

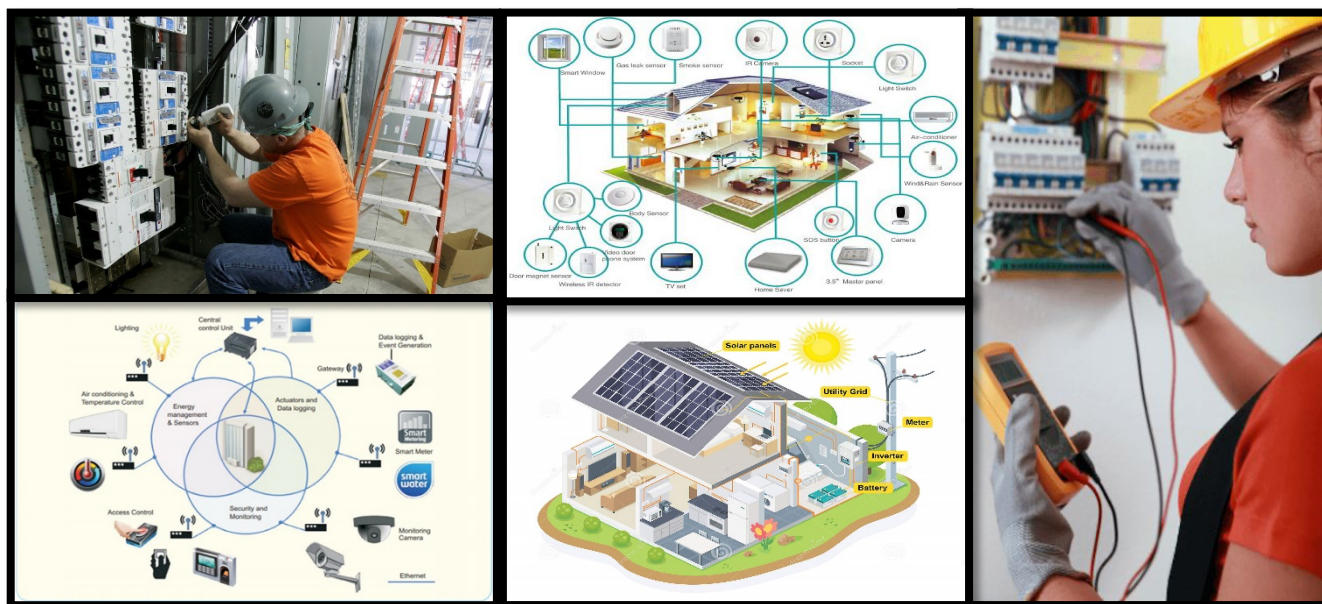


Kingdom of Cambodia
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National Training Board
Ministry of Labour and Vocational Training

Competency Based Curriculum Installation and Maintenance Power and Control System in Building, Level 5 Code: POWE 622



Department of Standard and Curriculum

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TABLE OF CONTENTS

	Pages
1. INTRODUCTION.....	1
2. NATIONAL QUALIFICATION FRAMEWORK	2
3. COMPETENCY BASED CURRICULUM.....	2
4. COURSE DESIGN	
• Course Description.....	3
• Student/Trainee Entry Requirement.....	3
• Course Structure	4
• Competency Analysis.....	7
• Assessment.....	8
• Principle of Course Delivery	9
• Resources	10
• Qualification of Instructors/Trainers.....	11
5. MODULE OF INSTRUCTION	
BASIC COMPETENCIES	
1. Supervising Application of Key Communication	13
LO1. Meet common and specific communication needs of clients and colleagues	15
LO2. Contribute to the development of communication strategies	16
LO3. Represent the organization	18
LO4. Facilitate group discussion	20
LO5. Conduct interviews	22
2. Supervising Development of Teams & Individuals	24
LO1. Supervise team leadership development	25
LO2. Foster individual and organizational growth	27
LO3. Monitor and evaluate workplace learning	29
LO4. Develop team commitment and cooperation	31
LO5. Facilitate accomplishment of organizational goals	33
3. Supervising on Problem-Solving Techniques in the Workplace	35
LO1. Analyze the problem.....	36
LO2. Identify the possible solution	38
LO3. Recommend solution to teams or higher management.....	40
LO4. Implement & Supervise Solution	42
LO5. Monitor outcomes	44
4. Supervising Data Collection and Analysis in the Workplace	46
LO1. Study information requirements	47
LO2. Process Data collected.....	49
LO3. Analyze, interpret and organize information gathered.....	51
LO4. Present findings, recommendations	53
5. Planning & Organization Work for Several Work Teams.....	55
LO1. Set objectives	57
LO2. Plan and schedule work activities	59
LO3. Implement work plans.....	60
LO4. Monitor work activities	62

LO5. Evaluate works plans & activities	64
6. Supervising Environmental Protection Implementation	66
LO1. Adopt environmental protection policy & principles	67
LO2. Implement specific environmental programs	69
LO3. Monitor activities on environmental protection /programs	71
7. Supervising OSH Work Issues in the Construction Industry.....	73
LO1. Risk identification.....	75
LO2. Risk assessment	76
LO3. Risk prevention & supervision	77
LO4. Emergency procedures	79
8. Applying Gender & Social Equity Principles & Policies	81
LO1. Follow guidelines or rules of conduct related to gender and social equity in the Workplace	82
LO2. Contribute to improve workplace guidelines in promoting gender and social equity	84
LO3. Recognize and report suspected cases of gender and other forms of social Inequity.....	86
9. Supervising Works to Comply with Procedures, Specifications and Manuals	88
LO1. Review Standard Operating Procedure (SOP's), specifications & manuals	89
LO2. Interpret compliance of SOP, manuals & specifications.....	70
LO3. Recording & reporting.....	92
10. Supervising Preparation, Using and Maintenance of Tools and Equipment	95
LO1. Supervise planning of resource requirements	97
LO2. Supervise requisition & acceptance of resources	97
11. Supervising Interpretations of Technical Drawing, Plans and Mathematic Calculations.....	99
LO1. Analyze signs, symbols and data	100
LO2. Interpret technical drawings and work plans	101
LO3. Approve drawings & plans/programs	103

CORE COMPETENCIES

1. Installing and Testing Electrical in Residential Building.....	105
LO1. Maintain safety and electrical standards.....	105
LO2. Prepare electrical drawings of electrical installation / equipment.....	109
LO3. Install and maintain electrical final residential circuits and wiring systems	113
LO4. Install and maintain AC incoming supply system	116
LO5. Inspect and test electrical installations.....	119
2. Installing and Testing Electrical in Commercial and Industrial Building.....	132
LO1. Maintain electrical installations.....	133
LO2. Prepare electrical drawings of electrical installation / equipment.....	137
LO3. Install and maintain industrial electrical final circuits and wiring systems	141
LO4. Install and maintain emergency lighting systems	145
LO5. Install and maintain 3-phase AC incoming supply system	149
LO6. Inspect and test electrical installations	152
3. Maintaining Electrical Machines and Applications	158
LO1. Maintain DC machines (motors).....	159
LO2. Maintain AC machines (motors).....	163
LO3. Maintain motor control circuits and equipment.....	166

LO4. Evaluate motor performance	170
LO5. Perform synchronization of generators to busbar	170
4. Maintaining Power System and Switchboards	174
LO1. Maintain incoming supply connected to switchboard and equipment	175
LO2. Maintain electrical switchboard	178
LO3. Perform isolation, lockout and tag out procedures	181
LO4. Maintain electrical power monitoring system.....	184
5. Maintaining Electrical Auxiliary Systems	187
LO1. Maintain temporary electrical supply connection.....	188
LO2. Maintain data cabling and equipment in Security system	191
LO3. Install and maintain fire alarm system	194
6. Programming Intelligent Building Control System.....	197
LO1. Program PLC system	198
LO2. Install smart home system.....	200
LO3. Manage Intelligent Building Control System.....	204
7. Maintaining Solar Photovoltaic Systems.....	207
LO1. Connect Solar Modules in various configurations	208
LO2. Test PV Modules Performance under different operating conditions	211
LO3. Maintain Off grid PV system.....	214
LO4. Maintain On grid PV system.....	217
6. ACKNOWLEDGEMENTS	243

1. INTRODUCTION

Developing a political program to further reform the existing technical and vocational education system in Cambodia, leading the technical and vocational education system towards implementing a capacity based approach to education and training and curriculum requirements. On competence as a national curriculum for implementation countrywide. The competency-based curriculum, which has been approved by the industry, makes the education system, technical and vocational education profession more widespread, and better tailored to the needs of the Cambodian economy, both formal and informal.

The competency-based curriculum is a framework or guideline for the continuous development of the curriculum, master plan for the course, curriculum framework, syllabus, and teaching methods, including academic resources and assessments for institutions. Technical and vocational training. The competency-based curriculum reflects a consensus standard by industry or community validation and approved by the Industrial Advisory Board. While competency standards have been developed and promulgated, they have been used to develop curriculum based on competency, master plan and subsequent curriculum framework for formal technical and vocational education programs.

Developing a competency-based curriculum is a complex, challenging and challenging task, as this is the first step in the development and preparation of a study and evaluation process for the course.

A competency-based curriculum is used to support an alternative training process:

- Traditional teaching where students grow together through courses, topics or as Module (Course Framework)
- Self-study is used by a number of training centers
- Alternative Training System
- Training in the workplace
- Prior recognition of education or ability

With the various strategies of the training and evaluation process used, the competency-based training approach is a methodology that focuses on learning outcomes and performance appraisals based on the requirements and standards set in the workplace.

The process of developing a competency-based curriculum involves a range of industry representatives (technical or specialized), curriculum developers and professors. A teacher or trainer with experience in a particular field or industry who must develop a competency-based curriculum. The Curriculum Development Team has developed a competency-based curriculum in which the learning outcomes and performance appraisals for the entire course are aligned with industry standards. Organizing each of the capabilities listed in the National Competency Standard into modules allows us to measure in part the capacity of the training modules.

A number of additional modules related to the profession to be included in the training have been developed, which support the implementation of all competencies included in the course, for example modules related to materials or processes, activities, or measurement processes. The modules may relate to additional knowledge, skills, and work behaviors related to one or more of the competencies included in the competency-based curriculum. A competency component may involve various modules for training that are required for the development of skills and standards that students or trainees must achieve.

The competency-based curriculum developed and promulgated can support the master plan and course framework as shown in Appendices 1 and 2 in each curriculum. The Master Plan and Course Framework designed for the formal training program are in line with the Cambodian Qualification Framework, incorporating all the basic and core competencies contained in the curriculum based on the competencies required by the Advisory Council Industry and approved and promulgated by the National Training Board. Within the framework of the course, there are a number of occupational skills related to the general competencies necessary for developing the knowledge, skills, and work behaviors of individuals in carrying out the activities that are fundamental to helping achieve core competencies. And strengthening analytical and work capacity.

2. National Qualification Framework

The establishment of a national qualification system for Cambodia requires the adoption of the Cambodian Qualification Framework, which provides a unified framework for better integration of education and training and other sub-sectors. The Cambodian Qualification Framework is a national tool for the development and classification of qualifications in line with the achievement criteria, as well as a policy and strategy for ensuring the quality of education and training that characterizes learning outcomes. The standards are clear and widely recognized in the national and international community.

Under the Cambodian Qualification Framework, the qualifications provided in education, technical and vocational training are based on the achievement of competency standards that meet industry requirements. Competencies defined in a particular qualification are those areas of employment that enable an individual or worker to obtain employment after they have achieved all the competencies set at that qualification level. Therefore, achieving a certain level of competence of an individual or worker will assure the industry that the person is capable of executing a specific task or task in accordance with industry standards.

The qualifications for education, technical and vocational training set out in the Cambodian Qualification Framework are:

- Technical and Vocational certification (Level 1)
- Technical and Vocational Certificate 1 (Level 2)
- Technical and Vocational Certificate 2 (Level 3)
- Technical and Vocational Certificate 3 (Level 4)
- High diploma / Technical and Vocational Certificate 4 (Level 5)
- Bachelor of Technology (Level 6)
- Master of Technology ((Level 7)
- Doctor of Technology (Level 8)

3. Competency-based curriculum

This section details the curriculum based on the "***Installation and Maintenance Power and Control System in Building Level 5***"

COURSE DESIGN

Course Title : **INSTALLATION AND MAINTENANCE POWER AND CONTROL SYSTEM IN BUILDING**

Nominal Duration of the Course : 1950Hrs (T42, P29, I10)

Qualification Level : 5 (High diploma Certificate 4)

Unit of Competency :

BASIC COMPETENCIES

1. Supervise application of key communication skills in the workplace
2. Supervise development of teams & individuals
3. Supervise on problem solving techniques in the workplace
4. Supervise data collection and analysis in the workplace
5. Plan & organize work for several work teams
6. Supervise environmental protection implementation
7. Supervise OHS work issues in the Construction Industry
8. Apply gender & social equity principles & policies
9. Supervise works to comply with procedures, specifications, and manuals
10. Supervise preparation, use and maintenance of tools and equipment
11. Supervise interpretations of technical drawings, plans and mathematic Calculations

CORE COMPETENCIES

1. Install and Test Electrical in Residential Building
2. Install and Test Electrical in Commercial and Industrial Building
3. Maintain Electrical Machines and Application
4. Maintain Power System and Switchboard
5. Maintain Electrical Auxiliary Systems
6. Program Intelligent Building Control Systems
7. Maintain Solar Photovoltaic Systems

COURSE DESCRIPTION:

This course is designed to develop the knowledge, skills, and attitude of an individual in the field of INSTALLATION AND MAINTENANCE POWER AND CONTROL SYSTEM IN BUILDING in accordance with electrical industry standards. It covers core competencies such as: a) Install and Test Electrical in Residential Building b) Install and Test Electrical in Commercial and Industrial Building c) Maintain Electrical Machines and Applications d) Maintain Power System and Switchboard e) Maintain Electrical Auxiliary Systems f) Program Intelligent Building Control Systems g) Maintain Solar Photovoltaic Systems.

Completion of this training course and passing equivalent competency assessment will qualify the individual to obtain the (High diploma Certificate 4) in Installation and Maintenance Power and Control System in Building.

Student/Trainee Entry Requirements:

Student/trainee should possess the following requirement:

1. Have completed Technical-Vocational Certificate level 4
2. Passed entrance examination
3. Physically and mentally fit,
4. Can perform basic mathematical computations,
5. Can communicate both orally and in written form, and
6. With good moral character.

Course Structure:

BASIC COMPETENCY
(330 Hours)

Unit of Competency	Module Title	Learning Outcomes	Nominal Duration
1. Supervise application of key communication skills in the workplace	1.1 Supervising application of key communication skills in the workplace	1.1.1 Meet common and specific communication needs of clients and colleagues 1.1.2 Contribute to the development of communication strategies 1.1.3 Represent the organization 1.1.4 Facilitate group discussion 1.1.5 Conduct interviews	30 hrs.
2. Supervise development of teams & individuals	2.1 Supervising development of teams & individuals	2.1.1 Supervise team leadership development 2.1.2 Foster individual and organizational growth 2.1.3 Monitor and evaluate workplace learning 2.1.4 Develop team commitment and cooperation 2.1.5 Facilitate accomplishment of organizational goals	30 hrs.
3. Supervise on problem solving techniques in the workplace	3.1 Supervising on problem solving techniques in the workplace	3.1.1 Analyze the problem 3.1.2 Identify the possible solution 3.1.3 Recommend solution to teams or higher management 3.1.4 Implement & Supervise Solution 3.1.5 Monitor outcomes	30 hrs.
4. Supervise data collection and analysis in the workplace	4.1 Supervising data collection and analysis in the workplace	4.1.1 Study information requirements 4.1.2 Process Data collected 4.1.3 Analyse, interpret and organize information gathered 4.1.4 Present findings, recommendations	30 hrs.
5. Plan & organize work for several work teams	5.1 Planning & organizing work for several work teams	5.1.1 Set objectives 5.1.2 Plan and schedule work activities 5.1.3 Implement work plans 5.1.4 Monitor work activities 5.1.5 Evaluate works plans & activities	30 hrs.
6. Supervise environmental protection implem 7. 8. entation	8.1 Supervising environmental protection implementation	8.1.1 Adopt environmental protection policy & principles 8.1.2 Implement specific environmental programs. 8.1.3 Monitor activities on	30 hrs.

		environmental protection /programs	
9. Supervise OHS work issues in the construction industry	9.1 Supervising OHS work issues in the construction industry	9.1.1 Risk identification 9.1.2 Risk assessment 9.1.3 Risk prevention & supervision 9.1.4 Emergency procedures	30 hrs.
10. Apply gender & social equity principles & policies	10.1 Applying gender & social equity principles & policies	10.1.1 Follow guidelines or rules of conduct related to gender and social equity in the workplace 10.1.2 Contribute to improve workplace guidelines in promoting gender and social equity 10.1.3 Recognize and report suspected cases of gender and other forms of social inequity	30 hrs.
11. Supervise works to comply with procedures, specifications, and manuals	11.1 Supervising works to comply with procedures, specifications, and manuals	11.1.1 Review Standard Operating Procedure (SOP's), specifications & manuals. 11.1.2 Interpret compliance of SOP, manuals & specifications 11.1.3 Recording & reporting	30 hrs.
12. Supervise preparation, use and maintenance of tools and equipment	12.1 Supervising preparation, use and maintenance of tools and equipment	12.1.1 Supervise planning of resource requirements 12.1.2 Supervise requisition & acceptance of resources	30 hrs.
13. Supervise interpretation of technical drawings, plans and mathematic Calculations	13.1 Supervising interpretation of technical drawings, plans and mathematic Calculations	13.1.1 Analyze signs, symbols and data 13.1.2 Interpret technical drawings and work plans 13.1.3 Approve drawings & plans	30 hrs.

CORE COMPETENCY
(1170hours)

Unit of Competency	Module Title	Learning Outcomes	Nominal Duration
1. Install and Test Electrical in Residential Building	1.1 Installing and Testing Electrical in Residential Building	1.1.1 Maintain safety and electrical standards 1.1.2 Prepare electrical drawings of electrical installation / equipment	135hrs

		1.1.3 Install and maintain electrical final residential circuits and wiring systems 1.1.4 Install and maintain AC incoming supply system 1.1.5 Inspect and test electrical installations	
2. Install and Test Electrical in Commercial and Industrial Building	1.2 Installing and Testing Electrical in Commercial and Industrial Building	2.1.1 Maintain electrical installations 2.1.2 Prepare electrical drawings of electrical installation / equipment 2.1.3 Install and maintain industrial electrical final circuits and wiring systems 2.1.4 Install and maintain emergency lighting systems 2.1.5 Install and maintain 3-phase AC incoming supply system 2.1.6 Inspect and test electrical installations	165hrs
3. Maintain Electrical Machines and Applications	1.3 Maintaining Electrical Machines and Applications	3.1.1 Maintain DC machines (motors) 3.1.2 Maintain AC machines (motors) 3.1.3 Maintain motor control circuits and equipment 3.1.4 Evaluate motor performance 3.1.5 Perform synchronization of generators to busbar	135hrs
4. Maintain Power System and Switchboard	1.4 Maintaining Power System and Switchboard	4.1.1 Maintain incoming supply connected to switchboard and equipment 4.1.2 Maintain electrical switchboard 4.1.3 Perform isolation, lockout and tag out procedures 4.1.4 Maintain electrical power monitoring system	150hrs
5. Maintain Electrical Auxiliary Systems	1.5 Maintaining Electrical Auxiliary Systems	5.1.1 Maintain temporary electrical supply connection 5.1.2 Maintain data cabling and equipment in Security system 5.1.3 Install and maintain fire alarm system	135hrs
6. Program Intelligent Building Control Systems	1.6 Programming Intelligent Building Control Systems	6.1.1 Program PLC system 6.1.2 Install smart home system 6.1.3 Manage Intelligent Building Control System	235hrs

7. Maintain Solar Photovoltaic Systems	1.7 Maintaining Solar Photovoltaic Systems	7.1.1 Connect Solar Modules in various configurations 7.1.2 Test PV Modules Performance under different operating conditions 7.1.3 Maintain Off grid PV system 7.1.4 Maintain On grid PV system	195hrs
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Competency Analysis:

Table 1: Basic Competencies

No.	UNIT OF COMPETENCY	MODULE																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.	Supervise application of key communication skills in the workplace	x	x	x	x																			
2.	Supervise development of teams & individuals					X	x	x	x	x														
3.	Supervise on problem solving techniques in the workplace										x	x	x	x	x									
4.	Supervise data collection and analysis in the workplace															x	x	x	x					
5.	Plan & organize work for several work teams																			x	x	x	x	x

Table 1: (continued....)

