



COMPETENCY BASED CURRICULUM FACILITY MANAGEMENT TECHNOLOGY DIPLOMA

**Technical Trainers Training and Resource Center
Department of Workforce Planning and Skills Development
Ministry of Education and Skills Development
Thimphu**



Course Curriculum
Facility Management Technology
Diploma

Technical Trainers Training and Resource Center
Department of workforce Planning and Skills Development
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Thimphu

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Department of Workforce Planning and Skills Development

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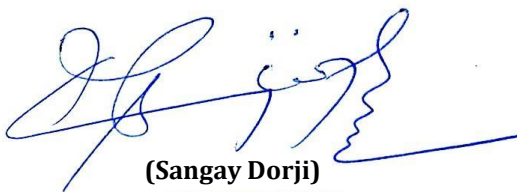
Foreword

Bhutan has seen a gradual increase in the requirement of skilled workers over the recent years due to rapid growth of industries. However, an acute shortage of skilled workers has affected the growth of industries. Since the skilled workers are crucial for socio-economic development of the country, it is important to have adequately trained and certified workers.

The Department of Workforce Planning and Skills Development with support from Institute of Technical Education (ITEs) Singapore, hereby presents the first edition of curriculum for Facility Management Technology as per the need of industries following the standard curriculum development process. It is expected to provide training delivery with reformed approaches having its content being directly related to labour market needs, focusing on imparting of skills and assessment based on industry work standards. Thus, the curriculum will help in bridging the skill gap between industry's needs and training institutes and, ultimately contribute to enhancing the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries and organization who were involved in the design and development. As it is a dynamic document which may require revision based on the needs of the changing labour market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum. Further, we look forward for successful implementation of this curriculum to meet the skilled workforce requirement by the labor market.

The Department hope that this document will help facilitate in addressing the issue of mismatch between skills supply and demand.



(Sangay Dorji)

Offtg. Director

Department of Workforce Planning and Skills Development

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Course Outline for Facility Management Technology, Diploma

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
Core modules		1440	CC
1.	OJT	420	CC
2.	Project works and assignments	360	
3.	Summative and formative assessment	180	
Total Core Duration		2400	
Soft skills			
4.	Applied Dzongkha	42	SS
5.	Applied ICT	90	SS
6.	Applied Mathematics	126	SS
7.	Professional English Language	136	SS
8.	Ethics and integrity	68	PD
9.	GNH and Human Values module	30	PD
10.	Entrepreneurship	70	SS
Total Duration (SS)		562	

Note: (*) This curriculum contains core modules which cover main competencies of Facility Management Technology Diploma and OJT component. There are separate curricula for subjects/modules for delivery of soft skills, professional development & values and environmental concern & safety. In order to achieve the qualification of Facility Management Technology Diploma, the subjects and modules listed must be accomplished as per the credit hours provided.

Content Competencies:

CC-Core Competencies

SS-Soft Skills

PD-Professional Development and Values

ES-Environmental concern and Safety

Course Structure (2 Years Program)

1. Semester 1:

SL. No	Subject/Module	Duration (Hours)
1.	Module 1 Learning Outcome (LO) 1- L09	547
2.	Professional English-I	68
3.	Applied ICT-I	45
4.	Institute Assessment	30
Total Duration:		690

2. Semester 2:

SL. No	Subject/Module	Duration (Hours)
1.	Module 1: L010-L012	111
2.	Module 2: Carry out installation and servicing of AC	124
3.	Module 3: Carry out water and sanitary services	338
4.	Professional English Language-II	68
5.	Institute Assessment	30
Total Duration		671

3. Semester 3:

SL. No	Subject/Module	Duration (Hours)
1.	Module 4: Carry out installation and servicing of fire safety and protection system	114
2.	Module 5: Carry out integration and monitoring of control systems in BMS	206
3.	Applied Mathematics	126
4.	Applied ICT-II	45
5.	Ethics and integrity	68
6.	Institute Assessment	30
Total Duration:		589

4. Semester 4

SL. No	Subject/Module	Duration (Hours)
1.	OJT	420
2.	Entrepreneurship	70
3.	GNH and Human Values	30
4.	Applied Dzongkha	42
5.	Institute Assessment	30
6.	National Assessment	60
Total Duration:		652

COMPETENCY PROFILE

Occupation: Facility Management Technologist

Level: Facility Management Technology Diploma

Competency Area	Sub-Competency Area	Competencies/Tasks			
A. Carryout installation and servicing of electrical systems	A1: Apply basic electrical theory	A1.01 Verify characteristics of AC and DC	A1.02 Measure resistance	A1.03 Measure voltage	A1.04 Measure current
		A1.05 Measure power	A1.06 Measure energy	A1.07 Measure frequency	
	A2: Apply basic electronic theory	A2.01 Verify characteristics of diode	A2.02 Verify characteristics of Zener diode	A2.03 Verify characteristics of transistor as a switch	A2.04 Verify characteristics of transistor as an amplifier
		A2.05 Verify characteristics of half wave rectifier	A2.06 Verify characteristics of full wave rectifier	A2.07 Verify filter circuit	A2.08 Verify characteristics of inverter
	A3: Verify DC circuit	A3.01 Verify ohms law	A3.02 Verify characteristics of series circuit	A3.03 Verify characteristics of parallel circuit	A3.04 Verify characteristics of combined circuit
	A4: Verify characteristics of AC circuit	A4.01 Check phase sequence (Three phase supply)	A4.02 Verify characteristics of balanced load in star connection	A4.03 Verify characteristics of unbalanced load in star connection	A4.04 Verify characteristics of balanced load in delta connection
		A4.05 Verify characteristics of resistive load	A4.06 Verify characteristics of inductive load	A4.07 Verify characteristics of capacitive load	A4.08 Verify characteristics of RL series circuit
		A4.09 Verify characteristics of RC series circuit	A4.10 Verify characteristics LC series circuit	A4.11 Verify characteristics of RLC series circuit	A4.12 Verify characteristics of RL parallel circuit

		A4.13 Verify characteristics of RC parallel circuit	A4.14 Verify characteristics of LC parallel circuit	A4.15 Verify characteristics of RLC parallel circuit	
	A5: Install electrical systems	A5.01 Prepare Tee joint	A5.02 Prepare straight joint	A5.03 Prepare Rat tail joint	A5.04 Perform surface wiring for lighting and power circuit
		A5.05 Perform concealed wiring for lighting and power circuit	A5.06 Perform distribution box wiring	A5.07 Install earthing	A5.08 Install building LA
		A5.09 Install surveillance system	A5.10 Install security system		
	A6: Perform installation test	A6.01 Perform continuity test	A6.02 Perform IR test	A6.03 Perform polarity test	A6.04 Perform soil resistivity test
		A6.05 Perform soil resistance test			
	A7: Service electrical systems	A7.01 Troubleshoot lighting circuits	A7.02 Troubleshoot power circuits	A7.03 Service earthing system	
	A8: Install solar PV system	A8.01 Install mounting structures	A8.02 Install PV panel	A8.03 Perform wiring of PV panel	A8.04 Install DC distribution board
		A8.05 Install controller	A8.06 Install battery	A8.07 Install inverter	A8.08 Install AC distribution board
		A8.09 Install energy meter (Bi-directional)	A8.10 Commission PV system		

	A9: Service solar PV system	A9.01 Perform inspection of solar PV system	A9.02 Service PV modules	A9.03 Service battery	A9.04 Service inverter/controller
		A9.05 Service protective devices			
	A10: Install backup power supply	A10.01 Install changeover switch	A10.02 Install UPS system	A10.03 Install Generator set	
	A11: Service backup power supply	A11.01 Replace fuel filter	A11.02 Change coolant	A11.03 Replace air filter	A11.04 Change engine oil
		A11.05 Clean fuel tank	A11.06 Service UPS		
	A12: Set up Audio Visual system	A12.01 Perform wiring of audio system	A12.02 Perform wiring of visual system	A12.03 Test performance	
B. Carryout installation and servicing of air conditioning system	B1: Perform copper tubing works	B1.01 Perform tube cutting	B1.02 Perform tube flaring	B1.03 Perform tube swaging	B1.04 Perform tube bending
		B1.05 Perform tube brazing			
	B2: Install Air Conditioner	B2.01 Prepare for installation of air conditioner	B2.02 Install indoor unit	B2.03 Install outdoor unit	B2.04 Perform leak test
		B2.05 Perform vacuuming	B2.06 Commission air conditioner		
	B3: Service Air conditioner	B3.01 Perform pump down/recovery	B3.02 Service indoor unit	B3.03 Service outdoor unit	B3.04 Troubleshoot electrical faults

