
30. DC motor (various types)
31. DC generators (various types and sizes)
32. AC motors (single and 3 – phase)
33. AC generators (single and 3 – phase)
34. Starters (various types)
35. Thermostats
36. Relays

**CONSUMABLES**

1. Ceiling roses
2. Plugs – assorted
3. Adaptors – assorted
4. Socket outlets – assorted
5. Switches – assorted
6. lamp holders – assorted

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7. Fuses – assorted
8. Circuit breakers
9. Clips
10. Fluorescent fittings
11. Wiring nails
12. Conduit pipes (PV and accessories)
13. Conduit pipes (galvanized steel)
14. Soldering lead
15. Armature
16. Batteries
17. Crocodile clips
18. Distilled water
19. Sulphuric acid
20. Cables (various sizes and cores)
21. Insulation varnish
22. Earth rod
23. Sealing wax
24. Ceramic insulator
25. Fire extinguisher
26. Sand bucket
27. Safety posters

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**LIST OF PARTICIPANTS**

S/No	NAME	ADDRESS
1.	Shuaibu Bulama	GSTC Potiskum, Yobe State
2.	Engr. M. S. Nuhu	PHCN TEN Transmission Company of Nigeria Mando RD Kaduna
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