No.	UNIT OF COMPETENCY	MODULE																			
		24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	38	40	41		
6.	Supervise environmental protection implementation	x	x	x																	

7.	Supervise OHS work issues in the construction industry				x	X	x	x													
8.	Apply gender & social equity principles & policies								x	x	x										
9.	Supervise works to comply with procedures, specifications, and manuals													x	x	x					
10.	Supervise preparation, use and maintenance of tools and equipment																x	x			
11.	Supervise interpretations of technical drawings, plans and mathematic calculations																		x	x	x

Table 2: Core Competencies

No.	UNIT OF COMPETENCY	Module																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1.	Install and Test Electrical in Residential Building	x	x	x	x	x															
2.	Install and Test Electrical in Commercial and Industrial Building						x	x	x	x	x	x									
3.	Maintain Electrical Machines and Applications												x	x	x	x	x				
4.	Maintain Power System and Switchboard																	x	x	x	x

Table 2: (continued....)

No.	UNIT OF COMPETENCY	Module									
		21	22	23	24	25	26	27	28	29	30
5.	Maintain Electrical Auxiliary Systems	x	x	x							
6.	Program Intelligent Building Control Systems				x	x	x				
7.	Maintain Solar Photovoltaic Systems							x	x	x	x

Assessment:

1. Oral questioning test
2. Written test/Theoretical exam
3. Practical workshop/workplace test
4. Direct observation while the task are being performed

Principle of Course delivery:

The delivery of training should adhere to the design of the competency-based curriculum. Delivery should be guided by the 10 basic principles of competency-based approach to TVET.

Recommended course delivery may include combination of the following:

1. School based Training
2. On-the job training/internship training
3. Dual training

Resources:

• Tools for training

1. Laser pointer	4. projector screen, portable type, big size	8. Permanent markers: blue, black, red
2. LCD Projector, 220V, 50/60Hz	5. White board, portable, 1.2m x 2.4m	9. Flip chart papers
3. Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	6. Writing paper A4 size	10. Handouts/Module/CBLM
	7. Whiteboard markers: blue, black, red, green	11. Printer A3 Color Ink jet (network printer)

• Materials:

1. Risk Assessment Form/Job sheet/Work sheet	38. Metal conduits and fittings	84. Wire Strap
2. Pencil (2B, HB, H, 2H)	39. Metal junction, square and utility boxes	85. Wire Markers
3. Graph paper mm (A4)	40. Screws (wood, metal)	86. Cable Tie
4. Rubber	41. Conduit clamps	87. Tie Mount
5. PVC conduits and fittings	42. Masonry drill bits 6mm	88. Cable Glands/Grommet
6. PVC moldings and fittings	43. Plastic plugs	89. Automotive wires/Conductors
7. Metal conduits and fittings	44. Metal trunking and fittings	90. Insulators
8. PVC junction, square and utility boxes	45. Electrical wires and cables	91. Contact cleaner
9. Metal junction, square and utility boxes	46. G.I. wires (for pulling electrical wire into conduits)	92. Insulating varnish/materials
10. Electrical wires and cables	47. Light receptacles	93. Carbon brushes
11. G.I. wires (for pulling electrical wire into conduits)	48. Wall switches (single, three-way, four-ways)	94. Sandpaper
12. Screws (wood, metal)	49. Metal clad outlets (Duplex, T-slot, Y-slot)	95. Waste rugs
13. Conduit clamps	50. Lamp relays	96. Electrical tapes
14. Plastic plugs	51. Lamp dimmers	97. Warning tags
15. Light receptacles	52. Flood lights/spotlights	98. Signage
16. Wall switches (single, three-way, four-ways)	53. Halogen lamps	99. Lockout/tagout
17. Convenience outlets (Duplex, T-slot, Y-slot)	54. Chandeliers	100. Motor cleaner
18. Lamp	55. 3 phase AC control panel complete with isolator, RCCB, MCBs, earthing and neutral strips	101. Insulating oil
19. Lamp dimmers	56. PVC cables	102. Circuit breakers/Fuses
20. Fluorescent lamp fixtures	57. Inspection form	103. Magnetic Contactors
21. Flood lights/spotlights	58. Testing report	104. Overload protection relay
22. Track lights	59. Shorting jumpers	105. Power Cabinet or MCC
23. Halogen lamps	60. Completed mockup wiring station	106. Power and Timers Relays c/w holder
		107. Terminal Blocks/Lugs
		108. Pilot lamps and Buzzer
		109. Actuators
		110. Push buttons
		111. Selector Switches

24. Chandeliers	61. AC motor circuit connection panel	112. Cable duct
25. Consumer Control Unit complete with isolator, RCCB, MCBs, earthing and neutral strips	62. Connecting cables	113. Din rail
26. Metering board complete with incoming isolator and consumer's isolator	63. PVC cables for connection	114. Wire Strap
27. 1.5mm ² PVC Cable (Red, Black, Green/Yellow)	64. Connecting terminal blocks	115. Wire Markers
28. 2.5mm ² PVC Cable (Red, Black, Green/Yellow)	65. Lock out devices	116. Cable Tie
29. 6 mm ² PVC Cable (Red, Black, Green/Yellow)	66. Tag out signages	117. Tie Mount
30. PVC pipes and fittings	67. Copper network cable	118. Cable Glands/Grommet
31. Masonry drill bits 6mm	68. 4 pair CAT 5E UTP cable	119. Automotive wires/Conductors
32. Plastic pipe glue	69. 4 pair CAT 6 UTP cable	120. Insulators
33. Masking tape roll	70. 25 pair CAT 5E/6 UTP cable	121. Contact cleaner
34. Electrical insulation tape roll	71. RJ45 plug	122. Insulating varnish/materials
35. Cable connectors (assorted colour)	72. Push button	123. Carbon brushes
36. Input & output devices	73. Selector switches	124. Electrical tapes
37. Connecting Wires	74. Step switches	125. Warning tags
	75. Meter switches	126. Signage
	76. Emergency switch	127. Lockout/tagout
	77. Terminal blocks	128. Motor cleaner
	78. Counter relay	129. Overload Relay
	79. Sensors	130. Over Temperature
	80. Proximity switch	131. Circuit Breaker
	81. Limit switch	132. Fuse
	82. Smoke detector	133. MC Connectors
	83. Fire detector	134. Solar Cables
		135. MC connector wrench
		136. Y Connectors for parallel connection
		137. 2.5mm ² PVC cables (grey, brown)
		138. 4 mm ² Solar cables (red, black)
		139. MC4 straight connectors
		140. Y types of parallel MC connector

• **Tools and Equipment :(machines/training simulator)**

1. Combination pliers	64. Rulers	107. Digital Multimeter
2. Long nose pliers	65. Measuring tapes	108. Insulation Tester
3. Pliers (diagonal side cutter)	66. Compass school	109. Socket polarity tester
4. Screwdrivers (plain tip, cross tip)	67. Triangle ruler	110. Electrical step ladder
5. Mechanical wrenches (open, box, socket, adjustable)	68. Protractor	111. Testing Board protection
6. Pipe wrenches	69. French curves	112. Digital earth tester
7. Plastic pipe cutter	70. Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080	113. Digital insulation tester
8. Steel pipe cutter		114. Leakage current tester
		115. Emergency lighting board
		116. Pencil/marker/chalk line

9. Pipe reamer	complete with	117. Polarity tester
10. Hack saw with blade	applicable OS software	118. Rotation sequence tester
11. Steel tape/Push-pull rule	71. AutoCAD software	119. Pliers
12. Pencil/marker	72. AC motor control panel boards	120. Wrenches
13. Wire strippers	73. VFD control circuit board	121. Wire splicers/strippers
14. Electrician's knife	74. Single phase test board	122. Electrician knives
15. Claw hammer	75. Three phase test board	123. Electric Hand drill
16. Flat files	76. AC motor training system	124. Hand or electric tapping/threading
17. Round files	77. MG-generator set	125. Hack saw
18. Half round files	78. Synchronization kits	126. File
19. Tool hoister with belt	79. Switchboard Training model	127. Manual/Hydraulic puncher
20. Mitre Swivel saw	80. Simulated transformer	128. Crimping tools
21. Multi-meter/tester	81. Knives	129. Soldering tools
22. Megger	82. Earth tester	130. Manual/Hydraulic pipe bender
23. Lamp tester	83. Megger	131. Manual/Electrical Pipe Threader/Reamer
24. Digital earth tester	84. Switchboard Training sets	132. High-speed cutter
25. Digital insulation tester	85. Primary injection testers c/e with shorted link and cables	133. Multi-tester
26. RCD Tester	86. Digital Multimeter	134. Clamp ammeter
27. Clamp meter	87. Insulation testers	135. Insulation resistance tester
28. Impact drill	88. Wire splicers	136. Ground resistance tester
29. Table with vice	89. Pliers	137. Earth leakage tester
30. Heat gun	90. Screwdrivers	138. Harmonic meter
31. Conduit bender 20mm	91. Ammeter	139. Phase Sequence Tester
32. Conduit bender 25mm	92. Clamp meter	140. Heat Tester
33. Switchboard Training units	93. Voltmeter	141. Diagonal Cutter
34. Motor connection	94. Oscilloscope	142. Punch Down Tool
35. Screwdrivers	95. Ohmmeter	143. Wire Stripper Tool
36. Non voltage contact tester	96. Inductance meter	144. Crimping tools
37. PLC training kits	97. PV Modules training kits	145. Network Cable tester
38. Continuity test	98. Pliers	146. Continuity test
39. Electrical insulation test	99. Screwdrivers (cross and straight, 180mm)	147. Electrical insulation test
40. High potential test (as the need arises)	100. Ring cutter	148. High potential test (as the need arises)
41. Earth resistance test	101. Crimping tools	149. Earth resistance test
42. Phase sequence test	102. Wire stripper	150. Phase sequence test
43. Load test	103. Digital multi meter	151. Load test
44. Winding resistance test	104. Insulation tester	152. Winding resistance test
45. Free running test	105. Clamp ammeter	153. Free running test
46. Smart Home Training kits	106. Irradiance Meter	154. DC Motor
47. Test pen		155. AC Motor
48. Screw Drivers		156. Stepper Motor
49. Pliers		157. Servo Motor
50. Digital multimeter		158. Dynamometers
51. Insulation Tester		159. Simulation Test/No Load Test
52. Pliers		160. Phase sequence
53. Screwdrivers (cross and straight, 180mm)		
54. Ring cutter		

55. Crimping tools 56. Wire stripper 57. Digital multi meter 58. Insulation tester 59. Clamp ammeter 60. Irradiance Meter 61. Standalone OFF GRID PV training stations 62. Lighting and PV modules stations 63. GRID tie PV system stations		161. Actual Operation 162. Temperature rise
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• **Personal Protective Equipment (PPE)**

1. Safety hat	4. Safety gloves	7. Safety goggles
2. Safety shoes	5. Dust mask	8. Hearing protection
3. Safety work uniform	6. Safety belt	9. Face shield

• **Service Information (Be used in workplace/workshop)**

1. Service Manual / Shop manual
2. Manufacturer's manual / factory manual
3. Specialized manual
4. General repair manual
5. Service manual Illustrations
6. Service publications
7. Computerized Service Data

Qualification of Instructors/Trainers:

1. Must be a holder of relevant high diploma/Bachelor Degree
2. Must have completed pedagogy program
3. Must have 3 years of teaching experience
4. Must have good command of the English language
5. Must have relevant practical work experience
6. Must be computer literate
7. Must have good interpersonal skill
8. Physically and Mentally fit
9. Good moral character

**MODULES OF INSTRUCTION
BASIC COMPETENCIES**

**INSTALLATION AND MAINTENANCE POWER AND CONTROL SYSTEM IN
BUILDING
HIGH DIPLOMA
(LEVEL 5)**

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Application of Key Communication

Module Title : Supervising Application of Key Communication

Module Descriptor :

This module covers the outcomes required to supervise the application of key communication skills in the workplace.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Meet common and specific communication needs of clients and colleagues
- LO2. Contribute to the development of communication strategies
- LO3. Represent the organization
- LO4. Facilitate group discussion
- LO5. Conduct interviews

LO1. Meet common and specific communication needs of clients and colleagues

Assessment Criteria:

1. Specific communication needs of clients and colleagues are identified and met
2. Different approaches are used to meet communication needs of clients and colleagues
3. Conflict is addressed promptly and in a timely way and in a manner, which does not compromise the standing of the organization

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Communication process
- 1.2 Dynamics of groups and different styles of group leadership
- 1.3 Communication skills relevant to client groups

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Full range of communication techniques including:
 - 3.1.1 Full range of communication
 - 3.1.2 Active listening
 - 3.1.3 Feedback
 - 3.1.4 Interpretation
 - 3.1.5 Role boundaries setting
 - 3.1.6 Negotiation
 - 3.1.7 Establishing empathy
- 3.2 Communication skills required to fulfill job roles as specified by the organization

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2

9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Contribute to the development of communication strategies

Assessment Criteria:

1. Strategies for internal and external dissemination of information are developed, promoted, implemented and reviewed as required
2. Channels of communication are established and reviewed regularly
3. Coaching in effective communication is provided
4. Work related network and relationship are maintained as necessary
5. Negotiation and conflict resolution strategies are used where required
6. Communication with clients and colleagues is appropriate to individual needs and organizational objectives

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Communication process
- 1.2 Dynamics of groups and different styles of group leadership
- 1.3 Communication skills relevant to client groups

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Full range of communication techniques including:
 - 3.1.1 Full range of communication
 - 3.1.2 Active listening
 - 3.1.3 Feedback
 - 3.1.4 Interpretation
 - 3.1.5 Role boundaries setting
 - 3.1.6 Negotiation
 - 3.1.7 Establishing empathy
- 3.2 Communication skills required to fulfill job roles as specified by the organization

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1

4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Represent the organization

Assessment Criteria:

1. When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization
2. Presentation is clear and sequential and delivered within a predetermined time
3. Utilize appropriate media to enhance presentation
4. Differences in views are respected
5. Written communication is consistent with organizational standards
6. Inquiries are responded in a manner consistent with organizational standard

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Communication process
- 1.2 Dynamics of groups and different styles of group leadership
- 1.3 Communication skills relevant to client groups

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Full range of communication techniques including:
 - 3.1.1 Full range of communication
 - 3.1.2 Active listening
 - 3.1.3 Feedback
 - 3.1.4 Interpretation
 - 3.1.5 Role boundaries setting
 - 3.1.6 Negotiation
 - 3.1.7 Establishing empathy
- 3.2 Communication skills required to fulfill job roles as specified by the organization

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1

5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Facilitate group discussion

Assessment Criteria:

1. Mechanisms which enhance effective group interaction is defined and implemented
2. Strategies which encourage all group members to participate are used routinely
3. Objectives and agenda for meetings and discussions are routinely set and followed
4. Relevant information is provided to group to facilitate outcomes
5. Evaluation of group communication strategies is undertaken to promote participation of all parties
6. Specific communication needs of individuals are identified and addressed

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Communication process
- 1.2 Dynamics of groups and different styles of group leadership
- 1.3 Communication skills relevant to client groups

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Full range of communication techniques including:
 - 3.1.1 Full range of communication
 - 3.1.2 Active listening
 - 3.1.3 Feedback
 - 3.1.4 Interpretation
 - 3.1.5 Role boundaries setting
 - 3.1.6 Negotiation
 - 3.1.7 Establishing empathy
- 3.2 Communication skills required to fulfill job roles as specified by the organization

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1

5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Conduct interviews

Assessment Criteria:

1. Types of interview are employed in interview situations
2. Records of interviews are made and maintained in accordance with organizational procedures
3. Effective questioning, listening and nonverbal communication techniques are used to ensure that the required message is communicated.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Communication process
- 1.2 Dynamics of groups and different styles of group leadership
- 1.3 Communication skills relevant to client groups

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Full range of communication techniques including:
 - 3.1.1 Full range of communication
 - 3.1.2 Active listening
 - 3.1.3 Feedback
 - 3.1.4 Interpretation
 - 3.1.5 Role boundaries setting
 - 3.1.6 Negotiation
 - 3.1.7 Establishing empathy
- 3.2 Communication skills required to fulfill job roles as specified by the organization

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO5.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Development of Teams & Individuals

Module Title : Supervising Development of Teams & Individuals

Module Descriptor :

This module covers the outcomes required to supervise the planning of individual and team development needs and facilitate the development of workgroups

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Supervise team leadership development
- LO2. Foster individual and organizational growth
- LO3. Monitor and evaluate workplace learning
- LO4. Develop team commitment and cooperation
- LO5. Facilitate accomplishment of organizational goals

LO1. Supervise team leadership development

Assessment Criteria:

1. Supervise Learning and development needs implementation in line with organizational requirements
2. Learning plan to meet team leadership developmental needs is collaboratively developed and implemented
3. Team leaders are encouraged to self-evaluate performance and identify areas for improvement
4. Feedback on performance of team leaders & members is collected & evaluated against planned outcomes.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Supervision, Coaching and mentoring principles
- 1.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective
- 1.3 How to facilitate team development and improvement
- 1.4 Learning theory
- 1.5 Methods and techniques for extracting and interpreting feedback
- 1.6 Methods for identifying and prioritizing personal development opportunities and options
- 1.7 Career paths and competency standards in the industry

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Listening Skills.
- 3.2 Planning Skills
- 3.3 Learning methods/domains (Blooms taxonomy etc.)
- 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management
- 3.5 Coaching and mentoring skills
- 3.6 Monitoring & evaluation skills
- 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes
- 3.8 Facilitation skills to conduct small group training sessions
- 3.9 Interpersonal skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Foster individual and organizational growth

Assessment Criteria:

1. Learning and development program goals and objectives are identified to match the needs.
2. Learning delivery methods are appropriate to the learning goals, the learning style of participants & availability of equipment and resources
3. Supervise workplace learning and coaching/ mentoring to facilitate individual and team achievement of competencies
4. Resources and timelines required for learning activities are identified and approved in accordance with organizational requirements

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Supervision, Coaching and mentoring principles
- 1.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective
- 1.3 How to facilitate team development and improvement
- 1.4 Learning theory
- 1.5 Methods and techniques for extracting and interpreting feedback
- 1.6 Methods for identifying and prioritizing personal development opportunities and options
- 1.7 Career paths and competency standards in the industry

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Listening Skills.
- 3.2 Planning Skills
- 3.3 Learning methods/domains (Blooms taxonomy etc.)
- 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management
- 3.5 Coaching and mentoring skills
- 3.6 Monitoring & evaluation skills
- 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes
- 3.8 Facilitation skills to conduct small group training sessions
- 3.9 Interpersonal skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Monitor and evaluate workplace learning

Assessment Criteria:

1. Feedback from individuals, teams is used to identify and implement improvements in future learning arrangements
2. Supervised outcomes and performance of individuals/teams are assessed and recorded to determine the effectiveness of development programs and the extent of additional support
3. Modifications to learning plans are negotiated to improve the efficiency and effectiveness of learning
4. Records and reports of competency are maintained in line with SOP & QMS

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Supervision, Coaching and mentoring principles
- 1.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective
- 1.3 How to facilitate team development and improvement
- 1.4 Learning theory
- 1.5 Methods and techniques for extracting and interpreting feedback
- 1.6 Methods for identifying and prioritizing personal development opportunities and options
- 1.7 Career paths and competency standards in the industry