		B3.05 Troubleshoot mechanical fault	B3.06 Charge refrigerant		
C. Carryout water and sanitary services	C1: Install piping system	C1.01 Estimate materials	C1.02 Cut pipes	C1.03 Ream pipe	C1.04 Thread GI pipe manually
		C1.05 Thread GI pipe mechanically			
	C2: Perform pipe jointing	C2.01 Perform CPVC pipe joint	C2.02 Perform PPR pipe joint	C2.03 Perform PEX pipe joint	C2.04 Perform copper pipe joint
		C2.05 Perform HDPE pipe joint	C2.06 Perform PVC pipe joint		
	C3: Install internal pipes and fittings	C3.01 Prepare layout	C3.02 Cut channel	C3.03 Apply water proofing	C3.04 Lay pipes
		C3.05 Install diverter	C3.06 Fix clamp	C3.07 Conduct pressure test	
	C4: Install external pipes and fittings	C4.01 Prepare layout	C4.02 Perform trenching	C4.03 Perform bedding	C4.04 Lay pipe
		C4.05 Fix valve	C4.06 Fix water meter	C4.07 Conduct leak test	C4.08 Insulate pipe
		C4.09 Perform back filling			
	C5: Install water pump and storage tank	C5.01 Install pump and accessories	C5.02 Test pump	C5.03 Fix tank components	
	C6: Install sanitary fixture and fittings	C6.01 Prepare layout	C6.02 Install washbasin with sensor	C6.03 Fix basin mixer	C6.04 Fix bottle trap

		C6.05 Install European water closet pan	C6.06 Install Asian water closet pan	C6.07 Fix cistern	C6.08 Install automatic urinal
		D6.09 Install kitchen sink	D6.10 Fix sink mixer	D6.11 Install bidet	D6.12 Install bathtub
		C6.13 Fix wall mixer	C6.14 Fix CP fittings	C6.15 Install cubical shower	C6.16 Fix bathroom accessories
		C6.17 Fix geyser			
	C7: Lay soil and waste pipelines	C7.01 Prepare layout	C7.02 Lay pipes (stack)	C7.03 Connect inspection chamber	
	C8: Service water, sanitary fittings and fixtures	C8.01 Clear blockage	C8.02 Fix leakage	C8.03 Service valve	C8.04 Service CP fittings
		C8.05 Service CP mixers	C8.06 Service cistern	C8.07 Service pump	C8.08 Service tank
		C8.09 Maintain record			
	D. Carryout installation and servicing of fire safety and protection system	D1: Install fire alarm and detection system	D1.01 Install fire detector	D1.02 Install manual call point	D1.03 Install audio and visual sounders
		D2: Install fire suppression system	D2.01 Prepare layout	D2.02 Install tank	D2.03 Install pump
			D2.05 Install hose reel system	D2.06 Install riser	D2.07 Use fire extinguisher

	D3: Service fire suppression system	D3.01 Service detection system	D3.02 Service hydrant system	D3.03 Service fire extinguisher	
E: Carry out integration and monitoring of control systems in Building Management System (BMS)	E1: Perform installation of PLC	E1.01 Install PLC software	E1.02 Perform basic PLC programming	E1.03 Install PLC hardware	E1.04 Connect PLC unit with input and output devices
		E1.05 Establish communication between PLC and programmer			
	E2: Integrate various types of control systems linked to Building Management system (BMS)	E2.01 Interpret BMS schematic layout diagram	E2.02 Integrate lighting control system	E2.03 Integrate AC control system	E2.04 Integrate Security and Surveillance system
		E2.05 Integrate Fire safety and protection system	E2.06 Integrate Public Addressing (PA) system		
	E3: Perform monitoring of Building Management System (BMS)	E3.01 Monitor real time parameters of Building Management System	E3.02 Monitor real time energy usage	E3.03 Monitor fire alarm system	E3.04 Monitor efficiency of AC system
		E3.05 Monitor security and surveillance system			
	E4: Perform Building Management system (BMS) wellness check	E4.01 Check sensors/actuators/controllers	E4.02 Check alarm and time programmes/status	E4.03 Check cables and connectors	E4.04 Maintain cleanliness of BMS components
		E4.05 Check operation of BMS output devices	E4.06 Check functionality of system software	E4.07 Check system's operational controls	E4.08 Troubleshoot Building Management System

Course Information

COURSE TITLE	Facility Management Technology
LEVEL	Diploma
COURSE OBJECTIVE	Upon completion of Facility Management Technology Diploma, the trainee will be able to: • Carry out installation and servicing of electrical systems • Carryout installation and servicing of air conditioning system • Carryout water and sanitation services • Carryout installation and servicing of fire safety & protection system • Carryout integration and monitoring of control systems in Building Management System
COURSE DESCRIPTION	This course is designed to provide learners the knowledge, skills and attitude to become competent Facility Management Technologist in accordance with industry standards. Upon completion of this course, the graduates will be able to work in industries where they can perform duties like carrying out installation and servicing of electrical system, air conditioning system, water & sanitation services, fire safety & protection system and to monitor building management system. To obtain the qualification of Facility Management Technology (Diploma), all learning outcomes prescribed for this qualification must be achieved.
TOTAL DURATION	2 years
TRAINING PROPORTION	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	• Completed class 12/ Certificate 3
TRAINER QUALIFICATION	• Must have a minimum qualification of degree in relevant field. Preference will be given to the candidates with minimum three years of working experience; • Must have undergone Training of Trainers-Technical Instruction and Pedagogy; • Must have five years of working experience if institute hires a guest lecturer

Assessment and Certification System

ASSESSMENT	Formative assessment for every module and learning outcome will be conducted through assignments, project works, continuous assessment, demonstration of practical skills/observations, oral questioning and written test. Summative assessment after completion of each national certificate level will be conducted by Bhutan Qualification and Professional Certificate Authority (BQPCA), MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with BQPCA, MoESD.
CERTIFICATION	On successful completion of course, the institute will award a certificate of achievement to the trainees. The Bhutan Qualification and Professional Certificate Authority (BQPCA), MoESD will award a National Certificate to the trainees upon the successful completion of each Certificate level assessment.
COURSE DELIVERY	1. Modular 2. Demonstration 3. Lecture 4. Discussion with problem-based learning 5. Industrial training/attachment 6. Project work
RESOURCES	Materials Pen, paper, wires, insulation tape, electrical loads, potentiometer, cleaning rag, jumper wire, resistors, breadboard, connecting probes, inductor, capacitor, wire, bulb, bulb holder, graph sheet, diode, zener diode, inverter, crocodile clip, probes, semi-conductor, hacksaw blade, pencil/chalk, conduit and fittings, MCBs, RCCB, lamp holders, power socket, modular boxes, switches, DB, saddles, screws, dowels, machine screws, drill bits, funnel, wire mesh, nuts & bolts, sand, cement, bricks/stone, electrode, GI pipe, building LA & accessories, earth strip, lugs, marker, aggregate, water, rivet, sealant, clamps, marking clothes, rope, cable tie, MC4 connectors, PV cables, conduits, saddle, DC distribution board, fuse, DCSPD, ferrule/tags, lead acid batteries, lithium-ion battery, battery rack, energy meter, observation checklist, squeegee, mild soap, soft bristle brush, distilled water, LA, manufacturer manual, notebook, changeover switch, fuel filter, fuel, tray, rubber abrasive, pressure spring, cleaning agent, emery paper, petroleum jelly, terminal lugs, cable, screw, washer, thermostat, heat gun, gaffer tape, masking tape, scissors, nails, AV cable, HDMI cable, projector with mounting accessories, TV/Monitor with accessories, projector screen, AV receiver, copper tube, flaring nut, oxygen and acetylene gas, propane gas can, water paper, filler rod, flux, wrapping tape, drill bits, PVC dowels, PVC insulation, recovery cylinder, air filter element, marking cloth, brush, thimble, refrigerant, pipe, fittings, drawing, BSR, hacksaw frame, lubricants, rag/marking clothes, CPVC glue, CVPC pipe & fitting, sand paper, PEX pipes & fittings, PPR pipes & fittings, thinning flux, copper pipes & fittings, washers, HDPE pipes & fittings, PVC pipes & fittings, lubricant, gasket, mason thread, chalk, nails, chalk line,