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Listening Skills.
- 3.2 Planning Skills
- 3.3 Learning methods/domains (Blooms taxonomy etc.)
- 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management
- 3.5 Coaching and mentoring skills
- 3.6 Monitoring & evaluation skills
- 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes
- 3.8 Facilitation skills to conduct small group training sessions
- 3.9 Interpersonal skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Develop team commitment and cooperation

Assessment Criteria:

1. Open communication processes to obtain and share information is used by team
2. Decisions are reached by consensus in accordance with the teams agreed roles and responsibilities
3. Mutual concern and support are developed within the team

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Supervision, Coaching and mentoring principles
- 1.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective
- 1.3 How to facilitate team development and improvement
- 1.4 Learning theory
- 1.5 Methods and techniques for extracting and interpreting feedback
- 1.6 Methods for identifying and prioritizing personal development opportunities and options
- 1.7 Career paths and competency standards in the industry

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Listening Skills.
- 3.2 Planning Skills
- 3.3 Learning methods/domains (Blooms taxonomy etc.)
- 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management
- 3.5 Coaching and mentoring skills
- 3.6 Monitoring & evaluation skills
- 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes
- 3.8 Facilitation skills to conduct small group training sessions
- 3.9 Interpersonal skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20

2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Facilitate accomplishment of organizational goals

Assessment Criteria:

1. Team members actively participated in team activities and communication processes
2. Teams members developed individual and joint responsibility for their actions
3. Collaborative efforts are sustained to attain organizational goals

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Supervision, Coaching and mentoring principles
- 1.2 How to work effectively with team members with diverse work styles, aspirations, cultures and perspective
- 1.3 How to facilitate team development and improvement
- 1.4 Learning theory
- 1.5 Methods and techniques for extracting and interpreting feedback
- 1.6 Methods for identifying and prioritizing personal development opportunities and options
- 1.7 Career paths and competency standards in the industry

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Listening Skills.
- 3.2 Planning Skills
- 3.3 Learning methods/domains (Blooms taxonomy etc.)
- 3.4 Communication skills including receiving feedback and reporting, maintaining effective relationships and conflict management
- 3.5 Coaching and mentoring skills
- 3.6 Monitoring & evaluation skills
- 3.7 Reporting skills to organize information; assess information for relevance and accuracy; identify and elaborate on learning outcomes
- 3.8 Facilitation skills to conduct small group training sessions
- 3.9 Interpersonal skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO5.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20

2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building
Unit of Competency : Supervise on Problem Solving Techniques in the Workplace
Module Title : Supervising on Problem-Solving Techniques in the Workplace

Module Descriptor :
This module covers the outcomes required to supervise the problem-solving techniques in the workplace.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :
Upon completion of this module, the students/trainees should be able to:

- LO1. Analyze the problem
- LO2. Identify the possible solution
- LO3. Recommend solution to teams or higher management
- LO4. Implement & Supervise Solution
- LO5. Monitor outcomes

LO1. Analyze the problem

Assessment Criteria:

1. Supervise evaluation and reporting techniques & reports
2. Supervise development of possible cause & solution statements based on findings within the areas of responsibilities

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 QMS organizational systems and functions
- 1.2 Maintenance practices & data management
- 1.3 Data management hardware and software
- 1.4 Knowledge of the client business domain
- 1.5 Broad knowledge base of diagnostic tools
- 1.6 General principles of OHS
- 1.7 Divisional/unit responsibilities

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervise decision making by individuals & teams
- 3.2 Communication skills applied
- 3.3 Supervise Teamwork in reference to personal responsibility
- 3.4 Time management as applied to self-management.
- 3.5 Analytical skills in relation to routine malfunctions.
- 3.6 General customer service skills displayed.
- 3.7 Consistently & effectively applying questioning and active listening skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Identify the possible solution

Assessment Criteria:

1. Supervise resolution decision making process in accordance with relevant procedures and safety
2. Strengths and weaknesses of possible options are considered

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 QMS organizational systems and functions
- 1.2 Maintenance practices & data management
- 1.3 Data management hardware and software
- 1.4 Knowledge of the client business domain
- 1.5 Broad knowledge base of diagnostic tools
- 1.6 General principles of OHS
- 1.7 Divisional/unit responsibilities

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervise decision making by individuals & teams
- 3.2 Communication skills applied
- 3.3 Supervise Teamwork in reference to personal responsibility
- 3.4 Time management as applied to self-management.
- 3.5 Analytical skills in relation to routine malfunctions.
- 3.6 General customer service skills displayed.
- 3.7 Consistently & effectively applying questioning and active listening skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Recommend solution to teams or higher management

Assessment Criteria:

1. reports/communication or documentations are prepared
2. Recommendations are presented to appropriate personnel in line with SOP QMS & OHS
3. Recommendations are followed-up if required

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 QMS organizational systems and functions
- 1.2 Maintenance practices & data management
- 1.3 Data management hardware and software
- 1.4 Knowledge of the client business domain
- 1.5 Broad knowledge base of diagnostic tools
- 1.6 General principles of OHS
- 1.7 Divisional/unit responsibilities

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervise decision making by individuals & teams
- 3.2 Communication skills applied
- 3.3 Supervise Teamwork in reference to personal responsibility
- 3.4 Time management as applied to self-management.
- 3.5 Analytical skills in relation to routine malfunctions.
- 3.6 General customer service skills displayed.
- 3.7 Consistently & effectively applying questioning and active listening skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Implement & Supervise Solution

Assessment Criteria:

1. Measurable objectives are identified
2. Resource needs are identified
3. Timelines are identified in accordance with plan
4. Corrective actions process is supervised
5. Recommendations are actioned & recorded

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 QMS organizational systems and functions
- 1.2 Maintenance practices & data management
- 1.3 Data management hardware and software
- 1.4 Knowledge of the client business domain
- 1.5 Broad knowledge base of diagnostic tools
- 1.6 General principles of OHS
- 1.7 Divisional/unit responsibilities

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervise decision making by individuals & teams
- 3.2 Communication skills applied
- 3.3 Supervise Teamwork in reference to personal responsibility
- 3.4 Time management as applied to self-management.
- 3.5 Analytical skills in relation to routine malfunctions.
- 3.6 General customer service skills displayed.
- 3.7 Consistently & effectively applying questioning and active listening skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1

5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Monitor outcomes

Assessment Criteria:

1. Recommendations are prepared and submitted to line with procedures.
2. Supervised implementation of processes and improvements.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 QMS organizational systems and functions
- 1.2 Maintenance practices & data management
- 1.3 Data management hardware and software
- 1.4 Knowledge of the client business domain
- 1.5 Broad knowledge base of diagnostic tools
- 1.6 General principles of OHS
- 1.7 Divisional/unit responsibilities

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervise decision making by individuals & teams
- 3.2 Communication skills applied
- 3.3 Supervise Teamwork in reference to personal responsibility
- 3.4 Time management as applied to self-management.
- 3.5 Analytical skills in relation to routine malfunctions.
- 3.6 General customer service skills displayed.
- 3.7 Consistently & effectively applying questioning and active listening skills

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO5.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2

10.	Whiteboard eraser	pc.	1
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Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Data Collection and Analysis in the Workplace

Module Title : Supervising Data Collection and Analysis in the Workplace

Module Descriptor :

This module covers the outcomes required to supervise the collection & processing of data in the workplace.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

LO1. Study information requirements

LO2. Process Data collected

LO3. Analyse, interpret and organize information gathered

LO4. Present findings, recommendations

LO1. Study information requirements

Assessment Criteria:

1. Needs are identified using established research procedures
2. Relevant forms and recording systems are used to gather the information.
3. Respondents are selected to implement survey / research based on established procedures

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Data processing, Information analysis and interpretation
- 1.2 Research methods
 - a. Qualitative
 - b. Quantitative
 - c. Statistical
- 1.3 Report writing
- 1.4 Use of relevant software
 - a. Spread sheets
 - b. Presentation graphics
 - c. Work processor
 - d. Statistical package

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Communication is clear, precise and varies according to the type of audience Research & Analysis techniques & processes
- 3.2 Data reading & interpretation
- 3.3 Problem solving
- 3.4 Analytical skills in relation to routine malfunctions
- 3.5 General customer service skills displayed
- 3.6 Time management as applied to self-management
- 3.7 Decision making within a limited range of options.

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20

2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Process Data collected

Assessment Criteria:

1. Data & Information are collected and collated based on the prescribed method
2. Relevant data are used as references in accordance with the objectives of the program.
3. Information is compiled according to the required form.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Data processing, Information analysis and interpretation
- 1.2 Research methods
 - a. Qualitative
 - b. Quantitative
 - c. Statistical
- 1.3 Report writing
- 1.4 Use of relevant software
 - a. Spread sheets
 - b. Presentation graphics
 - c. Work processor
 - d. Statistical package

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Communication is clear, precise and varies according to the type of audience Research & Analysis techniques & processes
- 3.2 Data reading & interpretation
- 3.3 Problem solving
- 3.4 Analytical skills in relation to routine malfunctions
- 3.5 General customer service skills displayed
- 3.6 Time management as applied to self-management
- 3.7 Decision making within a limited range of options.

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20

2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Analyse, interpret and organize information gathered

Assessment Criteria:

1. Data are analyzed using relevant methodologies
2. Where applicable, statistical analysis/methods are employed according to the objectives of the program
3. Graphs and other visual presentations are prepared to facilitate analysis / interpretation of information

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Data processing, Information analysis and interpretation
- 1.2 Research methods
 - a. Qualitative
 - b. Quantitative
 - c. Statistical
- 1.3 Report writing
- 1.4 Use of relevant software
 - a. Spread sheets
 - b. Presentation graphics
 - c. Work processor
 - d. Statistical package

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Communication is clear, precise and varies according to the type of audience Research & Analysis techniques & processes
- 3.2 Data reading & interpretation
- 3.3 Problem solving
- 3.4 Analytical skills in relation to routine malfunctions
- 3.5 General customer service skills displayed
- 3.6 Time management as applied to self-management
- 3.7 Decision making within a limited range of options.

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
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1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Present findings, recommendations

Assessment Criteria:

1. Report on recommendations are prepared in line with procedures
2. Recommendations are presented to appropriate personnel.
3. Recommendations are followed-up & monitored as appropriate.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Data processing, Information analysis and interpretation
- 1.2 Research methods
 - a. Qualitative
 - b. Quantitative
 - c. Statistical
- 1.3 Report writing
- 1.4 Use of relevant software
 - a. Spread sheets
 - b. Presentation graphics
 - c. Work processor
 - d. Statistical package

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Communication is clear, precise and varies according to the type of audience Research & Analysis techniques & processes
- 3.2 Data reading & interpretation
- 3.3 Problem solving
- 3.4 Analytical skills in relation to routine malfunctions
- 3.5 General customer service skills displayed
- 3.6 Time management as applied to self-management
- 3.7 Decision making within a limited range of options.

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1

3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Plan & Organize Work for Several Work Teams

Module Title : Planning & Organization Work for Several Work Teams

Module Descriptor :

This module covers the outcomes required to plan & organize work for several work teams.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

LO1. Set objectives

LO2. Plan and schedule work activities

LO3. Implement work plans

LO4. Monitor work activities

LO5. Evaluate works plans & activities

LO1. Set objectives

Assessment Criteria:

1. Work Objectives set are consistent with and linked to work activities in accordance with organizational aims
2. Objectives are stated as measurable targets with clear time frames
3. Support and commitment of team members are reflected in the objectives

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Organization strategic plan
- 1.2 SOP's
- 1.3 QMS
- 1.4 OHS
- 1.5 Teamwork & consultation strategies

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Planning
- 3.2 Organizing
- 3.3 Coordinating
- 3.4 Communication
- 3.5 Interpersonal/intra-person
- 3.6 Motivation
- 3.7 Presentation
- 3.8 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2

9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Plan and schedule work activities

Assessment Criteria:

1. Tasks/work activities to be completed are identified and prioritized as directed
2. Tasks/work activities are broken down into steps in accordance with agreed set time frames
3. Resources are allocated as per requirements of the activity
4. Schedule of work activities is coordinated with personnel concerned

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Organization strategic plan
- 1.2 SOP's
- 1.3 QMS
- 1.4 OHS
- 1.5 Teamwork & consultation strategies

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Planning
- 3.2 Organizing
- 3.3 Coordinating
- 3.4 Communication
- 3.5 Interpersonal/intra-person
- 3.6 Motivation
- 3.7 Presentation
- 3.8 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Implement work plans

Assessment Criteria:

1. Work methods and practices are identified in consultation with personnel concerned
2. Work plans are implemented in accordance with set time frames, resources & standards
3. Appropriate actions are always implemented

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Organization strategic plan
- 1.2 SOP's
- 1.3 QMS
- 1.4 OHS
- 1.5 Teamwork & consultation strategies

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Planning
- 3.2 Organizing
- 3.3 Coordinating
- 3.4 Communication
- 3.5 Interpersonal/intra-person
- 3.6 Motivation
- 3.7 Presentation
- 3.8 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2

10.	Whiteboard eraser	pc.	1
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Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Monitor work activities

Assessment Criteria:

1. Work activities & performances are monitored and compared with set objectives
2. Deviations from work activities are reported and recommendations are in accordance with set standards
3. Reporting requirements are compiled in accordance with SoP's & QMS
4. Reports are and maintained in accordance with standard operating procedures

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Organization strategic plan
- 1.2 SOP's
- 1.3 QMS
- 1.4 OHS
- 1.5 Teamwork & consultation strategies

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Planning
- 3.2 Organizing
- 3.3 Coordinating
- 3.4 Communication
- 3.5 Interpersonal/intra-person
- 3.6 Motivation
- 3.7 Presentation
- 3.8 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Evaluate works plans & activities

Assessment Criteria:

1. Plans, strategies & implementation outcomes are evaluated with teams in line with SoP's & QMS
2. Evaluation outcomes are recorded and actioned as required.
3. All evaluation data is recorded and used to provide team & supervisor feedback.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Organization strategic plan
- 1.2 SOP's
- 1.3 QMS
- 1.4 OHS
- 1.5 Teamwork & consultation strategies

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Planning
- 3.2 Organizing
- 3.3 Coordinating
- 3.4 Communication
- 3.5 Interpersonal/intra-person
- 3.6 Motivation
- 3.7 Presentation
- 3.8 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO5.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2

9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Environmental Protection Implementation

Module Title : Supervising Environmental Protection Implementation

Module Descriptor :

This module covers the outcomes required to supervise environmental protection implementation in the workplace

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

LO1. Adopt environmental protection policy & principles.

LO2. Implement specific environmental programs.

LO3. Monitor activities on environmental protection /programs

LO1. Adopt environmental protection policy & principles.**Assessment Criteria:**

1. Environmental legislations/conventions and local regulations are identified & adopted
2. Industrial standard/environmental practices are identified according to various environmental concerns & impact.
3. Environmental management support systems are established & operational

Related Knowledge, Skills, Attitude and Safety:**1. Knowledge includes the following:**

- 1.1 ISO 14001:2015, 14004:2016
- 1.2 Company EMS, policy & procedures
- 1.3 Environmental protocols
- 1.4 Supervisory principles
- 1.5 Internal & external auditor (EMS)
- 1.6 Compliance & noncompliance

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervisory skills
- 3.2 Management of ISO 14001:2015, 14004:2016
- 3.3 EMS Auditing skills
- 3.4 Research & analysis.
- 3.5 Fault finding & solution planning
- 3.6 Report writing

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2

10.	Whiteboard eraser	pc.	1
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Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Implement specific environmental programs.

Assessment Criteria:

1. **Programs/Activities** are identified according to organizations policies and guidelines
2. Individual roles/responsibilities are determined and performed based on the activities identified
3. Environmental issues are identified & resolved in accordance with organizations' policies and guidelines
4. Environmental stakeholders are consulted based on company environmental guidelines.

Related Knowledge, Skills, Attitude and Safety:

1. **Knowledge includes the following:**
 - 1.1 ISO 14001:2015, 14004:2016
 - 1.2 Company EMS, policy & procedures
 - 1.3 Environmental protocols
 - 1.4 Supervisory principles
 - 1.5 Internal & external auditor (EMS)
 - 1.6 Compliance & noncompliance
2. **Attitude includes the following:**
 - 2.1 Patriotism
 - 2.2 Quality consciousness
 - 2.3 Concern for details
 - 2.4 Honesty
 - 2.5 Punctuality
3. **Skill includes the following:**
 - 3.1 Supervisory skills
 - 3.2 Management of ISO 14001:2015, 14004:2016
 - 3.3 EMS Auditing skills
 - 3.4 Research & analysis.
 - 3.5 Fault finding & solution planning
 - 3.6 Report writing

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Monitor activities on environmental protection /programs

Assessment Criteria:

1. Activities are periodically monitored and evaluated according to the objectives of the environmental programmed.
2. Feedback from stakeholders are gathered and considered in proposing enhancements to the program based on consultations.
3. Data gathered are analyzed based on evaluation requirements within environmental auditing.
4. Environmental protection recommendations are made & submitted based on the findings.
5. Environmental non-compliance issues are reported, monitored and managed.

Related Knowledge, Skills, Attitude and Safety:

- 1. Knowledge includes the following:**
 - 1.1 ISO 14001:2015, 14004:2016
 - 1.2 Company EMS, policy & procedures
 - 1.3 Environmental protocols
 - 1.4 Supervisory principles
 - 1.5 Internal & external auditor (EMS)
 - 1.6 Compliance & noncompliance
- 2. Attitude includes the following:**
 - 2.1 Patriotism
 - 2.2 Quality consciousness
 - 2.3 Concern for details
 - 2.4 Honesty
 - 2.5 Punctuality
- 3. Skill includes the following:**
 - 3.1 Supervisory skills
 - 3.2 Management of ISO 14001:2015, 14004;2016
 - 3.3 EMS Auditing skills
 - 3.4 Research & analysis.
 - 3.5 Fault finding & solution planning
 - 3.6 Report writing

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
	Handouts	sets	20
1.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
2.	LCD Projector 220V,50/ 60 Hz	unit	1
3.	Projector screen, portable type big size	unit	1
4.	White board , portable 1.2 m X 2.4 m	pcs.	2

5.	OHP Projector	unit	1
6.	Whiteboard marker. Black	pcs.	2
7.	Whiteboard marker. Blue	pcs.	2
8.	Whiteboard marker. Red	pcs.	2
9.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise OSH Work Issues in the Construction Industry

Module Title : Supervising OSH Work Issues in the Construction Industry

Module Descriptor :

This module covers the outcomes required to supervise OHS work issues within any sector of the Construction Industry

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

LO1. Risk identification

LO2. Risk assessment

LO3. Risk prevention & supervision

LO4. Emergency procedures

LO1. Risk identification

Assessment Criteria:

1. OHS Risk Hazards in the work area are identified, assessed and reported to a Supervisor/designated person.
2. Supervisor compiles an OHS risk report in line with SOP, QMS & OHS procedures
3. Hazardous materials on a work site are correctly identified and used according to company and legislated procedures.

Related Knowledge, Skills, Attitude and Safety:

- 1. Knowledge includes the following:**
 - 1.1 What makes a risk/hazard situation?
 - 1.2 Identifying types of risks/hazards
 - 1.3 OHS & Construction terminology
 - 1.4 Safe work practices
 - 1.5 Emergency response procedure
 - 1.6 Evacuation procedures
 - 1.7 First Aid procedures
- 2. Attitude includes the following:**
 - 2.1 Patriotism
 - 2.2 Quality consciousness
 - 2.3 Concern for details
 - 2.4 Honesty
 - 2.5 Punctuality
- 3. Skill includes the following:**
 - 3.1 Identifying/assessing potential hazards
 - 3.2 Hazard response management & teamwork
 - 3.3 Communication skills
 - 3.4 Hazard management skills
 - 3.5 Crisis management

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2

9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Risk assessment

Assessment Criteria:

1. Supervisor & team assess the OHS risk hazards identified.
2. Supervisor implements & manages OHS risk assessment plan.

Related Knowledge, Skills, Attitude and Safety:

- 1. Knowledge includes the following:**
 - 1.1 What makes a risk/hazard situation?
 - 1.2 Identifying types of risks/hazards
 - 1.3 OHS & Construction terminology
 - 1.4 Safe work practices
 - 1.5 Emergency response procedure
 - 1.6 Evacuation procedures
 - 1.7 First Aid procedures
- 2. Attitude includes the following:**
 - 2.1 Patriotism
 - 2.2 Quality consciousness
 - 2.3 Concern for details
 - 2.4 Honesty
 - 2.5 Punctuality
- 3. Skill includes the following:**
 - 3.1 Identifying/assessing potential hazards
 - 3.2 Hazard response management & teamwork
 - 3.3 Communication skills
 - 3.4 Hazard management skills
 - 3.5 Crisis management

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Risk prevention & supervision

Assessment Criteria:

1. Supervisor ensures that Safe work practices, duty of care requirements and safe work instructions are implemented & maintained.
2. OHS, hazard, accident or incident reports contribute to updating workplace procedures & National OHS legislation.
3. Correct personal protective equipment (**PPE**) and clothing for each area of construction work are identified, worn, correctly fitted, used and stored according to SOP.
4. Measures for controlling risks and construction hazards are applied including training & multimedia signage.
5. Lists of designated OHS personnel names and contact data are visually available throughout the workplace in a range of media.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 What makes a risk/hazard situation?
- 1.2 Identifying types of risks/hazards
- 1.3 OHS & Construction terminology
- 1.4 Safe work practices
- 1.5 Emergency response procedure
- 1.6 Evacuation procedures
- 1.7 First Aid procedures

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Identifying/assessing potential hazards
- 3.2 Hazard response management & teamwork
- 3.3 Communication skills
- 3.4 Hazard management skills
- 3.5 Crisis management

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1

3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Emergency procedures

Assessment Criteria:

1. Response and evacuation procedures are known, practised and carried out effectively when required
2. Designated personnel are contacted in the event of an emergency.
3. First aid treatment of minor injuries is carried out correctly and details recorded for use by OHS Supervisor.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 What makes a risk/hazard situation?
- 1.2 Identifying types of risks/hazards
- 1.3 OHS & Construction terminology
- 1.4 Safe work practices
- 1.5 Emergency response procedure
- 1.6 Evacuation procedures
- 1.7 First Aid procedures

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Identifying/assessing potential hazards
- 3.2 Hazard response management & teamwork
- 3.3 Communication skills
- 3.4 Hazard management skills
- 3.5 Crisis management

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO4.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2

10.	Whiteboard eraser	pc.	1
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Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Apply Gender & Social Equity Principles & Policies

Module Title : Applying Gender & Social Equity Principles & Policies

Module Descriptor :

This module covers the outcomes required to apply principles and policies on gender and social equity contributing to positive and productive work environment.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

LO1. Follow guidelines or rules of conduct related to gender and social equity in the workplace

LO2. Contribute to improve workplace guidelines in promoting gender and social equity

LO3. Recognize and report suspected cases of gender and other forms of social inequity

LO1. Follow guidelines or rules of conduct related to gender and social equity in the workplace

Assessment Criteria:

1. Workplace practices and work instructions relating to interacting with different social groups based on gender, ethnicity and disability are recognized and followed, and clarification is sought where necessary
2. Relevant legislation, codes and national standards that impact on gender and social equity are recognized and followed
3. Introduction of and amendments to guidelines in the work conduct related to gender and social fairness practices are responded to positively and promptly in accordance with organizational requirements.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Relevant legislation from all levels of government on gender and other social equity issues involving ethnic groups and disability
- 1.2 Relevant gender and social equity official legislation, policies and workplace practices and procedures
- 1.3 Good practice approaches relevant to work area particularly regarding observance of and compliance with guidelines and policies that uphold and promote gender and social equity.
- 1.4 Gender and other social equity issues, especially in regard to sexual harassment and gender and other discrimination in the workplace
- 1.5 Gender issues in TVET areas traditionally not associated with women
- 1.6 General workplace practices and their potential impact on the gender and other dimensions of social equity

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Discuss and explain gender and other social equity issues in TVET
- 3.2 Communicate with co-workers and students in an inclusive manner that respects the rights of the different groups that constitute the workplace and the classroom
- 3.3 Recognize signs and manifestations of sexual harassment and other forms of gender-based violence in the workplace and in the classroom
- 3.4 Follow workplace directions and instructions
- 3.5 Ability to report and document cases of sexual harassment and other forms of gender-based violence and violence directed at other disadvantaged groups

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Contribute to improve workplace guidelines in promoting gender and social equity

Assessment Criteria:

1. Suggestions are made to designated personnel on how to improve social interaction and communication in the workplace to better promote gender and social equity
2. Information is gathered and improvements are suggested to help improve workplace guidelines and policies in promoting observing gender and social fairness.
3. Gender and social equity issues in the workplace practices are discussed in the workplace with colleagues and designated personnel.
4. Contributions to the review of workplace guidelines and policies gender and social equity guidelines and policies are made within limits of responsibility.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Relevant legislation from all levels of government on gender and other social equity issues involving ethnic groups and disability
- 1.2 Relevant gender and social equity official legislation, policies and workplace practices and procedures
- 1.3 Good practice approaches relevant to work area particularly regarding observance of and compliance with guidelines and policies that uphold and promote gender and social equity.
- 1.4 Gender and other social equity issues, especially in regard to sexual harassment and gender and other discrimination in the workplace
- 1.5 Gender issues in TVET areas traditionally not associated with women
- 1.6 General workplace practices and their potential impact on the gender and other dimensions of social equity

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Discuss and explain gender and other social equity issues in TVET
- 3.2 Communicate with co-workers and students in an inclusive manner that respects the rights of the different groups that constitute the workplace and the classroom
- 3.3 Recognize signs and manifestations of sexual harassment and other forms of gender-based violence in the workplace and in the classroom
- 3.4 Follow workplace directions and instructions
- 3.5 Ability to report and document cases of sexual harassment and other forms of gender-based violence and violence directed at other disadvantaged groups

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Recognize and report suspected cases of gender and other forms of social inequity

Assessment Criteria:

1. Signs and manifestations of gender and social inequities and its impact in the workplace are recognized.
2. Information about or observations of a suspected problem related to gender and social inequity are reported to supervisors and appropriate authorities.
3. Location and extent of suspected gender and social inequities is accurately recorded.
4. Reports on the effect of gender and social inequities are completed according to organizational guidelines.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Relevant legislation from all levels of government on gender and other social equity issues involving ethnic groups and disability
- 1.2 Relevant gender and social equity official legislation, policies and workplace practices and procedures
- 1.3 Good practice approaches relevant to work area particularly regarding observance of and compliance with guidelines and policies that uphold and promote gender and social equity.
- 1.4 Gender and other social equity issues, especially in regard to sexual harassment and gender and other discrimination in the workplace
- 1.5 Gender issues in TVET areas traditionally not associated with women
- 1.6 General workplace practices and their potential impact on the gender and other dimensions of social equity

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Discuss and explain gender and other social equity issues in TVET
- 3.2 Communicate with co-workers and students in an inclusive manner that respects the rights of the different groups that constitute the workplace and the classroom
- 3.3 Recognize signs and manifestations of sexual harassment and other forms of gender-based violence in the workplace and in the classroom
- 3.4 Follow workplace directions and instructions
- 3.5 Ability to report and document cases of sexual harassment and other forms of gender-based violence and violence directed at other disadvantaged groups

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Works to Comply with Procedures, Specifications and Manuals

Module Title : Supervising Works to Comply with Procedures, Specifications and Manuals

Module Descriptor :
This module covers the outcomes required to supervise compliance with operating procedures, supporting specifications & manuals.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :
Upon completion of this module, the students/trainees should be able to:

- LO1. Review Standard Operating Procedure (SOP's), specifications & manuals.
- LO2. Interpret compliance of SOP, manuals & specifications
- LO3. Recording & reporting

LO1. Review Standard Operating Procedure (SOP's), specifications & manuals.**Assessment Criteria:**

1. Supervise status review of SOP's for approved reports and compliance records in line with Quality Management System (QMS) requirements.
2. Existing specifications & manuals are reviewed as fit for use as per job requirements, in line with SOP & QMS.

Related Knowledge, Skills, Attitude and Safety:**1. Knowledge includes the following:**

- 1.1 Electric Installation manuals used in construction sector
- 1.2 Identification of symbols used in the manuals
- 1.3 Identification of units of measurements
- 1.4 Unit conversion
- 1.5 Compliance documents & records

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervisory processes
- 3.2 Interpretation of construction manuals and specifications
- 3.3 Accessing information and data
- 3.4 Monitoring & evaluation
- 3.5 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Interpret compliance of SOP, manuals & specifications

Assessment Criteria:

1. Relevant documents are applied to work processes
2. Compliance requirements are interpreted & applied to a range of work processes.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Electric Installation manuals used in construction sector
- 1.2 Identification of symbols used in the manuals
- 1.3 Identification of units of measurements
- 1.4 Unit conversion
- 1.5 Compliance documents & records

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervisory processes
- 3.2 Interpretation of construction manuals and specifications
- 3.3 Accessing information and data
- 3.4 Monitoring & evaluation
- 3.5 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2

8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Recording & reporting

Assessment Criteria:

1. Compliance data is recorded for a range of work activities according to job & SOP requirements
2. Supervise the process of recording all non-compliance data & actions.
3. Ensure that all correct work processes are interpreted in accordance with information contained on the manual or specifications.
4. Supervise storage/processing of documents and reports.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Electric Installation manuals used in construction sector
- 1.2 Identification of symbols used in the manuals
- 1.3 Identification of units of measurements
- 1.4 Unit conversion
- 1.5 Compliance documents & records

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervisory processes
- 3.2 Interpretation of construction manuals and specifications
- 3.3 Accessing information and data
- 3.4 Monitoring & evaluation
- 3.5 Reporting

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title : Installation and Maintenance Power and Control System in Building

Unit of Competency : Supervise Preparation, Use and Maintenance of Tools and Equipment

Module Title : Supervising Preparation, Using and Maintenance of Tools and Equipment

Module Descriptor :
This module covers the outcomes required to supervising the preparation of construction materials, tools & equipment for assigned tasks.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :
Upon completion of this module, the students/trainees should be able to:

- LO1. Supervise planning of resource requirements
- LO2. Supervise requisition & acceptance of resources

LO1. Supervise planning of resource requirements

Assessment Criteria:

1. Resource requirements are planned for as per job requirements
2. Quantity and description of materials conform with the job requirements
3. Resource planning list approved by supervisor in line with Standard Operating Procedures (SOP).

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Functions & types of construction equipment, tools & materials.
- 1.2 Application & management of forms and data records.
- 1.3 Procedure implementation processes

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervising preparation of tools, equipment & materials
- 3.2 Supervising management of tools, equipment & materials.
- 3.3 Supervising implementation of various procedures

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test

4. Written Test
5. Portfolio

LO2. Supervise requisition & acceptance of resources

Assessment Criteria:

1. Supervisor approves request for materials, equipment, and tools according to the SOP.
2. Resource acceptance and fit for use check is supervised and recorded in line with SOP.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Functions & types of construction equipment, tools & materials.
- 1.2 Application & management of forms and data records.
- 1.3 Procedure implementation processes

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Quality consciousness
- 2.3 Concern for details
- 2.4 Honesty
- 2.5 Punctuality

3. Skill includes the following:

- 3.1 Supervising preparation of tools, equipment & materials
- 3.2 Supervising management of tools, equipment & materials.
- 3.3 Supervising implementation of various procedures

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION

BASIC COMPETENCIES

Course Title	: Installation and Maintenance Power and Control System in Building
Unit of Competency	: Supervise Interpretations of Technical Drawing, Plans and Mathematic Calculations
Module Title	: Supervising Interpretations of Technical Drawing, Plans and Mathematic Calculations

Module Descriptor :

This module covers the outcomes required to supervising the interpretation of drawings, data and work plans by team members.

Level of Certification : High Diploma

Nominal Duration : 30 hrs.

Learning Out comes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Analyze signs, symbols and data
- LO2. Interpret technical drawings and work plans
- LO3. Approve drawings & plans

LO1. Analyze signs, symbols and data**Assessment Criteria:**

1. Technical plans are obtained according to job requirements
2. Drawings and data are clarified according to job specifications
3. Signs symbols and data are determined according to classification or as appropriate in drawings.

Related Knowledge, Skills, Attitude and Safety:**1. Knowledge includes the following:**

1.1 Mathematics

- Linear measurement
- Dimension
- Unit conversion

1.2 Drawings & Plan specifications

- Electrical, mechanical plan, symbols and abbreviations
- Drawing standard symbols

2. Attitude includes the following:

2.1 Patriotism

2.2 Quality consciousness

2.3 Concern for details

2.4 Honesty

2.5 Punctuality

3. Skill includes the following:

3.1 Interpreting technical plans

3.2 Matching specification details with existing resources

3.3 Completion of range of drawings/orthographic drawings

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO1.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Interpret technical drawings and work plans

Assessment Criteria:

1. Resources are identified & listed according to the drawing & work plan
2. Drawing & plan defects identified & recorded as required
3. Supervisor & team match existing/available resources to job requirements
4. Work plan is finalized following the interpretation.

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

1.1 Mathematics

- Linear measurement
- Dimension
- Unit conversion

1.2 Drawings & Plan specifications

- Electrical, mechanical plan, symbols and abbreviations
- Drawing standard symbols

2. Attitude includes the following:

2.1 Patriotism

2.2 Quality consciousness

2.3 Concern for details

2.4 Honesty

2.5 Punctuality

3. Skill includes the following:

3.1 Interpreting technical plans

3.2 Matching specification details with existing resources

3.3 Completion of range of drawings/orthographic drawings

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO2.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Approve drawings & plans

Assessment Criteria:

1. Supervisor approves any/all drawing/plan changes.
2. Non compliances listed and feedback provided to issuing source (drawings & plans).

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

1.1 Mathematics

- Linear measurement
- Dimension
- Unit conversion

1.2 Drawings & Plan specifications

- Electrical, mechanical plan, symbols and abbreviations
- Drawing standard symbols

2. Attitude includes the following:

2.1 Patriotism

2.2 Quality consciousness

2.3 Concern for details

2.4 Honesty

2.5 Punctuality

3. Skill includes the following:

3.1 Interpreting technical plans

3.2 Matching specification details with existing resources

3.3 Completion of range of drawings/orthographic drawings

Methodologies:

1. Lecture
2. Role playing
3. Self-paced instruction
4. Group Activities

Conditions:

Recommended list of tools, equipment and materials for the training of 20 students /trainees for the LO3.

A. Materials and equipment for training

Item No.	Description	Unit	Qty
1.	Handouts	sets	20
2.	Laptop, screen 15 inch , i7 processor, 500GB HDD, 4GB RAM, 786 MB VGA, complete with applicable OS soft wares	unit	1
3.	LCD Projector 220V,50/ 60 Hz	unit	1
4.	Projector screen, portable type big size	unit	1
5.	White board , portable 1.2 m X 2.4 m	pcs.	2
6.	OHP Projector	unit	1
7.	Whiteboard marker. Black	pcs.	2
8.	Whiteboard marker. Blue	pcs.	2
9.	Whiteboard marker. Red	pcs.	2
10.	Whiteboard eraser	pc.	1

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION (1)

CORE COMPETENCIES

Course title : Installation and Maintenance Power and Control System in Building
Unit of Competency : Install and Test Electrical in Residential Building
Module Title : Installing and Testing Electrical in Residential Building

Module Descriptor :

This module covers the outcomes required to design, install, test, and maintain single phase electrical installation and wiring systems in residential premises in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification: High Diploma

Nominal Duration : 135hrs (T3, P3)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Maintain safety and electrical standards
- LO2. Prepare electrical drawings of electrical installation / equipment
- LO3. Install and maintain electrical final residential circuits and wiring systems
- LO4. Install and maintain AC incoming supply system
- LO5. Inspect and test electrical installations

LO1. Maintain safety and electrical standards

Assessment Criteria:

1. Assess the risk involved in electrical works
2. Carry out risk prevention and supervision
3. Maintain electrical installation in accordance with requirements and regulations
4. Access to relevant code of practice for electrical installation correctly
5. Observe and adhere to safety rules and precautions at work area

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need to comply with Local OSH and NSC standards, and Code of Practices
- 1.2 Identify types of common occupational diseases
- 1.3 Explain the importance of risk assessment
- 1.4 Outline the basic/generic steps of risk assessment
- 1.5 Recognize risks at workplace
- 1.6 Describe the types of risk level
- 1.7 Describe the various types of risk control
- 1.8 Personal protective equipment (PPE)
- 1.9 Describe the general requirements to comply with the Code of Practice for electrical installation, maintenance, inspection, and testing

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Conducting risk assessment on electrical installation job
- 3.2 Recommending risk prevention action and control
- 3.3 Selecting proper PPE for the job

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Risk Assessment Form/Job sheet/Work sheet	pcs	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Mechanical wrenches (open, box, socket, adjustable)	sets	5
6.	Pipe wrenches	sets	5
7.	Plastic pipe cutter	pcs	5
8.	Steel pipe cutter	pcs	5
9.	Pipe reamer	pcs	5
10.	Hack saw with blade	pcs	10
11.	Steel tape/Push-pull rule	pcs	20
12.	Pencil/marker	pcs	20
13.	Wire strippers	pcs	20
14.	Electrician's knife	pcs	20
15.	Claw hammer	pcs	20
16.	Flat files	pcs	20
17.	Round files	pcs	20
18.	Half round files	pcs	20
19.	Tool hoister with belt	pcs	20
20.	Mitre Swivel saw	units	5
21.	Multi-meter/tester	units	5
22.	Megger	units	5
23.	Lamp tester	units	5

24.	Digital earth tester	units	5
25.	Digital insulation tester	units	5
26.	RCD Tester	units	5
27.	Clamp meter	units	5
28.	Impact drill	units	5
29.	Table with vice	units	5
30.	Heat gun	pcs	5
31.	Conduit bender 20mm	pcs	8
32.	Conduit bender 25mm	pcs	8

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Prepare electrical drawings of electrical installation / equipment

Assessment Criteria:

1. Interpret electrical drawings and diagrams for electrical installation, systems, and equipment correctly
2. Electrical symbols for devices are correctly selected
3. Establish correct current/ load demands based on requirements
4. Establish size of main and sub-main protective device in accordance with requirements
5. Establish size of main and sub-main cables in accordance with requirements
6. Produce the electrical drawing and diagrams in accordance with specifications and relevant standards and code of practice
7. Update electrical drawings as required arising from changes or modifications in requirements in accordance with specifications and relevant standards and code of practice using CAD software

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the various types of electrical drawing
- 1.2 Describe the common graphical symbols for Electrical installation drawing
- 1.3 Describe the application of as-built drawings
- 1.4 Explain the design procedures to determine maximum demand for a given set of electrical loads
- 1.5 Explain the method to determine the size and rating of cables and overcurrent protective devices required for electrical installations
- 1.6 Describe the application and requirements of the relevant code of practice relating to electrical drawings
- 1.7 Describe the features in the CAD menu
- 1.8 Explain modification of CAD features in electrical drawings

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting the electrical drawing and diagram correctly
- 3.2 Using the correct symbols for the electrical devices and accessories correctly
- 3.3 Completing the single line diagram with proper symbols, labels, rating of cable, isolator, RCCB, MCB and name of circuits with clearly stated number of points
- 3.4 Relating the relationship between cables sizes, isolator, protection circuit breakers