drawing, marker, screw, dowel, clamp, pipes & fitting, jointing compound, binding wire, male adapter, elbow, thread seal tape, diverter set, jug, bucket, pegs, mason thread, drawing, nail, fine aggregate, water, soil/sand, pipes & fittings, jointing compound, thread seal tape, jute, zinc, valves, Teflon tape, insulating materials, cable tie, binding wire, fine soil/sand, pegs, nuts & bolts, valves, pipes & fittings, jute, thread seal tape, zinc paste, hole saw cutter set, storage tank, tank nipple, valve, tee, elbow, union, bucket, jug, soap, M seal, gasket tank nipple, sanitary fixtures, drawing, chalk line, mason thread, Teflon tape, basin sensor, connection pipe, waste coupling, hose pipe, basin mixer set, bottle trap, white cement, WC pan, sand, gravel, screw, adhesive, dowel, traps, bricks, cistern, bracket, drill bit, urinal pot, urinal sensor, kitchen sink, sink mixer, bidet components, fine dry sand, brick, cement, bath tub, fittings, pipes, silicon sealant, wall mixer set, grinder blade, bib cock, valve, concealed stop cock, cubical set, TP holder, soap tray, towel rail, glass shelf, mirror, brush holder, soap dispenser, anchor bolt, geyser set, marking clothes, plumber putty, brush, thread seal tape, lubricant, gaskets, O-rings, washers, aerators, rubber washer, oil, valve, seal, scrub brushes or sponges, non-toxic cleaning agent or mild detergent, notebook, fire detector, communication cable, manual call point, audio & visual sounder, mounting bracket, push button, limit switch, sensor, wooden board, push button box, contactor, indicator lamp, indicator box, din rail, fuse, terminal block, relay, checklist, sensors, actuator, LAN cable, connector and disinfectant.

Tools

Pliers, screwdriver set, wire stripper, hammer, spirit level, hacksaw, electrician knife, measuring tape, spade, pickaxe, shovel, crowbar, fishing tape, cordless drill, plumb bob, wrench, crimping tool, earth clamps, trowels, digging bar, wrench set, water pipe level, mortar pan, wheelbarrow, mason's thread, combination pliers, spanner set, Allen key set, pulley, MC4 spanner wrench, torch, audio-video cabling tool, tube cutter, flaring tool set, tube expander, swaging tool set, reamer/deburring tool, copper tube bender, brazing torch, burner, lighter, table ladder, adjustable wrench, cylinder valve key, calculator, file, oil can, ratchet die set, pipe cutter, soldering torch, steel wire brush, punching tools, solvent, knife, PVC pipe cutter, lever puller, chisel, pipe wrench, try square, binding hook, mud rammer, saw cut set, wooden float, cable drum, plunger, auger snake, bucket/container, electrical hand tool set, chain wrench and hydrant wrench

Instrument

Multi-meter, voltmeter, frequency meter, energy meter, ohm meter, ammeter, clamp-on meter, LCR meter, phase sequence meter, wattmeter, earth tester, IR tester, infrared thermometer, hydrometer, feeler gauge, manifold gauge, micron gauge, leak detector, vane anemometer, flow meter and pressure gauge

Software

PLC software

Equipment

AC/DC source, CRO (Cathode Ray Oscilloscope), drilling machine, angle grinder, CCTV camera, burglar alarm system, tile cutter, ladder, PV panel, inverter, controller, DC bus bar, Battery Management System (BMS), UPS system, generator set, rivet gun, water pump, air compressor, computer, handheld microphone, charger, snake box, XLR cable, mixing console, cross over, equalizer, amplifier, quarter inch jack, low frequency speakers (sub-woofer), high frequency speakers, power cables, flight case, outboard rack, power strip, microphone stands, cordless power tool, pipe vice, gas welding set, indoor unit, outdoor unit, dry nitrogen gas cylinder set, vacuum pump, recovery machine, hand blower, high pressure washer gun, AC unit, threading machine, laser level, hydrostatic test pump, soil compactor, manual heating plate, water testing kit, alarm panel, welding machine, tank, circular saw, jockey pump, fire extinguisher, PLC CPU, Switching Mode Power Supply (SMPS), Building Management System and components, Firefighting and suppression system, AC system, security and surveillance system and computer set/laptop

PPE

Safety boots, safety gloves, safety helmet, ear muff, safety goggles, insulation gloves, respiratory mask, dust mask and working dress

Learning Materials

- Competency Based Learning Materials (CBLM)
- Reference books
- Hand-outs
- Audio visuals

Infrastructure and training facilities

- **Theory classroom size:** Minimum of 1.5 m² per trainee;
- **Practical Workshop size:** Minimum of 3 m² per trainee. Variables must be considered depending upon type of skills being taught and the number of trainees participating at a time.

Module Information:
Facility Management Technology Diploma

Module 1
on
Carrying out Installation and Servicing of Electrical Systems

MODULE INFORMATION

Occupation	Facility Management Technologist
Competency Area	Carry out Installation and Servicing of Electrical Systems
Module Title	Carrying out Installation and Servicing of Electrical Systems
Module Code	7119-L4-M1
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to apply basic electrical theory, verify AC & DC circuits, install and service electrical systems, solar PV system& backup power supply and to set up audio visual system
Nominal Duration	658 Hours
Certificate Level	Diploma
Pre-requisite	Completed class 12/ certificate 2
Learning Outcome	1. Apply basic electrical theory 2. Verify DC circuit 3. Verify characteristics of AC circuit 4. Apply basic electronic theory 5. Install electrical systems 6. Perform installation test 7. Service electrical system 8. Install solar PV system 9. Service solar PV system 10. Install backup power supply 11. Service backup power supply 12. Set up audio visual system

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 1	Apply basic electrical theory		
Duration	Theory: 11.5 hours	Practical: 25 hours	Total: 36.5 hours
Assessment Criteria	• Characteristics of AC and DC is verified as per the job requirement following standard procedures • Resistance is measured as per the job requirement following standard procedures • Voltage is measured as per the job requirement following standard procedures • Current is measured as per the job requirement following standard procedures • Power is measured as per the job requirement following standard procedures • Energy is measured as per the job requirement following standard procedures • Frequency is measured as per the job requirement following standard procedures		
Content	A1.00 • Introduction to Facility Management Technology • Trends and scope of Facility Management Technologist A1.01 Verify characteristics of AC and DC Knowledge • Characteristics of AC and DC • Advantages of AC over DC • Application of CRO Skills • Operating CRO • Observation skills • Interpreting data Attitude, safety and environmental concern • Effective time management • Having team work • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of instruments and materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.02 Measuring resistance Knowledge • Types of resistor • Definition of resistance • Factor affecting resistance • Power rating of resistor (Maximum safe current value) • Methods of calculating resistance Skills • Using multi-meter • Observation skills • Numeracy skills		