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Printer A3 Color Ink jet (network printer)	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Pencil (2B, HB, H, 2H)	box	8
3.	Graph paper mm (A4)	book	20
4.	Rubber	pcs	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Rulers	pcs	20
2.	Measuring tapes	pcs	20
3.	Compass school	pcs	20
4.	Triangle ruler	pcs	20
5.	Protractor	pcs	20
6.	French curves	sets	20
7.	Laptop, Screen 15", CPU core i7 11 th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	unit	20
8.	AutoCAD software	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Install and maintain electrical final residential circuits and wiring systems

Assessment Criteria:

1. Relevant codes of practices, regulations and standards are interpreted correctly
2. Interpret electrical drawings for electrical wiring in accordance with requirements and regulations
3. Draw detailed wiring diagram from layout drawing correctly
4. Locations of the electrical points and installation methods are identified and fixed according to layout plan
5. Equipment, protection devices and metering are connected in the correct sequence of control
6. Install lighting and power final circuits in accordance with electrical drawings and in compliance with relevant regulations and specifications
7. All items are securely fixed with no loose items
8. Appropriate inspections and tests are carried out in compliance with regulations and specifications
9. Test circuits for correct operation
10. Apply appropriate techniques and procedures to diagnose and rectify faults
11. Test results and description of actions taken are documented in accordance with requirements
12. Electrical installations are maintained in compliance with the NSC regulations and code of practice
13. Safety rules and precautions are observed and followed

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the importance of observing safety rules and regulations when performing electrical work
- 1.2 Describe the various types of common industrial electrical accessories used in residential installation.
- 1.3 Explain the protective safety measures in the context of:
- 1.4 Explain the construction and operation of the protective devices use for overcurrent and earth leakage protection
- 1.5 Describe the construction and application of common types of low voltage electric cables and the relevant electrical requirements
- 1.6 Describe cable colour codes for electrical installations
- 1.7 Explain the features and requirements of the common types of cabling and wiring systems
- 1.8 Explain the importance of earthing
- 1.9 Describe the parts of an earthing system including bonding, earth electrodes and their electrical requirements
- 1.10 Describe the common types of electric lamp:
- 1.11 Compare the performance of conventional lighting and LED lighting
- 1.12 Explain the relationship between current, voltage and resistance in an electric circuit
- 1.13 Relate the relationship to various lighting and power final circuit connections
- 1.14 Describe the requirements for lighting final circuits in according to relevant regulations and code of practice:
- 1.15 Explain the characteristics of the various types of lighting circuit connections:
- 1.16 Calculate current drawn and power consumed for the various lighting circuit connections
- 1.17 Explain the 2 types of socket-outlet (power) final circuit connections:

- 1.18 Describe the requirements for power final circuits in according to relevant regulations and code of practice:
- 1.19 Calculate the power demand in power final circuit

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Applying correct code of practice for the electrical installation
- 3.2 Interpreting electrical drawings for electrical wiring correctly in accordance with requirements and regulations
- 3.3 Completing detailed wiring diagram from layout drawing correctly
- 3.4 Locating electrical points and applying correct installation methods in layout plan
- 3.5 Connecting Equipment, protection devices and metering in the correct sequence of control
- 3.6 Installing lighting circuit for one way lamp control and 2 ways lighting control
- 3.7 Installing power final circuits in accordance with electrical drawings and in compliance with relevant regulations and specifications
- 3.8 -Radial power circuit
- 3.9 -ring power circuit
- 3.10 Fixing all items securely
- 3.11 Inspecting Installation method and check bends and location of draw out box are in compliant to code.
- 3.12 Carrying out inspections and tests in compliance with regulations and specifications
- 3.13 Test circuits for correct operation
- 3.14 Apply appropriate techniques and procedures to diagnose and rectify faults
- 3.15 Test results and description of actions taken are documented in accordance with requirements
- 3.16 Electrical installations are maintained in compliance with the NSC regulations and code of practice
- 3.17 Selecting proper PPE for the job

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	PVC conduits and fittings	pcs	12
3.	PVC moldings and fittings	pcs	16
4.	Metal conduits and fittings	pcs	16
5.	PVC junction, square and utility boxes	pcs	8
6.	Metal junction, square and utility boxes	pcs	8
7.	G.I. wires (for pulling electrical wire into conduits)	pcs	8
8.	Screws (wood, metal)	boxes	10
9.	Conduit clamps	pcs	110
10.	Plastic plugs	boxes	5
11.	Light receptacles	pcs	15
12.	Wall switches (single, three-way, four-ways)	pcs	20/20/20
13.	Convenience outlets (Duplex, T-slot, Y-slot)	pcs	20
14.	Lamp	pcs	20
15.	Lamp dimmers	pcs	20
16.	Fluorescent lamp fixtures	pcs	20
17.	Flood lights/spotlights	pcs	8
18.	Track lights	pcs	8
19.	Halogen lamps	pcs	8
20.	Chandeliers	pcs	4
21.	Consumer Control Unit complete with isolator, RCCB, MCBs, earthing and neutral strips	pcs	1
22.	Metering board complete with incoming isolator and consumer's isolator	pcs	8
23.	1.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5

24.	2.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
25.	6 mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
26.	PVC pipes and fittings	length	40
27.	Masonry drill bits 6mm	boxes	5
28.	Plastic pipe glue	boxes	5
29.	Masking tape roll	pcs	10
30.	Electrical insulation tape roll	pcs	10

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Mechanical wrenches (open, box, socket, adjustable)	sets	5
6.	Pipe wrenches	sets	5
7.	Plastic pipe cutter	pcs	5
8.	Steel pipe cutter	pcs	5
9.	Pipe reamer	pcs	5
10.	Hack saw with blade	pcs	10
11.	Steel tape/Push-pull rule	pcs	20
12.	Pencil/marker	pcs	20
13.	Wire strippers	pcs	20
14.	Electrician's knife	pcs	20
15.	Claw hammer	pcs	20
16.	Flat files	pcs	20
17.	Round files	pcs	20
18.	Half round files	pcs	20
19.	Tool hoister with belt	pcs	20
20.	Clamp meter	units	5
21.	Impact drill	units	5
22.	Table with vice	units	5
23.	Heat gun	pcs	5
24.	Conduit bender 20mm	pcs	8
25.	Conduit bender 25mm	pcs	8

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test

4. Written Test
5. Portfolio

LO4. Install and maintain AC incoming supply system

Assessment Criteria:

1. Interpret electrical drawing from supply system to consumer installation
2. Install AC incoming system including meter board and consumer unit according to the correct sequence of control requirements and regulations
3. Read energy meter correctly
4. Interpret energy bill correctly
5. Observe and adhere to safety rules and precautions in workplaces

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the difference between Alternating Current (AC) and Direct Current (DC)
- 1.2 Explain the functions of electricity generation, transmission and distribution systems
- 1.3 Explain the 3-phase, 4-wire supply system to consumers and their internal distribution
- 1.4 Describe cable colour codes for electrical installations
- 1.5 Explain the single-phase incoming supply installation to residential homes, inclusive of meter boards and consumer units
- 1.6 Describe the basic parameters and their unit of measurement in electric circuit:
- 1.7 Explain the relationship between current, voltage and resistance / impedance, power and energy
- 1.8 Determine the power of various loads in the installation
- 1.9 Determine the energy consumption of electrical installation
- 1.10 Perform calculation to obtain the electrical bill.

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting electrical drawing from supply system to consumer installation correctly
- 3.2 Installing AC incoming system including meter board and consumer unit according to the correct sequence of control requirements and regulations
- 3.3 Reading energy meter correctly
- 3.4 Interpreting energy bill correctly
- 3.5 Observing the safety rules during installation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1

2.	Mechanical pointer	pc	1
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B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	PVC conduits and fittings	pcs	12
3.	G.I. wires (for pulling electrical wire into conduits)	pcs	8
4.	Screws (wood, metal)	boxes	10
5.	Conduit clamps	pcs	110
6.	Metering board complete with incoming isolator and consumer's isolator	pcs	8
7.	1.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
8.	2.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
9.	PVC flexible and fittings	length	40

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Steel tape/Push-pull rule	pcs	20
6.	Wire strippers	pcs	20
7.	Electrician's knife	pcs	20
8.	Claw hammer	pcs	20

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20

2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Inspect and test electrical installations

Assessment Criteria:

1. Select required tools and test equipment for testing of electrical installation
2. Carry out inspection of completed installation to ensure compliance with specifications and relevant regulations
3. Conduct tests on completed installation in accordance with relevant regulations
4. Interpret and analyze test results
5. Perform rectification of faults
6. Document test results and actions in accordance with regulations
7. Observe and adhere to safety rules and precautions

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need for inspection and testing of an electrical installation
- 1.2 Explain the various types of tests that are required to be conducted on a completed electrical installation to ensure that it complies with the electrical requirements
- 1.3 Describe the test equipment and instruments used for testing electrical installations
- 1.4 Describe the procedure for inspection and testing of electrical installation
- 1.5 Explain and analyze values and readings of test
- 1.6 Describe the corrective action to rectify aspects of electrical installation that do not meet requirements of test

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting electrical drawing from supply system to consumer installation correctly
- 3.2 Applying the electrical installation tests as required by electrical requirement for safe and functional system, continuity test, insulation test, polarity test and earth effectiveness test
- 3.3 Troubleshooting and rectifying faults in electrical circuits
- 3.4 Complete test report correctly
- 3.5 Observing the safety rules during installation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 5

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Conduit clamps	pcs	110
3.	Consumer Control Unit complete with isolator, RCCB, MCBs, earthing and neutral strips	pcs	1
4.	Metering board complete with incoming isolator and consumer's isolator	pcs	8
5.	1.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
6.	2.5mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
7.	6 mm ² PVC Cable (Red, Black, Green/Yellow)	Roll	5
8.	PVC flexible and fittings	length	40
9.	Masonry drill bits 6mm	boxes	5
10.	Plastic pipe glue	boxes	5
11.	Masking tape roll	pcs	10
12.	Electrical insulation tape roll	pcs	10

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Pipe reamer	pcs	5
6.	Hack saw with blade	pcs	10
7.	Steel tape/Push-pull rule	pcs	20
8.	Pencil/marker	pcs	20
9.	Wire strippers	pcs	20

10.	Digital Multimeter	pcs	20
11.	Insulation Tester	pcs	20
12.	Socket polarity tester	pcs	20
13.	Electrical step ladder	pcs	5
14.	Testing Board protection	Pcs	3

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION (2)

CORE COMPETENCIES

Course title : Installation and Maintenance Power and Control System in Building
Unit of Competency : Install and Test Electrical in Commercial and Industrial Building
Module Title : Installing and Testing Electrical in Commercial and Industrial Building

Module Descriptor :

This module covers the outcomes required to design, install, test, and maintain three phase electrical installation and wiring systems in industrial and commercial premises in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 165hrs (T3, P4)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Maintain electrical installations
- LO2. Prepare electrical drawings of electrical installation / equipment
- LO3. Install and maintain industrial electrical final circuits and wiring systems
- LO4. Install and maintain emergency lighting systems
- LO5. Install and maintain 3-phase AC incoming supply system
- LO6. Inspect and test electrical installations

LO1. Maintain electrical installations

Assessment Criteria:

1. Interpret electrical drawing of electrical installation
2. Interpret code of practice for electrical installation correctly
3. Interpret information on cabling and wiring systems in electrical installation
4. Maintain electrical installation in accordance with requirements and regulations

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the various elements and basic requirements of different types of building drawings and electrical drawings
- 1.2 Describe the common graphical symbols for Electrical installation drawing
- 1.3 Explain the design procedures to determine maximum demand for a given set of electrical loads
- 1.4 Explain the method to determine the size and rating of cables and overcurrent protective devices required for electrical installations
- 1.5 Explain the selection criteria and procedures for switchgears with suitable interrupting capacity for an electrical installation, including short circuit calculations
- 1.6 Explain the necessity of distributing single-phase loads in the 3-phase system
- 1.7 Describe the application and requirements of the relevant code of practice relating to electrical drawings:
- 1.8 Describe the application of as-built drawings
- 1.9 Describe the technique for plotting of CAD drawings
- 1.10 Identify and list the types of electrical loads in a multiple-storey building

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Applying correct the common graphical symbols for Electrical installation drawing for the electrical installation
- 3.2 Applying the design procedures to determine maximum demand for a given set of electrical loads
- 3.3 Determining the size and rating of cables and overcurrent protective devices required for electrical installations Interpreting electrical drawings for electrical wiring correctly in accordance with requirements and regulations
- 3.4 Selecting the suitable switchgears with suitable interrupting capacity for an electrical installation, including short circuit calculations
- 3.5 Completing drawing with all the correct data inserted in Single Line Diagram

Methodologies:

- 1.1 Lecture
- 1.2 Demonstration
- 1.3 Self-paced instruction
- 1.4 Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Pipe wrenches	sets	5
6.	Spanners	sets	5
7.	Adjustable Wrenches	sets	5
8.	Open end wrenches	sets	5
9.	Box end wrenches	sets	5
10.	Plastic pipe cutter	pcs	5
11.	Pipe reamer	pcs	5
12.	Hack saw with blade	pcs	10
13.	Steel tape/Push-pull rule	pcs	20
14.	Pencil/marker	pcs	20
15.	Chalk line	pcs	5

16.	Wire strippers	pcs	20
17.	Electrician's knife	pcs	20
18.	Claw hammer	pcs	20
19.	Flat files	pcs	20
20.	Round files	pcs	20
21.	Half round files	pcs	20
22.	Tool hoister with belt	pcs	20
23.	Impact drill	units	5
24.	Portable grinder	units	5
25.	Conduit bender 20mm	pcs	8
26.	Conduit bender 25mm	pcs	8
27.	Ladder	pcs	5
28.	Multi-meter/tester	units	5
29.	Digital earth tester	units	5
30.	Digital insulation tester	units	5
31.	Leakage current tester	units	5
32.	Emergency lighting board	pcs	10
33.	Pencil/marker/chalk line	pcs	20
34.	Polarity tester	units	5
35.	Rotation sequence tester	pcs	5

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Prepare electrical drawings of electrical installation / equipment

Assessment Criteria:

1. Interpret information and requirements of electrical installation from drawings and specifications
2. Apply the correct electrical symbols as required
3. Establish correct current/load demand
4. Establish correct size of main and sub-main protective devices
5. Select the appropriate rating for main and sub-main cables
6. Select appropriate luminaires for electrical installations based on requirements
7. Allocate loads to phases of supply system in accordance with regulations
8. Produce electrical drawings and diagrams in accordance with specifications and relevant standards and code of practice

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the various elements and basic requirements of different types of building drawings and electrical drawings
- 1.2 Describe the common graphical symbols for Electrical installation drawing
- 1.3 Explain the design procedures to determine maximum demand for a given set of electrical loads
- 1.4 Explain the method to determine the size and rating of cables and overcurrent protective devices required for electrical installations
- 1.5 Explain the selection criteria and procedures for switchgears with suitable interrupting capacity for an electrical installation, including short circuit calculations
- 1.6 Explain the necessity of distributing single-phase loads in the 3-phase system
- 1.7 Describe the application and requirements of the relevant code of practice relating to electrical drawings
- 1.8 Describe the application of as-built drawings
- 1.9 Describe the technique for plotting of CAD drawings
- 1.10 Identify and list the types of electrical loads in a multiple-storey building

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting the electrical drawing and diagram correctly
- 3.2 Using the correct symbols for the electrical devices and accessories correctly
- 3.3 Completing the single line diagram with proper symbols, labels, rating of cable, isolator, RCCB, MCB and name of circuits with clearly stated number of points
- 3.4 Relating the relationship between cables sizes, isolator, protection circuit breakers

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Pencil (2B, HB, H, 2H)	box	8
3.	Graph paper mm (A4)	book	20
4.	Rubber	pcs	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Ruler	pcs	20
2.	Measuring tapes	pcs	20
3.	Compass school	pcs	20
4.	Triangle ruler	pcs	20
5.	Protractor	pcs	20
6.	French curves	sets	20
7.	AutoCAD software	pcs	20
8.	Printer A3 Color Ink jet (network printer)	pc	1
9.	Laptop, Screen 15", CPU core i7 11 th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	unit	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Install and maintain industrial electrical final circuits and wiring systems

Assessment Criteria:

1. Obtain and interpret the relevant information and requirements for installation
2. Install accessories in accordance with design requirements
3. Install wiring system for installation in accordance with design requirements
4. Install cables of correct size and color
5. Install earthing system in accordance with requirements
6. Inspect and test the installations for correct operation
7. Apply appropriate technique to rectify the faults in installation

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the importance of observing safety rules and regulations when performing electrical work
- 1.2 Describe the common accessories use in installation in industrial premises.
- 1.3 Explain the various wiring system in the industrial installation.
- 1.4 Select the appropriate wiring system to be used for the installation
- 1.5 Explain the importance of the space factor in a trunking and conduit system
- 1.6 Explain the construction and application of common types of low voltage electric cables.
- 1.7 Explain the cable colour code for electrical installations
- 1.8 Explain the requirements on the types of cabling and wiring systems for indoor and outdoor installations
- 1.9 Explain the relevant information on the final lighting and power circuits that is obtained from single-line and circuit diagrams for 3-phase system
- 1.10 Explain the method to install the power circuit for a 3-phase electrical equipment.
- 1.11 Explain the common type of lighting use for industries premises, sodium vapour lamp luminaires and high power, LED light
- 1.12 Explain the importance of earthing system in installation
- 1.13 Explain the Ingress Protection requirement for electrical installation and devices that are used in outdoor, pools and event
- 1.14 Explain the use of surge protection devices for lightning protection system in electrical installation. (SPD)

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Applying correct code of practice for the electrical installation
- 3.2 Interpreting electrical drawings for electrical wiring correctly in accordance with requirements and regulations
- 3.3 Selecting the appropriate wiring system to be used for the installation
- 3.4 Calculate the space factor in a trunking and conduit system
- 3.5 Applying the correct the cable colour code for electrical installations
- 3.6 Interpreting the relevant information on the final lighting and power circuits that is obtained from single-line and circuit diagrams for 3-phase system

- 3.7 Installing the power circuit for a 3-phase electrical equipment.
- 3.8 Select the common type of lighting use for industries premises, sodium vapour lamp luminaires and high power, LED light
- 3.9 Check the earthing effectiveness of earthing system in installation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Metal conduits and fittings	pcs	16
3.	Metal junction, square and utility boxes	pcs	8
4.	G.I. wires (for pulling electrical wire into conduits)	pcs	8
5.	Screws (wood, metal)	boxes	10
6.	Conduit clamps	pcs	110
7.	Masonry drill bits 6mm	boxes	5
8.	Plastic plugs	boxes	5

9.	Metal trunking and fittings	pcs	16
10.	Electrical wires and cables	meters	80
11.	G.I. wires (for pulling electrical wire into conduits)	pcs	8
12.	Light receptacles	pcs	15
13.	Wall switches (single, three-way, four-ways)	pcs	20/20/20
14.	Metal clad outlets (Duplex, T-slot, Y-slot)	pcs	20
15.	Lamp relays	pcs	20
16.	Lamp dimmers	pcs	20
17.	Flood lights/spotlights	pcs	8
18.	Halogen lamps	pcs	8
19.	Chandeliers	pcs	4
20.	3 phase AC control panel complete with isolator, RCCB, MCBs, earthing and neutral strips	pcs	1

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Pipe wrenches	sets	5
6.	Spanners	sets	5
7.	Adjustable Wrenches	sets	5
8.	Open end wrenches	sets	5
9.	Box end wrenches	sets	5
10.	Plastic pipe cutter	pcs	5
11.	Pipe reamer	pcs	5
12.	Hack saw with blade	pcs	10
13.	Steel tape/Push-pull rule	pcs	20
14.	Pencil/marker	pcs	20
15.	Chalk line	pcs	5
16.	Wire strippers	pcs	20
17.	Electrician's knife	pcs	20
18.	Claw hammer	pcs	20
19.	Flat files	pcs	20
20.	Round files	pcs	20
21.	Half round files	pcs	20
22.	Tool hoister with belt	pcs	20
23.	Impact drill	units	5
24.	Portable grinder	units	5
25.	Conduit bender 20mm	pcs	8
26.	Conduit bender 25mm	pcs	8
27.	Ladder	pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20

6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Install and maintain emergency lighting systems

Assessment Criteria:

1. Obtain and interpret the relevant information on emergency lighting system drawings correctly
2. Check equipment and components condition for safe use prior installation
3. Select appropriate tools according to the installation requirements
4. Wire-up the emergency lighting system in accordance with requirements
5. Perform inspection and testing of the installed emergency lighting
6. Troubleshoot the faulty emergency lighting installation
7. Update the relevant document accurately according to the given format

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need to provide emergency lighting for safe evacuation of the building occupants in the event of failure of the normal lighting
- 1.2 Explain the difference between maintained and non-maintained lighting system
- 1.3 Explain the requirements for the equipment and installation methods used to provide the power supply for the emergency lighting
- 1.4 Describe the list specific locations requiring the installation of emergency and exit lighting
- 1.5 Describe the requirements for an exit sign with regard to its:

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Applying correct code of practice for the emergency lighting electrical installation
- 3.2 Drawing the block diagram for maintained and non-maintained lighting system
- 3.3 Listing out the specific locations required for the installation of emergency and exit lighting
- 3.4 Maintain the emergency lighting system

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
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1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	PVC cables	pcs	16

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Hack saw with blade	pcs	10
6.	Steel tape/Push-pull rule	pcs	20
7.	Pencil/marker	pcs	20
8.	Chalk line	pcs	5
9.	Wire strippers	pcs	20
10.	Electrician's knife	pcs	20
11.	Claw hammer	pcs	20
12.	Ladder	pcs	5
13.	Laptop, Screen 15", CPU core i7 11 th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	unit	20
14.	Emergency lighting board	pcs	10

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20

5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Install and maintain 3-phase AC incoming supply system

Assessment Criteria:

1. Interpret electrical drawing from supply system to consumer installation
2. Install 3-phase AC incoming system including meter board and consumer unit according to requirements and regulations
3. Install cables with correct size and color for the installation
4. Prepare and use the correct wiring system in according to requirement
5. Select the correct conductors for earthing system

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the functions of electricity generation, transmission and distribution systems
- 1.2 Explain the 3-phase, 4-wire supply system to consumers and their internal distribution
- 1.3 Explain the incoming supply arrangement for electrical installations in industrial and commercial premises, including meter boards, consumer unit and distribution board
- 1.4 Describe the procedures in installing a 3-phase meter board to a 3-phase distribution board according to a given layout
- 1.5 Explain the relationship between current, voltage and resistance / impedance, power and energy for a 3-phase system installation
- 1.6 Describe the fundamentals of a 3-phase system
- 1.7 Describe the advantages of using a 3-phase supply system as compared to a single-phase supply system
- 1.8 Interpret the circuit diagrams of Star-connected system and Delta-connected system
- 1.9 Explain the need to provide isolation and switching in an installation
- 1.10 Describe methods of protection against overcurrent and electric shock
- 1.11 Explain the types of earthing system used in TT and TNS system
- 1.12 Explain the requirements for an earthing system
- 1.13 Explain the construction and operation of a single-phase / 3-phase residual current circuit breaker
- 1.14 Explain the Rating of RCCB and MCB
- 1.15 Explain the operating curve of various type of MCBs
- 1.16 Determine the current and power of various loads in a 3-phase installation
- 1.17 Determine the energy consumption of electrical installation

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Terminating 3 phase 4 wire supply to AC control panel
- 3.2 Drawing the connection of the 3-phase energy meter to the AC control panel
- 3.3 Completing detailed wiring diagram to the various single phase and 3 phase loads
- 3.4 Select the correct size of MCBs and RCDs as per single line diagram
- 3.5 Select the correct type of MCBs according to the different types of loads

Methodologies:

1. Lecture

2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 5

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Metal conduits and fittings	pcs	16
3.	Metal moldings and fittings	pcs	16
4.	External 3 phase isolator box	boxes	1
5.	Electrical insulation tape roll	pcs	10
6.	3 phase AC control panel c/w with isolator, main MCB, RCDs and outgoing MCBs	pcs	10
7.	1.5mm ² PVC Cable (Red, Yellow, Blue, Black, Green/Yellow)	Roll	5
8.	2.5mm ² PVC Cable (Red, Yellow, Blue, Black, Green/Yellow)	Roll	5
9.	6 mm ² PVC Cable (Red, Yellow, Blue, Black, Green/Yellow)	Roll	5

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Adjustable Wrenches	sets	5
6.	Hack saw with blade	pcs	10
7.	Steel tape/Push-pull rule	pcs	20
8.	Pencil/marker	pcs	20
9.	Chalk line	pcs	5
10.	Wire strippers	pcs	20
11.	Electrician's knife	pcs	20
12.	Claw hammer	pcs	20
13.	Tool hoister with belt	pcs	20
14.	Impact drill	units	5
15.	Portable grinder	units	5
16.	Ladder	pcs	5
17.	Multi-meter/tester	units	5
18.	Digital earth tester	units	5
19.	Digital insulation tester	units	5
20.	Leakage current tester	units	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO6. Inspect and test electrical installations

Assessment Criteria:

1. Select correct tools and test equipment for testing of electrical installation
2. Carry out inspection of completed installation to ensure compliance with specifications and relevant regulations
3. Conduct tests on completed installation in accordance with regulations
4. Troubleshoot and rectify faults
5. Document test results and actions in accordance with regulations

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need for inspection and testing of an electrical installation
- 1.2 Explain the various types of tests that are required to be conducted on a completed electrical installation to ensure that it complies with the electrical requirements
- 1.3 Describe the test equipment and instruments used for testing electrical installations
- 1.4 Describe the procedures for carryout the inspection and testing of electrical installation
- 1.5 Explain and analyze values and readings of test
- 1.6 Describe the corrective measures to rectify aspects of electrical installation that do not meet requirements of test

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Select the correct types of test instrument required for inspection and testing of the 3-phase electrical installation
- 3.2 Applying the electrical tests according to the following sequence: Continuity tests, insulation tests, polarity tests and earthing test
- 3.3 Completing Inspection and testing report
- 3.4 Troubleshooting and rectifying installation circuit

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building Learning Outcomes 6

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Inspection form	Pcs	20
3.	Testing report	pcs	20
4.	Shorting jumpers	pcs	20
5.	Completed mockup wiring station	boxes	5

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Long nose pliers	pcs	20
3.	Pliers (diagonal side cutter)	pcs	20
4.	Screwdrivers (plain tip, cross tip)	pcs	20
5.	Steel tape/Push-pull rule	pcs	20
6.	Pencil/marker	pcs	20
7.	Chalk line	pcs	5
8.	Wire strippers	pcs	20
9.	Electrician's knife	pcs	20
10.	Portable grinder	units	5
11.	Ladder	pcs	5
12.	Multi-meter/tester	units	5
13.	Digital earth tester	units	5
14.	Polarity tester	units	5
15.	Rotation sequence tester	pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20

4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION (3)

CORE COMPETENCIES

Course title : **Installation and Maintenance Power and Control System in Building**

Unit of Competency : Maintain Electrical Machines and Applications

Module Title : Maintaining Electrical Machines and Applications

Module Descriptor :

This module covers the outcomes required to maintain electrical motor installations including their associated conventional, digital, and advanced control systems for various industrial motor applications in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 135hrs (T3, P3)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Maintain DC machines (motors)
- LO2. Maintain AC machines (motors)
- LO3. Maintain motor control circuits and equipment
- LO4. Evaluate motor performance
- LO5. Perform synchronization of generators to busbar

LO1. Maintain DC machines (motors)

Assessment Criteria:

1. Interpret relevant information on motor from technical specifications and diagrams correctly
2. Perform inspection and tests on motor in compliance with safety rules, procedures, and requirements
3. Maintain motor in compliance with safety rules, procedures, and requirements

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the characteristics of a simple magnet
- 1.2 Describe the characteristics and operation of an electro-magnetic induction circuit
- 1.3 Define the following terms related to electrical machines:
- 1.4 Describe the general construction, principles of operation, applications of DC motors
- 1.5 Describe the type of maintenance to be carried out a DC motor:
- 1.6 Describe how speed control is achieved in DC motors
- 1.7 Explain how the DC motor works in the following electrical system and the key technical specifications required

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Record data on machine correctly
- 3.2 Carrying out of maintenance to be carried out a DC motor:
- 3.3 Completing inspection and test report

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1

4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Wire Strap	PCS	20
3.	Wire Markers	PCS	20
4.	Cable Tie	PCS	20
5.	Tie Mount	PCS	20
6.	Cable Glands/Grommet	PCS	20
7.	Automotive wires/Conductors	PCS	20
8.	Insulators	PCS	20
9.	Contact cleaner	PCS	20
10.	Insulating varnish/materials	PCS	20
11.	Carbon brushes	PCS	20
12.	Sandpaper	PCS	20
13.	Waste rugs	PCS	20
14.	Electrical tapes	PCS	20
15.	Warning tags	PCS	20
16.	Signage	PCS	20
17.	Lockout/tagout	PCS	20
18.	Motor cleaner	PCS	20
19.	Insulating oil	PCS	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Pliers	pcs	20
2.	Wrenches	pcs	20
3.	Wire splicers/strippers	pcs	20
4.	Electrician knives	pcs	20
5.	Electric Hand drill	pcs	20
6.	Hand or electric taping/threading	pcs	20
7.	Hack saw	pcs	20
8.	File	pcs	20
9.	Manual/Hydraulic puncher	pcs	20
10.	Crimping tools	pcs	20

11.	Soldering tools	pcs	20
12.	Manual/Hydraulic pipe bender	pcs	20
13.	Manual/Electrical Pipe Threader/Reamer	pcs	20
14.	High-speed cutter	pcs	20
15.	Multi-tester	pcs	20
16.	Clamp ammeter	pcs	20
17.	Insulation resistance tester	pcs	20
18.	Ground resistance tester	pcs	20
19.	Earth leakage tester	pcs	20
20.	Harmonic meter	pcs	20
21.	Phase Sequence Tester	pcs	20
22.	Heat Tester	pcs	20

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Maintain AC machines (motors)

Assessment Criteria:

- 1 Interpret relevant information on motor from technical specifications and diagrams correctly
- 2 Perform inspection and tests on motor in compliance with safety rules, procedures, and requirements
- 3 Maintain motor in compliance with safety rules, procedures, and requirements

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the basic operation and application of transformers
- 1.2 Describe the construction and principles of operation of single-phase induction motors
- 1.3 Explain the function of the following components of a single-phase induction motor:
- 1.4 Explain selection of circuit breakers for motor protection and operation
- 1.5 Describe the difference in construction and principles of operation of three-phase induction and synchronous motors
- 1.6 Describe how the direction of 3 phase motor can be changed
- 1.7 Describe the types of AC motors for single-phase and three-phase applications
- 1.8 Calculate the following for a 3-phase induction motor given the number of poles, frequency, and slip
- 1.9 Outline the factors governing the magnitude of the torque of a 3-phase induction motor
- 1.10 Describe the inspection and testing procedures on a motor
- 1.11 Describe the methods for controlling the speed of three-phase motor.
- 1.12 Describe how the AC motor is being applied to the following electrical systems and explain how it works
- 1.13 Describe the general construction and principles of operation of a 3-phase AC generator

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Drawing out the single-phase AC motor starting circuit
- 3.2 Record data on ac motors
- 3.3 Perform reversing of direction in a three-phase ac motor
- 3.4 Test AC motor operation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Wire Strap	PCS	20
3.	Wire Markers	PCS	20
4.	Cable Tie	PCS	20
5.	Tie Mount	PCS	20
6.	Cable Glands/Grommet	PCS	20
7.	Automotive wires/Conductors	PCS	20
8.	Insulators	PCS	20
9.	Contact cleaner	PCS	20
10.	Insulating varnish/materials	PCS	20
11.	Carbon brushes	PCS	20
12.	Sandpaper	PCS	20
13.	Waste rugs	PCS	20
14.	Electrical tapes	PCS	20
15.	Warning tags	PCS	20
16.	Signage	PCS	20
17.	Lockout/tagout	PCS	20
18.	Motor cleaner	PCS	20
19.	Insulating oil	PCS	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
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1.	Pliers	pcs	20
2.	Wrenches	pcs	20
3.	Wire splicers/strippers	pcs	20
4.	Electrician knives	pcs	20
5.	Electric Hand drill	pcs	20
6.	Hand or electric taping/threading	pcs	20
7.	Hack saw	pcs	20
8.	File	pcs	20
9.	Manual/Hydraulic puncher	pcs	20
10.	Crimping tools	pcs	20
11.	Soldering tools	pcs	20
12.	Manual/Hydraulic pipe bender	pcs	20
13.	Manual/Electrical Pipe Threader/Reamer	pcs	20
14.	High-speed cutter	pcs	20
15.	Multi-tester	pcs	20
16.	Clamp ammeter	pcs	20
17.	Insulation resistance tester	pcs	20
18.	Ground resistance tester	pcs	20
19.	Earth leakage tester	pcs	20
20.	Harmonic meter	pcs	20
21.	Phase Sequence Tester	pcs	20
22.	Heat Tester	pcs	20

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Maintain motor control circuits and equipment

Assessment Criteria:

- 1 Interpret relevant information on motor circuits and equipment from manual, specification sheet and circuit diagrams correctly
- 2 Wire up motor control circuits in accordance with circuit diagram (power and control circuits, labelling of wiring)
- 3 Perform insulation resistance tests and continuity tests according to requirements
- 4 Perform tests to verify operation of motor control circuit
- 5 Rectify faults and malfunctions in motor control circuit
- 6 Program and test motor drive system in accordance with control application and requirements

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Outline the requirements for the control of motors
- 1.2 Describe the common types and applications of motor control circuits and starters used in industry
- 1.3 Describe the common type of faults in induction motors and motor control circuits
- 1.4 Explain how speed control is achieved by drives:
- 1.5 Variable frequency drive (DC and AC) or Variable Speed drive
- 1.6 Terms VFD, VSD and VVVF
- 1.7 Describe the difference between a soft starter and Variable frequency drive
- 1.8 Describe selection of soft starter and VFD for different motor applications
- 1.9 Describe the benefits of using soft starter and VFD in motor control
- 1.10 Describe the program settings to run the motor application for the required load performance in terms of speed, torque, scheduling
- 1.11 Outline the methods for braking of AC motors

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Wire up the motor control panel operating as
- 3.2 Applying proper test method to ensure safe operation of motor before live supply is connected
- 3.3 Operating the different starter methods
- 3.4 Testing and troubleshooting the motor circuits
- 3.5 Demonstrating the operation of the VSD drive

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/
trainees for Installation and Maintenance Power and Control System in Building LO 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Circuit breakers/Fuses	PCS	20
3.	Magnetic Contactors	PCS	20
4.	Overload protection relay	PCS	20
5.	Power Cabinet or MCC	PCS	20
6.	Power and Timers Relays c/w holder	PCS	20
7.	Terminal Blocks/Lugs	PCS	20
8.	Pilot lamps and Buzzer	PCS	20
9.	Actuators	PCS	20
10.	Push buttons	PCS	20
11.	Selector Switches	PCS	20
12.	Cable duct	PCS	20
13.	Din rail	PCS	20
14.	Wire Strap	PCS	20
15.	Wire Markers	PCS	20
16.	Cable Tie	PCS	20
17.	Tie Mount	PCS	20
18.	Cable Glands/Grommet	PCS	20

19.	Automotive wires/Conductors	PCS	20
20.	Insulators	PCS	20
21.	Contact cleaner	PCS	20
22.	Insulating varnish/materials	PCS	20
23.	Carbon brushes	PCS	20
24.	Electrical tapes	PCS	20
25.	Warning tags	PCS	20
26.	Signage	PCS	20
27.	Lockout/tagout	PCS	20
28.	Motor cleaner	PCS	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Pliers (diagonal side cutter)	pcs	20
3.	Long nose pliers	pcs	20
4.	Screwdrivers (plain tip, cross tip)	sets	5
5.	Pipe Wrenches	sets	5
6.	Steel pipe cutter	units	5
7.	Pipe reamer	pcs	10
8.	Hack saw with blade	pcs	10
9.	Steel tape/Push-pull rule	pcs	20
10.	Pencil/marker	pcs	20
11.	Electrician's knife	pcs	20
12.	Claw hammer	pcs	20
13.	Flat files	pcs	20
14.	Half round files	pcs	20
15.	Round files	pcs	20
16.	Tools hoister with belt	pcs	20
17.	Chalk line	pcs	5
18.	Chisels	pcs	20
19.	Portable grinder	units	5
20.	Pipe threading Machine	units	1
21.	Impact drill	units	5
22.	Soldering iron kit	units	5
23.	Ladder	pcs	5
24.	AC motor control panel boards	Pcs	20
25.	VFD control circuit board	Pcs	20
26.	Single phase test board	pcs	5
27.	Three phase test board	Pcs	5
28.	Multi meter (Analogue)	Pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20

8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Evaluate motor performance

Assessment Criteria:

- 1 Interpret relevant information on engineering requirements of motor and applications
- 2 Plan work in compliance with standard safety norms related with AC motors
- 3 Use appropriate test equipment and set up to evaluate the induction motor performance by no load test/ blocked rotor test and brake test
- 4 Measure the slip of 3-phase squirrel cage induction motor by tachometer for different output
- 5 Draw slip/ load characteristics of the motor
- 6 Plot the speed torque (Slip/Torque) characteristics of slip ring
- 7 Analyze performance data of motor correctly to determine maintenance and/or rectification where appropriate

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the criteria in selecting type of motors for different applications
- 1.2 Determine the factors that affect the motor performance with reference to machine data being monitored
- 1.3 Determine the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
- 1.4 Explain follow up rectification work required after data analysis on motors

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Record the motor data that affects the motor performance
- 3.2 Determining the efficiency of 3 phase squirrel cage induction motor by no load test/ blocked rotor test and brake test.
- 3.3 Recommending rectification work required after data analysis on motors

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/ trainees for Installation and Maintenance Power and Control System in Building LO4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15”, CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Circuit breakers/Fuses	PCS	20
3.	Magnetic Contactors	PCS	20
4.	Overload protection relay	PCS	20
5.	Power Cabinet or MCC	PCS	20
6.	Power and Timers Relays c/w holder	PCS	20
7.	Terminal Blocks/Lugs	PCS	20
8.	Pilot lamps and Buzzer	PCS	20
9.	Actuators	PCS	20
10.	Push buttons	PCS	20
11.	Selector Switches	PCS	20
12.	Cable duct	PCS	20
13.	Din rail	PCS	20
14.	AC motor circuit connection panel	PCS	20
15.	Connecting cables	PCS	100

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Pliers (diagonal side cutter)	pcs	20
3.	Long nose pliers	pcs	20
4.	Screwdrivers (plain tip, cross tip)	sets	5
5.	AC motor training system	sets	5

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20

4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO5. Perform synchronization of generators to busbar

Assessment Criteria:

- 1 Interpret relevant information on engineering requirements of generators to be synchronized to existing busbars in switchboard
- 2 Check to see that appropriate monitoring instruments are set up for proper synchronization
- 3 Perform synchronization of alternator to infinite busbars in accordance with correct procedures using synchro scope
- 4 Record and analyze performance of generators in the synchronization

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need to synchronize the alternator to busbar.
- 1.2 Explain the construction and operation of a 3-phase alternator.
- 1.3 Explain the conditions compulsory for synchronization the alternator to busbars
- 1.4 Explain the importance of observing safety rules and regulations when performing electrical work

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Articulating the conditions for generator synchronization
- 3.2 Connect the generator synchronization method
- 3.3 Perform the synchronization of the generator to

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1

6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Circuit breakers/Fuses	PCS	20
3.	Magnetic Contactors	PCS	20
4.	Overload protection relay	PCS	20
5.	Power Cabinet or MCC	PCS	20
6.	Power and Timers Relays c/w holder	PCS	20
7.	Terminal Blocks/Lugs	PCS	20
8.	Pilot lamps and Buzzer	PCS	20
9.	Actuators	PCS	20
10.	Push buttons	PCS	20
11.	Selector Switches	PCS	20
12.	Cable duct	PCS	20
13.	Din rail	PCS	20
14.	Connecting cables	PCS	100