	<i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling of instruments • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.03 Measuring voltage <i>Knowledge</i> • Definition of voltage • Formulae for voltage calculation • Units and symbols of voltage • Types of instrument errors <i>Skills</i> • Using Voltmeter • Using multimeter • Observation skills • Instrument reading skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.04 Measuring current <i>Knowledge</i> • Definition of current • Unit and symbols of current • Types of current • Effects of electric current <i>Skills</i> • Using ammeter • Using clamp on meter • Using multimeter • Interpreting circuit diagrams • Instrument reading skills • Observation skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials
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	• Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.05 Measuring power Knowledge • Definition of power • Unit and symbol of power • Types of power • Power triangle • Definition of power factor • Importance of power factor Skills • Using wattmeter • Using multimeter • Instrument reading skills • Interpreting circuit diagram Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.06 Measuring energy Knowledge • Definition of electric energy • Unit and symbol of energy • Calculation of energy consumed • Electricity tariff ✓ Definition ✓ Types ✓ Calculation Skills • Observation skills • Using energy meter • Interpreting circuit diagram • Numeracy skills • Using multimeter Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation
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	- Ensuring appropriate use of PPE - Ensuring proper disposal of waste A1.07 Measuring frequency Knowledge - Definition of frequency - Unit and symbol of frequency - Relation between time and frequency - Effects of frequency Skills - Using frequency meter - Observation skills - Using multimeter Attitude, safety and environmental concern - Effective time management - Having integrity and work ethics - Proper handling and storage of tools - Efficient use of materials - Ensuring to follow OHS rules and regulation - Ensuring appropriate use of PPE - Ensuring proper disposal of waste
Learning Conditions	Learning Materials - Competency Based Learning Materials (CBLM) - Hand-outs - Audio Visuals - Reference books - Manuals Learning facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop Materials - Connectors, wires, insulation tape, electrical loads, potentiometer and resistor Tools - Pliers, screw driver set and wire stripper Instruments - Multi-meter, voltmeter, frequency meter, energy meter, ohm meter, ammeter, clamp on meter and wattmeter Equipment - AC/DC power supply and CRO PPE - Safety shoes, workshop dress, safety goggles and safety gloves

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 2	Verify DC circuits		
Duration	Theory: 8 hours	Practical:16 hours	Total: 24 hours
Assessment Criteria	• Ohms law is verified as per the job requirement following standard procedure • Characteristics of series circuit is verified as per the job requirement following standard procedure • Characteristics of parallel circuit is verified as per the job requirement following standard procedure • Characteristics of combined circuit is verified as per the job requirement following standard procedure		
Content	A2.01 Verifying ohms law Knowledge • Statement of Ohm's Law • Application of Ohm's Law • Limitations of Ohm's Law Skills • Using multimeter • Using ammeter • Using voltmeter • Instrument reading skills • Interpreting data • Interpreting circuit diagram • Observation skills • Numeracy skills • Analytical skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A2.02 Verifying characteristics of series circuit Knowledge • Characteristics of series circuit • Statement of Kirchoff's Voltage Law (KVL) • Application of KVL • Calculations related to KVL • Advantages and disadvantages of series circuit Skills • Observation skills • Using ammeter • Using voltmeter		

	● Using multimeter ● Interpreting circuit diagram ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow OHS rules and regulation ● Ensure to make correct connection of circuits ● Ensure to appropriate meter range selection A2.03 Verifying characteristics of parallel circuit <i>Knowledge</i> ● Characteristics of parallel circuit ● Statement of Kirchoff's Current Law (KCL) ● Application of KCL ● Calculation related to KCL ● Advantages and disadvantages of parallel circuit <i>Skills</i> ● Observation skills ● Using ammeter ● Using voltmeter ● Using multimeter ● Interpreting circuit diagram ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to make correct connection of circuits ● Ensure to appropriate meter range selection A2.03 Verifying characteristics of combined circuit <i>Knowledge</i> ● Characteristics of combined circuit ● Calculations related to combined circuit ● Advantages and disadvantages of combined circuit ● Applications of combined circuit <i>Skills</i> ● Observation skills ● Using ammeter ● Using voltmeter ● Using multimeter ● Interpreting circuit diagram ● Numeracy skills
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	<i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, cleaning rag, jumper wire, resistors and breadboard Tools • Plier, screw driver set and wire stripper Instruments • Ammeter, voltmeter and multimeter Equipment • AC/DC power supply PPE • Safety shoes, workshop dress, safety goggles and safety gloves
Instructional Methodologies	The trainer shall use <i>inter alia</i> , the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i> , the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 3	Verify AC circuits		
Duration	Theory:57 hours	Practical:58 hours	Total: 115 hours
Assessment Criteria	- Phase sequence of 3-Phase supply is checked as per the job requirement following standard procedure - Characteristics of balanced load in star connection is verified as per the job requirement following standard procedure - Characteristics of unbalanced load in star connection is verified as per the job requirement following standard procedure - Characteristics of balanced load in delta connection is verified as per the job requirement following standard procedure - Characteristics of resistive load is verified as per the job requirement following standard procedure - Characteristics of inductive load is verified as per the job requirement following standard procedure - Characteristics of capacitive load is verified as per the job requirement following standard procedure - Characteristics of RL series load is verified as per the job requirement following standard procedure - Characteristics of RC series load is verified as per the job requirement following standard procedure - Characteristics of RLC series load is verified as per the job requirement following standard procedure - Characteristics of RC parallel load is verified as per the job requirement following standard procedure - Characteristics of LC parallel load is verified as per the job requirement following standard procedure - Characteristics of RLC parallel load is verified as per the job requirement following standard procedure		
Content	A3.01 Checking phase sequence of 3-Phase supply Knowledge - Difference between single and poly phase - Advantages of poly-phase over single phase - Types of poly-phase circuit - Definition of phase sequence - Purpose of checking phase sequence Skills - Using phase sequence meter - Using multimeter - Observation skills - Numeracy skills - Instrument reading skills Attitude, safety and environmental concern - Being vigilant and patient		

	● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.02 Verifying characteristics of balanced load in star connection Knowledge ● Types of three phase load configuration ● Characteristics of balanced star load ● Calculations ● Application of star connection Skills ● Interpreting circuit diagram ● Using multi-meter ● Using clamp on meter ● Instrument reading skills ● Using ammeter Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.03 Verifying characteristics of unbalanced load in star connection Knowledge ● Characteristics of unbalanced star load in 3-wire & 4-wire supply system ● Neutral current calculation ● Disadvantage of presence of neutral current ● Methods to reduce neutral current Skills ● Interpreting circuit diagram ● Using multi-meter ● Using clamp on meter ● Instrument reading skills Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.04 Verifying characteristics of balanced load in delta connection Knowledge ● Advantages and disadvantages of delta connection ● Characteristics of balanced delta load ● Calculations ● Applications of delta connection Skills ● Using multi-meter ● Using ammeter ● Interpreting circuit diagram
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	● Using clamp on meter ● Instrument reading skills ● Observation skills ● Analytical skills ● Numeracy skills <i>Attitude, safety and environmental concern</i> ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.05 Verifying characteristics of resistive load <i>Knowledge</i> ● Types of electrical loads ● Characteristics of resistive load ● Calculations ● Vector/phasor diagram of resistive load ● Waveform <i>Skills</i> ● Operating CRO ● Using LCR meter ● Using ammeter ● Using voltmeter ● Observation skills <i>Attitude, safety and environmental concern</i> ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.06 Verifying characteristics of inductive load <i>Knowledge</i> ● Introduction to inductor ● Types of inductors ● Factors affecting inductance of a coil ● Characteristics of inductive load (vector/phasor diagram of inductive load, power triangle) ● Inductance in series and parallel ● Waveform ● Application of inductor <i>Skills</i> ● Operating CRO ● Using LCR meter ● Using ammeter ● Using voltmeter ● Observation skills ● Numeracy skills
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	<i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.07 Verifying characteristics of capacitive load <i>Knowledge</i> • Introduction to capacitor • Types of capacitors • Factors affecting capacitance of a capacitor • Characteristics of capacitive load (Vector/Phasor diagram of capacitive load, power triangle) • Capacitance in series and parallel • Waveform • Application of capacitor <i>Skills</i> • Operating CRO • Using LCR meter • Using ammeter • Using voltmeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.08 Verifying characteristics of RL series circuits <i>Knowledge</i> • Impedance, power and voltage triangle • Power factor • Characteristics of RL series circuit • Vector/Phasor diagram of RL circuit • Waveform • Application of RL load <i>Skills</i> • Operating CRO • Using LCR meter • Using ammeter • Using voltmeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE
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	- Ensuring proper disposal of waste A3.09 Verifying characteristics of RC series circuit Knowledge - Impedance, power and voltage triangle - Power factor - Characteristics of RC series circuit - Vector/Phasor diagram of RC circuit - Waveform - Application of RC circuit Skills - Operating CRO - Using LCR meter - Using ammeter - Using voltmeter - Observation skills - Analytical skills - Numeracy skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste A3.10 Verifying characteristics of LC series circuit Knowledge - Impedance, power and voltage triangle - Power factor - Characteristics of LC series circuit - Vector/Phasor diagram of LC circuit - Waveform - Application of LC circuit Skills - Operating CRO - Using LCR meter - Using ammeter - Using voltmeter - Interpreting circuit diagram - Observation skills - Analytical skills - Numeracy skills Attitude, safety and environmental concern - Effective time management - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste
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	A3.11 Verifying characteristics of RLC series circuit Knowledge ● Impedance, power and voltage triangle ● Power factor ● Characteristics of RLC series circuit ● Vector/Phasor diagram of RLC circuit ● Waveform ● Resonance ● Application of RLC circuit Skills ● Operating CRO ● Using LCR meter ● Using ammeter ● Using voltmeter ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of wastes A3.12 Verifying characteristics of RL parallel circuit Knowledge ● Admittance, power and current triangle ● Power factor ● Characteristics of RL parallel circuit ● Vector/Phasor diagram of RL parallel circuit ● Waveform ● Application of RL parallel circuit Skills ● Operating CRO ● Using LCR meter ● Using ammeter ● Using voltmeter ● Observation skills ● Analytical skills ● Numeracy skills Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste A3.13 Verifying characteristics of RC parallel circuit Knowledge ● Admittance, current and power triangle ● Power factor
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	• Characteristics of RC parallel circuit • Vector/Phasor Diagram of RC parallel circuit • Waveform • Applications of RC parallel circuit Skills • Operating CRO • Using LCR meter • Using ammeter • Using voltmeter • Observation skills • Analytical skills • Numeracy skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.14 Verifying characteristics of LC parallel circuit Knowledge • Admittance, current and power triangle • Power factor • Characteristics of LC parallel circuit • Vector/Phasor Diagram of LC parallel circuit • Resonance frequency • Waveform • Applications of LC parallel circuit Skills • Operating CRO • Using LCR meter • Using ammeter • Using voltmeter • Observation skills • Analytical skills • Numeracy skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.15 Verifying characteristics of RLC parallel circuit Knowledge • Admittance, current and power triangle • Power factor • Characteristics of RLC parallel circuit • Parallel resonance • Vector/Phasor Diagram of RLC parallel circuit
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	● Waveform ● Applications of RLC parallel circuit Skills ● Operating CRO ● Using LCR meter ● Using ammeter ● Using voltmeter ● Observation skills ● Analytical skills ● Numeracy skills Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste
Learning Conditions	Learning Materials ● Competency Based Learning Materials (CBLM) ● Hand-outs ● Audio Visuals ● Reference books ● Manuals Learning facilities and infrastructure ● Classroom with adequate facilities ● Information Technology (IT) lab ● Library ● Workshop Materials ● Pen, Paper, connecting probes, resistor, inductor, capacitor, wire, bread board, bulb and bulb holder Tools ● Pliers, screw driver set, tester and wire stripper Instruments ● Multi-meter, ammeter, voltmeter, LCR meter and phase sequence meter Equipment ● AC power supply and CRO PPE ● Safety shoes, workshop dress, safety goggles and safety gloves

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 4	Apply basic electronic theory		
Duration	Theory: 24 hours	Practical: 48 hours	Total: 72 hours
Assessment Criteria	• VI Characteristics of diode is verified as per the job requirement following standard procedures • VI Characteristics of Zener diode is verified as per the job requirement following standard procedures • Characteristics of half wave rectifier is verified as per the job requirement following standard procedures • Characteristics of full wave rectifier is verified as per the job requirement following standard procedures • Characteristics of filter circuit is verified as per the job requirement following standard procedures • Characteristics of transistor as switch is verified as per the job requirement following standard procedures • Characteristics of transistor as amplifier is verified as per the job requirement following standard procedures • Characteristics of inverter is verified as per the job requirement following standard procedures		
Content	A4.01 Verify characteristics of diode Knowledge • Introduction to Semi-conductor • Working principle of diode • Types of diodes • V-I Characteristics of diode • Application of diode Skills • Using multimeter • Observation skills • Numeracy skills Attitude, safety and environmental concern • Effective time management • Having team work • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of instruments and materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.02 Verifying characteristics of Zener Diode Knowledge • Working principle of Zener diode • V-I characteristics of Zener diode • Applications of Zener diode		

	<i>Skills</i> • Using multi-meter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling of instruments • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.03 Verifying half wave rectifier <i>Knowledge</i> • Introduction to rectifier • Types of rectifiers • Applications of rectifier • Characteristics of half wave rectifier • Limitations of half wave rectifier • Calculation related to rectifier (Vrms, V-peak, V-peak-peak) <i>Skills</i> • Operating CRO • Using multimeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.04 Verifying full wave rectifier <i>Knowledge</i> • Types of full wave rectifier • Differences between full and half wave rectifier • Advantages and disadvantages of full wave rectifier • Characteristics and application of full wave rectifier • Calculation related to rectifier (Vrms, V-peak, V-peak-peak) <i>Skills</i> • Operating of CRO • Using multi-meter • Observation skills • Numeracy skills
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	<i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.05 Verifying filter circuits <i>Knowledge</i> • Definition of filter • Types of filters • Characteristics of filter circuits • Applications of filter circuits <i>Skills</i> • Using CRO • Using multi-meter • Observation skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.06 Verify characteristic of transistor as a switch <i>Knowledge</i> • Working principle of transistor • Transistor configuration • Transistor biasing • Types of Transistors • Characteristics of transistors • Transistor symbols • Application of transistor • Characteristics of transistor as a switch <i>Skills</i> • Using multimeter • Observation skills • Numeracy skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.07 Verifying characteristics of transistor as an amplifier Knowledge • Characteristics of transistor as an amplifier • Gain calculation Skills • Operating CRO • Using multimeter • Observation skills • Numeracy skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A4.08 Verifying characteristics of inverter Knowledge • Introduction to inverter • Types of inverter • Applications of inverter • Characteristics of inverter • Waveform • Calculation related to inverter (V_{rms}, V-peak, V-peak-peak) Skills • Interpreting circuit diagram • Operating CRO • Using multimeter • Observation skills • Numeracy skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books

	• Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen & paper, graph sheet, diode, zener diode, bread board, resistor, inverter, crocodile clip, probes, jumper wire, capacitor, potentiometer, semi-conductor and inductor Tools • Pliers, screw driver set and wire stripper Instruments • Multi-meter, Voltmeter and ammeter Equipment • Variable DC power supply and CRO PPE • Safety shoes, workshop dress, safety goggles and safety gloves
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M2		
Learning Outcome 5	Install electrical systems		
Duration	Theory: 20.5 hours	Practical:101 hours	Total: 121.5 hours
Assessment Criteria	• Rat tail joint is made as per the job requirement following standard procedure • Straight joint is made as per the job requirement following standard procedure • Tee joint is made as per the job requirement following standard procedure • Surface wiring is performed as per the job requirement following standard procedure • Concealed wiring is performed as per the job requirement following standard procedure • DB is installed as per the job requirement following standard procedure • Earthing is installed as per the job requirement following standard procedure • Building LA is installed as per the job requirement following standard procedure • Surveillance system is installed as per the standard procedure • Security system is installed as per the standard procedure		
Content	A5.01 Preparing rat tail joint Knowledge • Types of wires • Types of wire joints • Application of rat tail joint Skills • Using wire stripper • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.02 Preparing straight joint Knowledge • Application of straight joint Skills • Observation skills • Using wire stripper Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection		