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Combination pliers	pcs	20
2.	Pliers (diagonal side cutter)	pcs	20
3.	Long nose pliers	pcs	20
4.	Screwdrivers (plain tip, cross tip)	sets	5
5.	AC motor training system	sets	5
6.	Synchronization kits	Pcs	5
7.	MG-generator set	Pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20

9.	Face shield	pcs	20
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Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION (4)

CORE COMPETENCIES

Course title : **Installation and Maintenance Power and Control System in Building**

Unit of Competency : Maintain Power System and Switchboards

Module Title : Maintaining Power System and Switchboards

Module Descriptor :

This module covers the outcomes required to perform proper isolation, lockout tag out procedures as well as maintain low voltage electrical switchboards and power improvement and monitoring system in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 150hrs (T2, P4)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Maintain incoming supply connected to switchboard and equipment
- LO2. Maintain electrical switchboard
- LO3. Perform isolation, lockout and tag out procedures
- LO4. Maintain electrical power monitoring system

LO1. Maintain incoming supply connected to switchboard and equipment

Assessment Criteria:

- 1 Interpret relevant information of electrical switchboard and equipment from drawings, diagrams and/or manuals correctly
- 2 Maintain incoming and outgoing indicating lamps in accordance with requirements
- 3 Carry out insulation test on incoming and outgoing busbars of switchboard in accordance with requirements

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the functions of electricity generation, transmission and distribution systems
- 1.2 Explain the 3-phase, 4-wire supply system to consumers and their internal distribution
- 1.3 Describe the fundamentals of a 3-phase system
- 1.4 Describe the phase relationship between the various phase and line values of voltage and current in a 3-phase star/delta supply system
- 1.5 Describe the phase relationship between the various phase and line values of voltage and current in a 3-phase star/delta-connected load/equipment
- 1.6 Explain the importance of observing safety rules and regulations when performing electrical work

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Draw the 3-phase incoming supply from substation transformer to LV switchboard in switchroom
- 3.2 Connect the transformer's secondary in star configuration
- 3.3 Measure the incoming supply for the switchboard in term of phase and line value as shown in panel voltmeter

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	1.5mm ² PVC cable (Red, Yellow, Blue, Black, Green/Yellow)	roll	5
3.	2.5mm ² PVC cable (Red, Yellow, Blue, Black, Green/Yellow)	roll	5
4.	1.5mm ² PVC cable (Red, Black, Green/Yellow)	roll	3
5.	2.5mm ² PVC cable (Red, Black, Green/Yellow)	roll	3

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Switchboard Training model	PCS	5
2.	Simulated transformer	PCS	5
3.	Knives	PCS	5
4.	Earth tester	PCS	5
5.	Multi meter	PCS	5
6.	Phase rotation tester	PCS	5
7.	Thermal Image Camera	PCS	2

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Maintain electrical switchboard

Assessment Criteria:

1. Wire the voltmeter and ammeter circuit
2. Current Transformer's secondaries are checked for earthing
3. Wire up the overcurrent protection relay circuit correctly
4. Wire up the earth fault relay circuit correctly
5. Perform injection test and calibrate the overcurrent and earth fault relays circuits

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the construction and operation of low voltage switchboards
- 1.2 Explain the measuring and protection requirement for a LV consumer installations
- 1.3 Installation of meters LV supply exceeding 100A /phase
- 1.4 Describe the different types and design of switchboards
- 1.5 Explain the types of protective switchgear used in switchboards
- 1.6 Explain the function
- 1.7 Explain the operation of trip circuit under overcurrent, earth fault and earth leakage conditions
- 1.8 Describe the method in conducting the standard tests for a low voltage switchboard

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Completing the identification of components in switchboards
- 3.2 Drawing the voltmeter and indicating circuit protected by fuses
- 3.3 Completing the ammeter and energy meter circuit with emphasis given to the earthing of secondary side of CTs.
- 3.4 Completing the overcurrent and earth fault circuits
- 3.5 Performing Primary injection test on switchboard overcurrent and earth fault relays.
- 3.6 Conducting the standard tests for a low voltage switchboard:
- 3.7 Insulation resistance test
- 3.8 Polarity test
- 3.9 Earth continuity test
- 3.10 Performing periodic maintenance of switchboard and completing the maintenance checklist.

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	PVC cables for connection	Pcs	80m
3.	Connecting terminal blocks	Pcs	200

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Switchboard Training sets	set	10
2.	Primary injection testers c/e with shorted link and cables	set	2
3.	Digital Multimeter	Pcs	10
4.	Insulation testers	Pcs	10
5.	Wire splicers	Pcs	10
6.	Pliers	Pcs	10
7.	Screwdrivers	pcs	20
8.	Terminal Image Camera	pcs	2
9.	Earth tester	pcs	10

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20

6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Perform isolation, lockout and tag out procedures

Assessment Criteria:

1. Interpret relevant information of low voltage circuit breaker and busbar system from diagrams and/or manuals correctly
2. Perform lockout and tag out procedures according to requirements
3. Perform insulation resistance test for outgoing busbars

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the construction and safety features incorporated in the low voltage busbar system
- 1.2 Explain the need for Lock Up Tag out (LOTO)
- 1.3 Explain the correct sequence of lockout and tagout perform on the switchboard during maintenance of a faulty motor repair.

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Identifying the different lock out devices for different tasks.
- 3.2 Interpret the power flow sequence from single line diagram so that the correct MCB is locked out appropriately.
- 3.3 Articulate the correct sequence of lock out tag out to perform maintenance on a fault motor

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1

6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Lock out devices	Pcs	20
3.	Tag out signages	Pcs	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Digital Multimeter	Pcs	10
2.	Pliers	Pcs	10
3.	Switchboard Training units	sets	10
4.	Motor connection	Pcs	20
5.	Screwdrivers	pcs	20
6.	Non voltage contact tester	pcs	10

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Maintain electrical power monitoring system

Assessment Criteria:

1. Obtain and interpret relevant information of low voltage smart switchboard system from diagrams and/or manuals correctly
2. Configure smart switchboard via intelligent devices for remote energy/power monitoring of 3-phase outgoing loads

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the construction and features of a low voltage smart switchboard incorporated with ACB and outgoing MCCBs
- 1.2 Explain the benefits of remote monitoring for electrical power system
- 1.3 Explain power factor method in the AC system
- 1.4 Explain the need for and methods of power factor correction for electrical distribution system
- 1.5 Explain the procedures of checking and maintaining power factor correction equipment
- 1.6 Calculate the power factor in the circuit and the reactive power produced

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Drawing the power factor control circuit
- 3.2 Demonstrating how the power factor back is used to correct the power factor to the required power factor values
- 3.3 Performing inspection on condition of the capacitor banks safely

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1

3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Rags	Pcs	10

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Digital Multimeter	Pcs	10
2.	Wire splicers	Pcs	10
3.	Pliers	Pcs	10
4.	Power factor control regulator	Pcs	5
5.	Capacitor banks	Pcs	15
6.	Screwdrivers	pcs	20
7.	Non voltage contact tester	pcs	10
8.	Power factor meter	pcs	5
9.	Vacuum cleaner	Pcs	2
10.	Locked-out tagged-out	Pcs	5
11.	Power meter	Pcs	2
12.	Voltage transformer	Pcs	6
13.	Current transformer	Pcs	6

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning

2. Observation
3. Interview Test
4. Written Test

MODULES OF INSTRUCTION (5)

CORE COMPETENCIES

Course title : **Installation and Maintenance Power and Control System in Building**

Unit of Competency : Maintain Electrical Auxiliary Systems

Module Title : Maintaining Electrical Auxiliary Systems

Module Descriptor :

This module covers the outcomes required to maintain temporary installation, Security and Fire Alarm System with related digital and data cabling and carry out PAT testing in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 135hrs (T3, P3)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

LO1. Maintain temporary electrical supply connection

LO2. Maintain data cabling and equipment in Security system

LO3 Install and maintain fire alarm system

LO1. Maintain temporary electrical supply connection

Assessment Criteria:

- 1 Obtain and interpret relevant information of low voltage socket outlet assembly (SOA) from diagrams and/or manuals
- 2 Install 3-phase 5-pin plug and socket (Red) assembly, the outgoing 3-phase 5-pin plug and socket (Red) assemblies, and 1-phase 3-pin plug & socket (Blue) assemblies in accordance with requirements
- 3 Perform correct lock out and tag out (LOTO) and isolation procedure correctly when performing a motor maintenance
- 4 Perform correct LOTO procedure to disconnect the SOA from AC control panel board

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need for the code of practice for typical temporary electrical installations
- 1.2 Explain the requirements for temporary electrical installations in terms
- 1.3 Type of supply (including those of mobile generator sets)
- 1.4 Type of earthing arrangements
- 1.5 Protection and safety
- 1.6 Selection and erection of equipment
- 1.7 Explain the technical requirements for the setting up and operation of mobile generator set at construction work sites according to the requirements of relevant code of practice
- 1.8 Socket Outlet Assembly
- 1.9 Describe the construction and features of a socket outlet assembly (SOA)
- 1.10 Explain the benefits of using SOA in a temporary electrical supply system
- 1.11 Describe the electrical tests to check the safety and operation of a newly assembled SOA
- 1.12 Explain the proper LOTO and isolation procedures for connection and disconnection of SOA
- 1.13 Explain requirements for temporary installations

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 interpreting relevant information of low voltage socket outlet assembly (SOA) from diagrams and/or manuals
- 3.2 Installing 3-phase 5-pin plug and socket (Red) assembly, the outgoing 3-phase 5-pin plug and socket (Red) assemblies, and 1-phase 3-pin plug & socket (Blue) assemblies in accordance with requirements
- 3.3 Performing lock out and tag out (LOTO) and isolation procedure correctly when performing a motor maintenance with reference to Single line Diagram
- 3.4 Performing correct LOTO procedure to disconnect the SOA from AC control panel board

Methodologies:

1. Lecture

2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	PVC conduits and fittings	pcs	12
3.	PVC moldings and fittings	pcs	16
4.	Metal conduits and fittings	pcs	12
5.	PVC junction, square and utility boxes	pcs	8
6.	Metal junction, square and utility boxes	pcs	8
7.	Electrical wires and cables	meters	120
8.	G.I. wires (for pulling electrical wire into conduits)	pcs	5
9.	Screw (for wood and for metal)	boxes	5
10.	Conduit clamps	pcs	110
11.	Masonry drill bits 6mm	boxes	5
12.	Plastic plugs	boxes	10

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
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1.	Ammeter	sets	5
2.	Clamp meter	sets	5
3.	Voltmeter	sets	5
4.	Oscilloscope	sets	5
5.	Ohmmeter	sets	5
6.	Inductance meter	sets	5
7.	Power meter	Pcs	2
8.	Voltage transformer	Pcs	6
9.	Current transformer	Pcs	6

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Maintain data cabling and equipment in Security system

Assessment Criteria:

- 1 Obtain relevant information on wiring system/cables/components from specification sheet/circuit diagrams/vendor's technical manuals and brochures
- 2 Use appropriate tools and techniques to cut and prepare cables for termination to system network components
- 3 Connect cables to system network components in accordance with specifications, standards, and code of practice
- 4 Verify signal performance of cable is within acceptable limits and relevant standards
- 5 Use appropriate techniques and tests to identify, locate and rectify faults in wiring system/cables
- 6 Document test results and description of actions taken in accordance with requirements
- 7 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the requirements of structured cabling systems
- 1.2 Describe the general layout and requirements of network cabling systems
- 1.3 Describe basic guidelines for cables and equipment for communication wiring installations
- 1.4 Explain the use of tools and techniques for cable termination
- 1.5 Describe different types of copper network cables
- 1.6 Describe the colour coding system for copper media cables
- 1.7 Describe the techniques for field termination, testing and troubleshooting of copper network cabling system
- 1.8 Explain the requirements under the Administration Standards for the Telecommunication Infrastructure of Commercial Building
- 1.9 Describe the application of power over LAN
- 1.10 Describe the basic working principles of the fibre-optic cable systems
- 1.11 Describe different types of optical fibre cable
- 1.12 Describe the colour coding system for optical fibre cables
- 1.13 Explain the use of tools for fibre termination
- 1.14 Explain the required safety procedures when performing optical fibre network termination
- 1.15 Describe the procedure of terminating fibre-optic cables
- 1.16 Explain the basics of fibre to the home/premises/desk
- 1.17 Describe the testing procedures for fibre cabling system
- 1.18 Explain the procedures for cable management and labelling
- 1.19 Describe the procedures for grounding and bonding
- 1.20 Describe the importance and applications of security systems
- 1.21 Describe the major components and working principles of video surveillance systems
- 1.22 Describe the different types of cabling systems and accessories used in video surveillance systems

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness

2.7 Cooperation

2.8 Teamwork

2.9 Patient

3. Skill includes the following:

3.1 Obtaining relevant information on wiring system/cables/components from specification sheet/circuit diagrams/vendor's technical manuals and brochures

3.2 Using appropriate tools and techniques to cut and prepare cables for termination to system network components

3.3 Connecting cables to system network components in accordance with specifications, standards and code of practice

3.4 Verifying signal performance of cable is within acceptable limits and relevant standards

3.5 Using appropriate techniques and tests to identify, locate and rectify faults in wiring system/cables

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	G.I. wires (for pulling electrical wire into conduits)	pcs	5
3.	Screw (for wood and for metal)	boxes	5
4.	Conduit clamps	pcs	110
5.	Masonry drill bits 6mm	boxes	5
6.	Plastic plugs	boxes	10
7.	Copper network cable	pcs	10m
8.	4 pair CAT 5E UTP cable	pcs	20
9.	4 pair CAT 6 UTP cable	pcs	8
10.	25 pair CAT 5E/6 UTP cable	pcs	8
11.	RJ45 plug	meters	120

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Voltmeter	sets	5
2.	Ohmmeter	sets	5
3.	Inductance meter	sets	5
4.	Diagonal Cutter	sets	10
5.	Punch Down Tool	sets	10
6.	Wire Stripper Tool	sets	10
7.	Crimping tools	sets	10
8.	Network Cable tester	sets	10

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Install and maintain fire alarm system

Assessment Criteria:

- 1 Interpret technical references such as layout diagram of fire alarm system correctly
- 2 Identify correct equipment and components for installation according to the given specifications
- 3 Check equipment and components condition for safe use prior to installation
- 4 Select appropriate tools according to the installation requirements
- 5 Wire-up call-points to fire alarm in accordance with drawings and requirements
- 6 Inspect and test fire alarm system in accordance with requirements
- 7 Troubleshoot and rectify faults in fire alarm installation
- 8 Update the relevant document accurately according to the given format

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the requirements of a fire alarm system in terms of detection of a fire or fire condition and the sounding of alarm
- 1.2 Explain the general requirements in the installation of electrical fire alarm systems and their associated components in buildings
- 1.3 Describe the component parts of the fire alarm system and explain their functions
- 1.4 Explain the procedure to restore an activated alarm
- 1.5 Explain the safety precautions to be observed when installing and maintaining a fire alarm system

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Drawing the layout diagram of fire alarm system correctly
- 3.2 Labelling the correct equipment and components for installation according to the given specifications
- 3.3 Checking equipment and components condition for safe use prior to installation
- 3.4 Selecting appropriate tools according to the installation requirements
- 3.5 Wiring-up call-points to fire alarm in accordance with drawings and requirements
- 3.6 Inspecting and testing fire alarm system in accordance with requirements
- 3.7 Troubleshooting and rectifying faults in fire alarm installation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 3

A. Tools for training

No.	Description	Unit	Quantity
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1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Push button	pcs	12
3.	Selector switches	pcs	16
4.	Step switches	pcs	12
5.	Meter switches	pcs	8
6.	Emergency switch	pcs	8
7.	Terminal blocks	pcs	120
8.	Counter relay	pcs	5
9.	Sensors	pcs	5
10.	Proximity switch	pcs	10
11.	Limit switch	pcs	5
12.	Smoke detector	pcs	10
13.	Fire detector	pcs	5
14.	1.5mm ² PVC cable (Red, Yellow, Blue, Black, Green/Yellow)	Rolls	5
15.	2.5mm ² PVC cable (Red, Yellow, Blue, Black, Green/Yellow)	Rolls	5
16.	Fire alarm wire	Rolls	1

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Clamp meter	sets	5
2.	Digital Multimeter	sets	10

3.	Digital Insulation Tester	sets	5
4.	Fire alarm control panel training kits	sets	5
5.	Resistance (EOL)	pcs	5
6.	Heat sensor tester	pcs	5
7.	Address device	pcs	5

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

MODULES OF INSTRUCTION (6)

CORE COMPETENCIES

Course title : **Installation and Maintenance Power and Control System in Building**

Unit of Competency : Programme Intelligent Building Control System

Module Title : Programming Intelligent Building Control System

Module Descriptor :

This module covers the outcomes required to program, test, and maintain PLC system and Intelligent Building Control System to deliver smart home control solutions in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 235hrs (T3, P7)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

LO1. Program PLC system

LO2. Install smart home system

LO3 Manage Intelligent Building Control System

LO1. Program PLC system

Assessment Criteria:

- 1 Interpret essential information pertaining to PLC system and electrical installation correctly
- 2 Program and install PLC system in accordance with control application
- 3 Install energy meter correctly
- 4 Access and monitor energy meter from PLC system
- 5 Apply appropriate techniques and procedures to diagnose and rectify faults in system
- 6 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the PLC architecture
- 1.2 Describe the working principle of various types of PLC components
- 1.3 Describe the differences between PLC and Smart Relay
- 1.4 Describe the working principle, characteristics and application of the energy meter
- 1.5 Describe the communication protocol of the PLC and energy meter
- 1.6 Describe a home electrical control system architecture
- 1.7 Describe the types of input and output devices used for home electrical control system

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Configure the PLC for input and output operation
- 3.2 Connect input and output devices to PLC I/O channels
- 3.3 Program the PLC for input and output application
- 3.4 Test and troubleshoot PLC operation

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15”, CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Cable connectors (assorted colour)	pcs	20
3.	Input & output devices	psc	20

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	PLC training kits	pcs	20
2.	Continuity test	sets	10
3.	Electrical insulation test	sets	5
4.	High potential test (as the need arises)	pcs	10
5.	Earth resistance test	pcs	10
6.	Phase sequence test	pcs	10
7.	Load test	pcs	10
8.	Winding resistance test	pcs	10
9.	Free running test	pcs	10
10.	Laptop, Screen 15”, CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	20
11.	PLC simulate tool	pc	20

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20

8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Install smart home system

Assessment Criteria:

- 1 Interpret essential information pertaining to smart home and electrical installation correctly
- 2 Install smart home system in accordance with control requirements
- 3 Program smart devices through mobile phone for control application operation
- 4 Apply appropriate techniques and procedures to diagnose and rectify faults in system
- 5 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the need for compliance with relevant codes of practices, standards and regulations for the household appliances in installations
- 1.2 Explain the common home automation standards and products
- 1.3 Explain the protocols for Smart Home devices and its interoperability and safety
- 1.4 Explain the various types of network configuration
- 1.5 Explain the differences between conventional switches and smart switches
- 1.6 Explain the benefits and advantages of Smart Home systems
- 1.7 Explain the concept of controlling the smart devices using mobile phone

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Explain the importance of Voice Controlled Home Automation
- 3.2 Explain the common voice activated devices
- 3.3 Explain the common voice-controlled devices
- 3.4 Explain methods to configure and link up the devices
- 3.5 Explain the meaning of IFTTT and applets
- 3.6 Drawing the power factor control circuit

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Overload Relay	pcs	5
3.	Over Temperature	pcs	5
4.	Circuit Breaker	pcs	5
5.	Fuse	pcs	5

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Smart home training kits	sets	20
2.	Continuity test	sets	10
3.	Electrical insulation test	sets	5
4.	High potential test (as the need arises)	pcs	10
5.	Earth resistance test	pcs	10
6.	Phase sequence test	pcs	10
7.	Load test	pcs	10
8.	Winding resistance test	pcs	10
9.	Free running test	pcs	10
10.	DC Motor	Unit	5
11.	AC Motor	Unit	5
12.	Stepper Motor	Unit	5
13.	Servo Motor	Unit	5
14.	Dynamometers	pcs	5
15.	Simulation Test/No Load Test	pcs	5
16.	Phase sequence	pcs	5
17.	Actual Operation	pcs	5
18.	Temperature rise	pcs	5

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Manage Intelligent Building Control System

Assessment Criteria:

- 1 Program and setup home appliances with voice activated devices
- 2 Install and program the voice-controlled devices using IFTTT to create chains of simple conditional statements
- 3 Test the installed voice-controlled home automation for correct operation
- 4 Apply appropriate techniques and procedures to diagnose and rectify faults
- 5 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Explain the importance of Voice Controlled Home Automation
- 1.2 Explain the common voice activated devices
- 1.3 Explain the common voice-controlled devices
- 1.4 Explain methods to configure and link up the devices
- 1.5 Explain the meaning of IFTTT and applets

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Program and setup home appliances with voice activated devices
- 3.2 Install and program the voice-controlled devices using IFTTT to create chains of simple conditional statements
- 3.3 Test the installed voice-controlled home automation for correct operation
- 3.4 Apply appropriate techniques and procedures to diagnose and rectify faults
- 3.5 Observe and follow safety rules at all times

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1

3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	Connecting Wires	pcs	10

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	Smart Home Training kits	pcs	10
2.	Test pen	Pcs	10
3.	Screw Drivers	Pcs	10
4.	Pliers	Pcs	10
5.	Digital multimeter	Pcs	10
6.	Insulation Tester	Pcs	5
7.	Wi Fi router + internet	set	1
8.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	20

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test

5. Portfolio

MODULES OF INSTRUCTION (7)

CORE COMPETENCIES

Course title : **Installation and Maintenance Power and Control System in Building**

Unit of Competency : Maintain Solar Photovoltaic Systems

Module Title : Maintaining Solar Photovoltaic Systems

Module Descriptor :

This module covers the outcomes required to test and maintain off-grid and grid-tie solar photovoltaic (PV) systems in compliance with relevant local standards, regulations, and codes of practice.