	A5.03 Preparing Tee joint Knowledge • Application of Tee joint Skills • Observation skills • Using wire stripper Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.04 Performing surface wiring for lighting and power circuit Knowledge • Electrical signs and symbols • Types of wiring and its application • Circuit diagram of staircase wiring, corridor wiring, hostel wiring and go-down wiring • Installation rules • Advantages and disadvantages of different types of wiring • Types of sub-circuit • Types of switches • Types of sockets • Types of holders • Types of luminaries/lamps • Color coding of wire • Size of wires • Different size of casing capping bit and its accessories • Estimation and costing • Bill of Quantity (BOQ) Skills • Wire drawing skills • Using drilling machines • Using multimeter • Using IR tester • Numeracy skills • Interpreting drawing • Interpreting BSR • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
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	A5.05 Performing concealed wiring for lighting and power circuit Knowledge • Types of concealed wiring • Methods of concealed wiring • Advantages and disadvantages of concealed wiring • Application of concealed wiring Skills • Interpreting drawings • Using drilling machine • Using angle grinder • Using tile cutter • Analytical skills • Numeracy skills • Using IR tester Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.06 Performing distribution box wiring Knowledge • Types of distribution box • Definition of MCB • Types of MCB • Selection of MCB • Working principles of MCB • Definition of RCCB • Working principle of RCCB • Construction of RCCB and their functions • Selection of RCCB • Definition of ELCB • Working principles of ELCB • Function of ELCB • Definition of RCBO • Difference between RCCB, ELCB and RCBO • Wire size • Colour coding of wire Skills • Using insulation resistance (IR) tester • Using spirit level • Using drilling machine • Interpreting drawing • Wire drawing skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.07 Installing earthing Knowledge • Introduction to earthing • Types of earthing • Purpose of watering arrangement • Artificial treatment of soil • Types of earth continuity conductor • Size of earth lead • Purpose of charcoal and salt • Purpose of bonding earth electrode Skills • Interpreting drawing • Using earth tester • Using drilling machine • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.08 Installing building Lighting Arrestor (LA) Knowledge • Types of building LA • Application of building LA Skills • Interpreting drawing • Using drilling machine • Using IR tester Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.09 Installing surveillance system Knowledge • Introduction to surveillance system • Types of surveillance system • Working principle of surveillance system • Components of surveillance system and its function
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	Skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A5.10 Installing security system Knowledge • Introduction to security system • Types of security system • Working principle of security system • Components of security system and its function Skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Hacksaw blade, pencil/ chalk, conduit and fittings, insulation tape, MCBs, RCCB, wire, lamp holders, power socket, modular boxes, switches, bulb, DB, saddles, screws, dowels, machine screws, drill bits, funnel, wire mesh, nuts & bolts, sand, cement, bricks/stone, electrode, GI pipe, building LA & accessories, earth strip, screws, dowels and drill bit Tools • Pliers, Screw driver set, hammer, sprit level, hacksaw, electrician knife, measuring tape, wire stripper, spade, pick axe, shovel, crow bar, fishing tape, cordless drill and plum bob

	Instruments • Multimeter, energy meter, earth tester and IR tester Equipment • Drilling machine, angle grinder, CCTV camera, burglar alarm system, tile cutter and ladder PPE • Safety Gloves, safety shoes, workshop dress, safety helmet, safety goggles, safety harness, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 6	Perform installation test		
Duration	Theory: 5 hours	Practical:17 hours	Total: 22 hours
Assessment Criteria	- Continuity test is performed as per the job requirement following standard procedure - IR test is performed as per the job requirement following standard procedure - Polarity test is performed as per the job requirement following standard procedure - Soil resistivity test is performed as per the job requirement following standard procedure - Soil resistance test is performed as per the job requirement following standard procedure		
Content	A6.01 Performing continuity test Knowledge - Purpose of continuity test - Inference of test result Skills - Observation skills - Interpreting circuit diagram - Using multimeter Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits - Ensure to appropriate meter range selection A6.02 Performing insulation resistance test Knowledge - Working principle of IR tester - Function of IR tester - Types of IR tester - Purpose of IR test - Application IR test - Inference of test result Skills - Observation skills - Using IR tester - Interpreting circuit diagram Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation		

	• Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A6.03 Performing polarity test Knowledge • Importance of polarity test • Inference of test result Skills • Observation skills • Interpreting circuit diagram • Using multimeter Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A6.04 Performing soil resistivity test Knowledge • Introduction to soil resistivity • Factors affecting soil resistivity • Purpose of earth resistivity test • Calculation of soil resistivity • Methods of soil resistivity test Skills • Observation skills • Using Earth tester • Interpreting circuit diagram Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A6.05 Performing soil resistance test Knowledge • Purpose of soil resistance test • Standard soil resistance for domestic installations • Methods of testing earth resistance Skills • Observation skills • Using Earth tester • Interpreting circuit diagram Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE
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	• Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, pencil, wires and notebook Tools • Plier, screw driver set and wire stripper Instruments • Multimeter, earth tester set and IR tester Equipment • Drilling machine and ladder PPE • Safety gloves, safety shoes, workshop dress, safety helmet, Safety goggles, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 7	Service electrical system		
Duration	Theory: 6 hours	Practical:30 hours	Total: 36 hours
Assessment Criteria	- Lighting system is troubleshoot as per the job requirement following standard procedure - Power circuit is troubleshoot as per the job requirement following standard procedure - Earthing system is serviced as per the job requirement following standard procedure		
Content	A7.01 Troubleshooting lighting system Knowledge - Working of ceiling fan - Components of ceiling fan - Common faults and remedies of ceiling fan - Working of LED luminaries - Components of LED luminaries - Common faults and remedies of LED luminaries Skills - Using multi-meter - Using IR tester - Communication skills - Analytical skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits - Ensure to appropriate meter range selection A7.02 Troubleshooting power circuits Knowledge - Common faults and remedies in power circuits - Types of power socket Skills - Using multimeter - Using IR tester - Analytical skills - Observation skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits		

	• Ensure to appropriate meter range selection A7.03 Servicing earthing system Knowledge • Common faults and remedies in earthing system • Importance of servicing earthing Skills • Using IR tester • Analytical skills • Observation skills • Using multimeter • Using earth tester Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Luminaries, MCCB, RCCB, MCB, Isolator switch, ceiling fan, PVC tape, power socket, insulation tape, wire, salt, nuts & bolts and lugs Tools • Plier, screw driver set, wire stripper, wrench, crimping tool and earth clamps Instruments • Multimeter, earth tester and IR tester Equipment • Ladder and drilling machine PPE • Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, mask and reflective vest

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: ● Lecture ● Interactive discussion ● Demonstration ● Industrial visit/training ● Guided practice ● Group practice with project-based learning ● Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: ● Practical observation ● Oral/viva-voce ● Written test ● Assignment ● Project work

Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 8	Install solar PV system		
Duration	Theory: 31 hours	Practical:49 hours	Total: 80 hours
Assessment Criteria	● Mounting structure is installed as per the job requirement following standard procedure ● PV panel is installed as per the job requirement following standard procedure ● Wiring of PV panel is performed as per the job requirement following standard procedure ● DC distribution board is installed as per the job requirement following standard procedure ● Controller is installed as per the job requirement following standard procedure ● Battery is installed as per the job requirement following standard procedure ● Inverter is installed as per the job requirement following standard procedure ● AC distribution is installed as per the job requirement following standard procedure ● Energy meter is installed as per the job requirement following standard procedure ● Solar PV system is commissioned as per the job requirement following standard procedure		
Content	A8.01 Installing mounting structure Knowledge ● Introduction to solar PV system ● Types of solar PV system ● Types of foundation ● Types of mounting structure ● Components of mounting structure ● Introduction to solar tracker (Single-axis and dual-axis tracking) Skills ● Using drilling machine ● Using rivet gun ● Observation skills ● Numeracy skills Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensuring to follow OHS rules and regulation ● Ensure to make correct connection of circuits ● Ensure to appropriate meter range selection A8.02 Installing PV panel Knowledge ● Components of PV system ● Application of PV system ● Types of mounting clamps		

	Skills • Interpreting drawing • Using drilling machine • Observation skills • Planning skills • Problem solving skill Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.03 Performing wiring of PV panel Knowledge • Series-parallel connection of PV modules • Types of PV panel connectors • Types of PV cables • Properties of PV cables Skills • Using drilling machine • Using crimping tool • Interpreting drawing • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.04 Installing DC distribution board Knowledge • Working principle of fuse, DCSPD and MCB • Function of fuse, DCSPD and MCB • Difference between the fuse, DCSPD and MCB • Importance of DCDB Skills • Using multimeter • Using drilling machine • Observation skills • Analytical skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	• Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.05 Installing controller Knowledge • Function of charge controller • Types of charge controller (Series, shunt, PWM and MPPT) • Difference between PWM type and MPPT type charge controller Skills • Using multimeter • Using drilling machine • Observation skills • Communication skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.06 Installing battery Knowledge • Construction of battery • Types of batteries • Types of battery connections • Charging and discharging of battery • Introduction to battery switch Skills • Using multimeter • Interpreting circuit diagram • Observation skills • Communication skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.07 Installing inverter Knowledge • Definition of inverter • Types of inverters • Application of inverter Skills • Using multimeter • Observation skills • Communication skills
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	<i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.08 Installing AC distribution board <i>Knowledge</i> • Components of AC DB • Working principle of ACSPD • Application of ACSPD <i>Skills</i> • Interpreting Circuit diagram • Using multimeter • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.09 Installing energy meter <i>Knowledge</i> • Definition of energy meter • Importance of identifying location for fixing energy meter • Types of energy meter • Application of bidirectional energy meter • Sizing of bidirectional energy meter <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A8.10 Commissioning PV system <i>Knowledge</i> • Anti-islanding feature • Types of pre-commissioning test <i>Skills</i> • Using multimeter • Observation skills
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	<i>Attitude, safety and environmental concern</i> • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, marker, sand, cement, aggregate, water, screws, rivet, nuts and bolts, sealant, clamps, markin clothes, rope, cable tie, MC4 connectors, PV cables, conduits, saddle, insulation tape, lugs, DC distribution board, fuse, DCSPD, MCB, ferrule/tags, lead acid batteries, lithium-ion battery, battery rack and energy meter Tools • Measuring tape, spade, trowels, shovel, digging bar, pliers, hammer, wrench set, spirit level, water pipe level, mortar pan, wheel barrow, mason thread, combination pliers, spanner set, allen key set, pully and MC4 spanner wrench Instruments • Multimeter, earth tester and IR tester Equipment • Drilling machine, PV panel, inverter, controller, ladder, DC bus bar, Battery Management System(BMS) and rivet gun PPE • Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 9	Service solar PV system		
Duration	Theory: 10 hours	Practical:30 hours	Total: 40 hours
Assessment Criteria	- Solar PV system is inspected as per the job requirement following standard procedure - PV module is serviced as per the job requirement following standard procedure - Battery is serviced as per the job requirement following standard procedure - Invertor or controller is serviced as per the job requirement following standard procedure - Protective device is serviced as per the job requirement following standard procedure		
Content	A9.01 Performing inspection of solar PV system Knowledge - Purpose of conducting inspection - Faults related to solar PV system - Inspection checklist Skills - Observation skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits - Ensure to appropriate meter range selection A9.02 Servicing PV module Knowledge - Importance of servicing PV modules - Defects in PV module Skills - Using multi-meter - Using an infrared thermometer - Interpreting circuit diagram - Observation skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits - Ensure to appropriate meter range selection		

	A9.03 Servicing battery Knowledge • Safety precautions while handling battery • Importance of servicing battery • Factors affecting battery life • Environmental impacts of battery waste • Importance of ventilation • Importance of specific gravity of battery • Function of hydrometer • Types of battery defects • Procedures of adding electrolyte • Causes and effects of battery failure Skills • Using multi-meter • Using hydrometer • Interpreting circuit diagram • Observation skills • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A9.04 Servicing inverter Knowledge • Importance of servicing an inverter • Inverter protection system • Types of inverter faults • Error codes of inverter Skills • Using multi-meter • Meter reading skills • Interpreting circuit diagram • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A9.05 Servicing protective device Knowledge • Types of protective devices in PV solar system • Common faults and remedies of protective device
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	Skills • Using multi-meter • Interpreting circuit diagram • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, observation checklist, wire, MC4 connector, squeegee, mild soap, soft bristle brush, insulation tape, wire, fuse, MCB, SPD, distilled water and LA Tools • Plier, screwdriver set, wire stripper and wrench set Instruments • Multimeter, infrared thermometer and hydrometer Equipment • Ladder PPE • Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 10	Install backup power supply		
Duration	Theory: 7 hours	Practical:35 hours	Total: 42 hours
Assessment Criteria	• Changeover switch is installed as per the job requirement following standard procedure • UPS is installed as per the job requirement following standard procedure • Generator set is installed as per the job requirement following standard procedure		
Content	A10.01 Installing changeover switch Knowledge • Definition of changeover switch • Types and application of change over switch • Current rating of changeover switch Skills • Observation skills • Using multimeter • Using drilling machine Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A10.02 Installing UPS Knowledge • Introduction to UPS system • Working of UPS • Components of UPS • Types of UPS system • Sizing of UPS • Features of UPS Skills • Observation skills • Using multimeter • Interpreting circuit diagram • Analytical skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection		

	A10.03 Installing generator set Knowledge • Introduction to generator set • Components of generator and its functions • Types of generator set Skills • Using multi-meter • Interpreting circuit diagram • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, manufacturer manual, notebook, changeover switch and lugs Tools • Plier, screwdriver set, wire stripper, crimping tool and wrench set Instruments • Multimeter Equipment • UPS system, generator set and drilling machine PPE • Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 11	Service backup power supply		
Duration	Theory: 7 hours	Practical:30 hours	Total: 37 hours
Assessment Criteria	- Oil/fuel filter is replaced as per the job requirement following standard procedure - Coolant is changed as per the job requirement following standard procedure - Air filter is replaced as per the job requirement following standard procedure - Engine oil is serviced as per the job requirement following standard procedure - Fuel tank is cleaned as per the job requirement following standard procedure - UPS is serviced as per the job requirement following standard procedure		
Content	A11.01 Replacing fuel filter Knowledge - Purpose of fuel filter - Types of filters - Intervals of changing filter - Importance of filling the new filter with fuel prior to fitting - Consequences of delaying in fuel filter replacement Skills - Observation skills - Using filter wrench Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits - Ensure to appropriate meter range selection A11.02 Changing coolant Knowledge - Importance of DG cooling system - Components of cooling system and their functions - Types of coolants - Types of cooling system - Purpose of radiator - Properties of coolant Skills - Observation skills - Operating DG set Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits		

	• Ensure to appropriate meter range selection A11.03 Replace air filter Knowledge • Function of air filter • Types of air filter • Interval of changing air filter Skills • Observation skills • Using blower Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A11.04 Servicing thermostat Knowledge • Working principle of thermostat • Function of thermostat • Types of thermostats • Application of thermostat Skills • Observation skills • Using multimeter Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection A11.05 Cleaning fuel tank Knowledge • Importance of cleaning fuel tank • Functions of fuel tank • Components of fuel tank Skills • Observation skills • Operating air compressor • Operating water pump Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
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	A11.06 Servicing UPS Knowledge ● Importance of servicing UPS Skills ● Observation skills ● Operating air compressor ● Operating water pump Attitude, safety and environmental concern ● Being vigilant and patient ● Having work ethics and integrity ● Ensuring appropriate use of PPE ● Ensuring proper disposal of waste ● Ensure to make correct connection of circuits
Learning Conditions	Learning Materials ● Competency Based Learning Materials (CBLM) ● Hand-outs ● Audio Visuals ● Reference books ● Manuals Learning facilities and infrastructure ● Classroom with adequate facilities ● Information Technology (IT) lab ● Library ● Workshop Materials ● Pen, paper, fuel filter, fuel, tray, distilled water, rubber abrasive, pressure spring, cleaning agent, emery paper, petroleum jelly, terminal lugs, cable, nuts & bolts, screw, washer, thermostat and heat gun Tools ● Plier, screwdriver set, wire stripper and wrench set Instruments ● Multimeter, feeler gauge and hydrometer Equipment ● Water pump and air compressor PPE ● Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, safety harness, mouth mask, reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: ● Lecture ● Interactive discussion ● Demonstration ● Industrial visit/training ● Guided practice ● Group practice with project-based learning ● Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out Installation and Servicing of Electrical Systems		
Module Code	7119-L4-M1		
Learning Outcome 12	Set up audio visual system		
Duration	Theory: 10 hours	Practical: 22 hours	Total: 32 hours
Assessment Criteria	- Wiring of audio is performed as per the job requirement following standard procedure - Wiring of visual com as per the job requirement following standard procedure - Performance is tested as per the job requirement following standard procedure		
Content	A12.01 Performing wiring of audio system Knowledge - Balanced vs unbalanced audio cables - Components of audio system and its function Skills - Observation skills - Analytical skills - Problem solving skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits A12.02 Performing wiring of visual system Knowledge - Components of visual system - Line connection for setting up visual system - Common faults in setting up visual system - Introduction to AV receiver Skills - Using drilling machine - Using multimeter - Observation skills Attitude, safety and environmental concern - Being vigilant and patient - Having work ethics and integrity - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation - Ensure to make correct connection of circuits A12.03 Testing performance of AV system Knowledge - Common installation problems - Process of configuring and optimizing the Settings		