Level of Certification : High Diploma

Nominal Duration : 195hrs (T3, P5)

Learning Outcomes :

Upon completion of this module, the students/trainees should be able to:

- LO1. Connect Solar Modules in various configurations
- LO2. Test PV Modules Performance under different operating conditions
- LO3. Maintain Off grid PV system
- LO4. Maintain On grid PV system

LO1. Connect Solar Modules in various configurations

Assessment Criteria:

- 1 Test a photocell under different light condition and measure its output voltage
- 2 Connect and measure open circuit voltage for 2 cells in series and in parallel respectively
- 3 Connect and measure the open circuit voltage and short circuit current for a given PV module
- 4 Connect 2 PV modules in series and measure Voc and Isc
- 5 Connect 2 PV module in Parallel and measure Voc and Isc of combination
- 6 Connect and pair 2 series PV modules in parallel and measure Voc and Isc of combination
- 7 Group the PV modules to produce the required system voltage
- 8 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe how a solar cell works
- 1.2 Draw electrical symbols for PV installations and equipment
- 1.3 Describe the Basic electrical knowledge for PV system
- 1.4 Explain the different terminology used in Solar PV
- 1.5 Describe the following terminology used in PV module
- 1.6 Describe the use of common types of electrical circuit testers to measure PV circuits

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Testing a photocell under different light condition and measure its output voltage
- 3.2 Connecting 2 PV modules in series and measuring its open circuit voltage and short circuit current
- 3.3 Connect 2 PV module in Parallel and measure Voc and Isc of combination
- 3.4 Group the PV modules to produce the required system voltage

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 1

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	MC Connectors	PCS	100
3.	Solar Cables	PCS	80m
4.	MC connector wrench	PCS	5
5.	Y Connectors for parallel connection	PCS	40

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	PV Modules training kits	PCS	20
2.	Pliers	Pcs	10
3.	Screwdrivers (cross and straight, 180mm)	Pcs	10
4.	Ring cutter	Pcs	10
5.	Crimping tools	Pcs	10
6.	Wire stripper	Pcs	10
7.	Digital multi meter	Pcs	10
8.	Insulation tester	Pcs	5
9.	Clamp ammeter	Pcs	10
10.	Irradiance Meter	Pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20

7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO2. Test PV Modules Performance under different operating conditions

Assessment Criteria:

- 1 Interpret information on solar system from manual, wiring diagrams and drawings correctly
- 2 Set up the PV panels under different radiant light condition, measure the irradiance and determine its effect on Voc and Isc of PV
- 3 Set up the PV panels under different tilting angles and measure its effect on Voc and Isc of PV
- 4 Measure the Voc and Isc when the surface temperature of the PV module is heated up over a period of time
- 5 Verify system start-up and shut-down functionality in accordance with procedures
- 6 Maintain PV system according system specifications, safety standards and code of practice
- 7 Inspect the PV module to examine for microcrack, corrosion, browning, dirt stain etc., according to checklist
- 8 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Factors affecting Solar PV performance
- 1.2 Describe the standard test conditions (STC) used in PV module manufacturing.
- 1.3 Describe how the light condition affects solar performance and determine the effect of shading.
- 1.4 Describe how the tilting mount on PV panel on the roof and the side of a building affects the PV performance.
- 1.5 Explain how the insolation and temperature affects the PV performance.
- 1.6 Describe the tools to be used to measure PV performance.
- 1.7 Describe of PV efficiency factors such as irradiance, temperature and shading

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting information on solar system from manual, wiring diagrams and drawings correctly
- 3.2 Determining the effect of different radiant light condition on its effect on Voc and Isc of PV
- 3.3 Measuring the Voc and Isc with change in surface temperature of the PV module heated up over a period of time
- 3.4 Verifying system start-up and shut-down functionality in accordance with procedures
- 3.5 Maintaining PV system according to system specifications, safety standards and code of practice
- 3.6 Inspecting the PV module to examine for microcrack, corrosion, browning, dirt stain etc., according to checklist

Methodologies:

1. Lecture

2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 2

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	MC Connectors	PCS	100
3.	Solar Cables	PCS	80m
4.	MC connector wrench	PCS	5
5.	Y Connectors for parallel connection	PCS	40

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	PV Modules training kits	PCS	20
2.	Pliers	Pcs	10
3.	Screwdrivers (cross and straight, 180mm)	Pcs	10
4.	Ring cutter	Pcs	10
5.	Crimping tools	Pcs	10
6.	Wire stripper	Pcs	10

7.	Digital multi meter	Pcs	10
8.	Insulation tester	Pcs	5
9.	Clamp ammeter	Pcs	10
10.	Irradiance Meter	Pcs	5

F. Personal Protective Equipment for students ‘uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO3. Maintain Off grid PV system

Assessment Criteria:

- 1 Interpret information on the solar system from manual, wiring diagrams and drawings correctly
- 2 Install the PV system as per drawing requirements
- 3 Perform inspection checks on the PV system
- 4 Conduct the essential electrical tests before the PV system is turned on
- 5 Measure the Voc and Isc to check for abnormally
- 6 Conduct functional checks on the PV operation
- 7 Complete inspection and test technical reports
- 8 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the components and their function in a standalone PV system.
- 1.2 Describe the operation of the stand-alone off grid PV system
- 1.3 Describe the electrical tests to be carried out on the Off-grid PV system during maintenance
- 1.4 Describe the tools to be used during maintenance of Off Grid PV system.

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Drawing the circuit for standalone PV system
- 3.2 Identifying correctly all the parts of the PV systems
- 3.3 Inspecting the different parts of the PV system
- 3.4 Performing all the required electrical testing of the standalone PV system

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 3

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1

2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	2.5mm ² PVC cables (grey, brown)	m	100
3.	4 mm ² Solar cables (red, black)	m	50
4.	MC4 straight connectors	Pcs	100
5.	Y types of parallel MC connector	Pcs	40

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	PV Modules training kits	sets	20
2.	Pliers	Pcs	10
3.	Screwdrivers (cross and straight, 180mm)	Pcs	10
4.	Ring cutter	Pcs	10
5.	Crimping tools	Pcs	10
6.	Wire stripper	Pcs	10
7.	Digital multi meter	Pcs	10
8.	Insulation tester	Pcs	5
9.	Clamp ammeter	Pcs	10
10.	Irradiance Meter	Pcs	5
11.	Standalone OFF GRID PV training stations	Pcs	10
12.	Lighting and PV modules stations	Pcs	10
13.	Battery tester	pcs	5

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20
4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20

6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

LO4. Maintain On grid PV system

Assessment Criteria:

- 1 Interpret information on the solar system from manual, wiring diagrams and drawings correctly
- 2 Install the PV system as per drawing requirements
- 3 Perform inspection checks on the PV system
- 4 Conduct the essential electrical tests before the PV system is turned on
- 5 Measure the Voc and Isc to check for abnormally
- 6 Conduct functional checks on the PV operation
- 7 Complete inspection and test technical reports
- 8 Observe and follow safety rules at all times

Related Knowledge, Skills, Attitude and Safety:

1. Knowledge includes the following:

- 1.1 Describe the following components and their function in a grid tied PV system.
- 1.2 Describe the operation of the Grid Tie PV system
- 1.3 Explain what is anti-islanding protection.
- 1.4 Describe the required electrical tests to be carried out on the grid-tied PV system during maintenance
- 1.5 Describe the tools to be used during maintenance of Grid-Tied PV system.

2. Attitude includes the following:

- 2.1 Patriotism
- 2.2 Safety consciousness
- 2.3 Responsibility
- 2.4 Industriousness
- 2.5 Obedience
- 2.6 Quality consciousness
- 2.7 Cooperation
- 2.8 Teamwork
- 2.9 Patient

3. Skill includes the following:

- 3.1 Interpreting information on the solar system from manual, wiring diagrams and drawings correctly
- 3.2 Installing the grid tie PV system as per drawing requirements
- 3.3 Performing inspection checks on the PV system
- 3.4 Conducting the essential electrical tests before the PV system is turned on
- 3.5 Measuring the Voc and Isc to check for abnormally
- 3.6 Conducting the functional checks on the PV operation
- 3.7 Completing inspection and test technical reports

Methodologies:

1. Lecture
2. Demonstration
3. Self-paced instruction
4. Group activities

Conditions:

Recommended list of tools, equipment, and materials for the training of 20 students/trainees for Installation and Maintenance Power and Control System in Building LO 4

A. Tools for training

No.	Description	Unit	Quantity
1.	Laser pointer	pc	1
2.	Mechanical pointer	pc	1

B. Equipment and PPE for Instructor's use

No.	Description	Unit	Quantity
1.	LCD Projector, 220V, 50/60Hz	unit	1
2.	Laptop, Screen 15", CPU core i7 11th gen, 512GB SSD + 1TB HDD, RAM 16GB, GPU 6GB Nvidia2080 complete with applicable OS software	pc	1
3.	projector screen, portable type, big size	unit	1
4.	White board, portable, 1.2m x 2.4m	unit	2
5.	Safety hat	Pc	1
6.	Safety shoes	Pair	1
7.	Safety work uniform	Set	1
8.	Safety gloves	Pair	1
9.	Dust mask	Pc	1
10.	Safety belt	Pc	1
11.	Safety goggles	Pair	1
12.	Hearing protection	Pair	1
13.	Face shield	pc	1

C. Materials for training

No.	Description	Unit	Quantity
1.	Writing paper A4 size	Ream	1
2.	Whiteboard markers: blue, black, red, green	Pcs	4
3.	Permanent markers: blue, black, red	Pcs	3
4.	Flip chart papers	Sheets	8

D. Materials for students' practice

No.	Description	Unit	Quantity
1.	Handouts/Module/CBLM	sets	20
2.	2.5mm ² PVC cables (grey, brown)	m	100
3.	4 mm ² Solar cables (red, black)	m	50
4.	MC4 straight connectors	Pcs	100
5.	Y types of parallel MC connector	Pcs	40

E. Tools and Equipment for students' practice

No.	Description	Unit	Quantity
1.	PV Modules training kits	sets	20
2.	Pliers	Pcs	10
3.	Screwdrivers (cross and straight, 180mm)	Pcs	10
4.	Ring cutter	Pcs	10
5.	Crimping tools	Pcs	10
6.	Wire stripper	Pcs	10
7.	Digital multi meter	Pcs	10
8.	Insulation tester	Pcs	5
9.	Clamp ammeter	Pcs	10
10.	Irradiance Meter	Pcs	5
11.	GRID tie PV system stations	Pcs	10
12.	Lighting and PV modules stations	Pcs	10

F. Personal Protective Equipment for students 'uses

No.	Description	Unit	Quantity
1.	Safety hat	pcs	20
2.	Safety shoes	pairs	20
3.	Safety work uniform	sets	20

4.	Safety gloves	pairs	20
5.	Dust mask	pcs	20
6.	Safety belt	pcs	20
7.	Safety goggles	pairs	20
8.	Hearing Protection	pairs	20
9.	Face shield	pcs	20

Assessment Methods:

1. Demonstration with oral questioning
2. Observation
3. Interview Test
4. Written Test
5. Portfolio

6. ACKNOWLEDGEMENT

In Behalf of National Training Board, expresses its cordial thanks and appreciation to Department of Standard and Curriculum to lead and facilitate the processes of competency standard development and to many representatives of business, industry, academe and government agencies who rendered their time and expertise to the development and validation of this Competency Standard.

6.1 NTB, Sub-committee of Competency Standards, Testing and Certifications

N0	NAME	DESIGNATION/ ORGANIZATION	NTB POSITION
1.	H.E Hing Sideth	Royal Government Delegation in Charge of Technical and Vocational Education and Training of the Ministry of Labor and Vocational Training	Chief
2.	Mr. Muong Pasy	Vice President of National Polytechnic Institute of Cambodia	Vice Chief
3.	H.E Chan Sopha	Director General of the Cambodian Standards Institute of the Ministry of Industry, Science, Technology and Innovation	Vice Chief
4.	Mr. Phuong Visith	Deputy Director General of Technical and Vocational Education and Training of the Ministry of Labor and Vocational Training	Vice Chief
5.	H.E Teang Sak	Director of Department Standard and Curriculum	Vice Chief
6.	H.E Sanet Vattana	Undersecretary of State, Ministry of Social Affairs, Veterans and Youth Fitness	Member
7.	Mr. Ung Chinna	Director of Education Quality Assurance Department of the Ministry of Education, Youth and Sports	Member
8.	Mr. Chan Savuth	Deputy Director of Department Labor Market Information of the Ministry of Labor and Vocational Training	Member
9.	Mr. Khim Yorm	Deputy Director of Department Standard and Curriculum	Member
10.	Mrs. Ieng Sochanthy	Deputy Director of Department Institute Management of the Ministry of Labor and Vocational Training	Member
11.	Mr. Kuon Phymalene	Deputy Director of Department Quality Assurance of the Ministry of Labor and Vocational Training	Member
12.	Mr. Koh Chhino	Deputy Director of Personnel and Human Resource Development of the Ministry of Agriculture, Forestry and Fisheries	Member
13.	Mr. Thi Bunthorn	Deputy Director of Personnel Department, General Department of Administration and Finance of the Ministry of Public Works and Transport	Member

14.	Mr. Enn Vuthy	Deputy Director of Department Standard and Curriculum	Member
15.	Mr. Chum Vuth	Deputy Director of Preah Kossamak Polytechnic Institute Representative of training providers	Member
16.	Mr. Ok Vireak	Deputy Director of Industrial Technical Institute Representative of training providers	Member
17.	Mr. Moeun Thannak	Deputy Director of National Polytechnic Institute of Angkor Representative of technical teachers	Member
18.	Mr. Proum Peou	Dean of the Faculty of Mechanical Engineering of the National Polytechnic Institute of Cambodia Representative of technical teachers	Member
19.	Mr. Chy Vanny	Dean of the Faculty of Electricity, Kossamak Polytechnic Institute Representative of technical teachers	Member
20.	Mr. Khay Socheat	Chief Office of Department Standard and Curriculum	Member
21.	Mr. Nea Sovantha	Chief Office of the Ministry of Labor and Vocational Training	Member
22.	Mr. Mam Say	Chief Office of Education Quality Supervision Office of National Polytechnic Institute of Cambodia	Member
23.	Mr. Kong Dyna	Deputy Director of Industrial Technical Institute	Member
24.	Mrs. Men Makara	Deputy Director of the Institute for the Smile of Children Representatives of national and international organizations	Member
25.	Mr. Chaov Sing	Vice Chief of Basic Training Office of the General Department of Health Technology of the Ministry of Health	Member
26.	Mr. Sok Huosambath	Technical Advisor of Mong Rithy Group	Member
27.	Mr. Vong Borith	General Treasurer of the Federation of Trade Unions of Cambodia	Member
28.	Mr. Say Ratanak	Head of Training and Development, RMA (Cambodia)	Member
29.	Mr. Cheam Sovannarith	Director of Maintenance and Repair Services of Komin Khmer Co., Ltd.	Member
30.	Mr. Ri Saokhun	N.C.X Spray Manager	Member
31.	Mrs. Pich Rothmony	Member of the Executive Committee of the Chamber of Commerce and Micro-Enterprises	Member
32.	Mr. Bunheang	Chief Office of Department Standard and Curriculum	Secretary

6.2 Sector Skills Council (SSC)

1.			Chief
2.			Vice Chief
3.			Member
4.			Member
5.			Member
6.			Member
7.			Member
8.			Member
9.			Member
10.			Member

6.3 Technical Working Group (TWG)

1.	Mr. Yoeurn Samrem	Deputy Chief Department of National Technical Training Institute	Chief
2.	Mr. Vann Phay	Instructor of National Technical Training Institute	Vice Chief
3.	Mr. Ros Raksa	Deputy Dean of Preah Kossamak Polytechnic Institute	Member
4.	Mr. Nam Sokkhim	Instructor of National Polytechnic Institute of Angkor	Member
5.	Mr. Sok Sorithy	Instructor of Regional Polytechnic Institute Techo Sen Svay Rieng	Member
6.	Dr. Vai Vannak	Instructor of Institute Technology of Cambodia	Member

6.4 Secretariat

1.	H.E Teang Sak	Director of Department Standard and Curriculum	Chief
2.	Mr. San Seng	Director of Department Quality Assurance	Vice Chief
3.	Mr. Khim Yorm	Deputy Director of Department Standard and Curriculum	Vice Chief
4.	Mr. Enn Vuthy	Deputy Director of Department Standard and Curriculum	Member
5.	Mr. Khay Socheat	Chief Office of Department Standard and Curriculum	Member
6.	Mr. Mam Pich	Chief Office of Department Standard and Curriculum	Member
7.	Mr. Horn Vanna	Chief Office of Department Standard and Curriculum	Member
8.	Mr. Sem Bunthorn	Chief Office of Department Quality Assurance	Member
9.	Mr. Mom Naro	Official of Department Standard and Curriculum	Member
10.	Mrs. Teav Saroeung	Official of Department Standard and Curriculum	Member

11.	Ms. Lim Rina	Official of Department Standard and Curriculum	Member
12.	Mr. Sam Vandeth	Official of Department Standard and Curriculum	Member

6.5 Technical Consultant for Skills for Competitiveness (S4C) Project

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2.	Mr. Loh Kum Fei	Program Coordinator cum Cherf Trainer 2
3.	Mr. Seow Bee Ling	Program Coordinator cum Cherf Trainer 3
4.	Dr. Hor Mengheang	Deputy Program Coordinator cum Trainer
5.	Mr. Heng Seng Meng	International Expert Electrical
6.	Mr. Prak Chandararith	National Expert Electrical