	Skills • Using multi-meter • Observation skills Attitude, safety and environmental concern • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to make correct connection of circuits • Ensure to appropriate meter range selection
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, gaffer tape, masking tape, scissors, nails, AV cable, HDMI cable, projector with mounting accessories, TV/Monitor with accessories, projector screen and AV receiver Tools • Plier, screwdriver, wire stripper, wrench set, hammer, torch, audio-video cabling tool and allen key Equipment • Computer, handheld microphone, charger, snake box, XLR cable, mixing console, cross over, equalizer, amplifier, quarter inch jack, low frequency speakers (sub-woofer), high frequency speakers, power cables, flight case, outboard rack, power strip, ladder, microphone strands, drilling machine and cordless power tool PPE • Safety gloves, safety shoes, workshop dress, safety helmet, safety goggles, mask and reflective vest
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module 2
on
Carrying out Installation and Servicing of Air Conditioning System

MODULE INFORMATION

Occupation	Facility Management Technologist
Competency Area	Carry out Installation and Servicing of Air Conditioning system
Module Title	Carrying out Installation and Servicing of Air Conditioning system
Module Code	7119-L4-M2
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to perform copper tubing works, install and service air conditioner.
Nominal Duration	124 Hours
Certificate Level	Diploma
Pre-requisite	Completed Module 1
Learning Outcome	1.Perform copper tubing works 2.Install air conditioner 3.Service conditioner

Module Title	Carrying out Installation and Servicing of Air Conditioning system		
Module Code	7119-L4-M2		
Learning Outcome 1	Perform copper tubing works		
Duration	Theory: 5 hours	Practical: 29 hours	Total: 34 hours
Assessment Criteria	• Tube cutting is performed as per job requirement following standard procedures • Tube flaring is performed as per the job requirement following standard procedure • Tube swaging is performed as per the standard procedure • Tube bending is performed as per the job requirement following standard procedure • Tube brazing is performed as per job requirement following standard procedure		
Contents	B1.01 Performing tube cutting Knowledge • Advantages of using copper tube • Advantages of using tube cutter • Specification of tube and their application Skills • Using tube cutter • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B1.02 Performing tube flaring Knowledge • Definition of flaring • Purpose of tube flaring • Types of flaring tool • Calculation of flaring Skills • Using flaring tool • Numeracy skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment		

	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B1.03 Performing tube swaging Knowledge • Definition of swaging • Purpose of swaging • Types of swaging tool • Calculation of swaging Skills • Using tube expander • Using swaging tool • Numeracy skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B1.04 Performing tube bending Knowledge • Methods of tube bending • Types of copper tube bender Skills • Using copper tube bender • Numeracy skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
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	B1.05 Performing tube brazing Knowledge • Definition of brazing • Purpose of brazing • Types of filler material • Purpose of flux Skills • Using brazing torch • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Copper tube, marker, flaring nut, oxygen and acetylene gas, propane gas can, water paper, filler rod and flux Tools • Tube cutter, measuring tape, flaring tool set, tube expander, swaging tool set, reamer/deburring tool, copper tube bender, brazing torch, burner, lighter and plier Equipment • Pipe vice and gas welding set PPE • Safety gloves, safety boots, workshop dress, welding goggles and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training

	• Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Air Conditioning system		
Module Code	7119-L4-M2		
Learning Outcome 2	Perform installation of air conditioner		
Duration	Theory: 11 hours	Practical:31 hours	Total: 42 hours
Assessment Criteria	- Preparation for installation of air conditioning is done as per job requirement following standard procedures - Indoor unit is installed as per the job requirement following standard procedure - Outdoor unit is installed as per the standard procedure - Leak test is performed as per the job requirement following standard procedure - Vacuuming is performed as per job requirement following standard procedure - Air conditioner is commissioned as per job requirement following standard procedure		
Contents	B2.01 Prepare for installation of air conditioner Knowledge - Introduction to AC - Types of AC - Location and position of the indoor and outdoor unit - Cooling and heating load calculation Skills - Observation skills - Numeracy skill - Communication skill Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation B2.02 Installing indoor unit Knowledge - Types of indoor unit - Working principle of AC - Components of indoor unit and its functions - Importance of insulating pipes Skills - Analytical skills - Communication skills - Observation skill Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability		

	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.03 Installing outdoor unit Knowledge • Components of outdoor unit and its functions Skills • Analytical skills • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.04 Performing leak test Knowledge • Purpose of leak test • Causes and remedies of leakage Skills • Using manifold gauge • Using leak detector • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.05 Performing vacuuming Knowledge • Function of vacuum pump • Purpose of vacuuming Skills • Using manifold gauge • Using vacuum pump • Observation skills Attitude, safety and environmental concern • Being efficient in using resources
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	• Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B2.06 Commissioning air conditioner Knowledge • Mode of AC Skills • Using vane anemometer • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen, notebook, wrapping tape, drill bits, PVC dowels, PVC insulation, screws and copper tube Tools • Measuring tape, table ladder, tube cutter, adjustable wrench, spanner set, tube bender, screwdriver set, flaring tool set, swagging tools, allen key and cylinder valve key Instrument • Manifold gauge, micron gauge, leak detector, clamp on meter and vane anemometer Equipment • Calculator, drilling machine, indoor unit, outdoor unit, dry nitrogen gas cylinder

	set and vacuum pump PPE • Safety gloves, safety boots, workshop dress, welding goggles and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Carrying out Installation and Servicing of Air Conditioning system		
Module Code	7119-L4-M2		
Learning Outcome 3	Service air conditioner		
Duration	Theory: 9 hours	Practical: 39 hours	Total: 48 hours
Assessment Criteria	• Pump down is serviced as per job requirement following standard procedures • Indoor unit is serviced as per the job requirement following standard procedure • Outdoor unit is installed as per the standard procedure • Electrical fault is troubleshoot as per the job requirement following standard procedure • Mechanical fault is troubleshoot as per job requirement following standard procedure • Refrigerant is recharged as per job requirement following standard procedure		
Contents	B3.01 Performing pump down Knowledge • Different Ozone Depleting Substance (ODS) • Concept of Green House Gas (GHG) • Concept of Global Warming Potential (GWP) • Purpose of pump down • Purpose of Purging • Purpose of recovery • Methods of recovery Skills • Observation skills • Using recovery machine • Using vacuum pump Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B3.02 Servicing indoor unit Knowledge • Importance of timely servicing • Servicing checklist Skills • Using hand blower • Using high pressure washer gun • Observation skill Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity		

	• Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B3.03 Servicing outdoor unit Knowledge • Importance of timely servicing • Servicing checklist Skills • Using hand blower • Using high pressure washer gun • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B3.04 Troubleshooting electrical faults Knowledge • Causes and remedies of electrical fault • Importance of measuring compressor current Skills • Using clamp on meter • Interpreting circuit diagram • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B3.05 Troubleshooting mechanical fault Knowledge • Causes and remedies of mechanical fault Skills • Observation skills • Using manifold gauge
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation B3.06 Recharging Refrigerant <i>Knowledge</i> • Definition of refrigerant • Types of refrigerants • Classes of refrigerant • Safety precautions while handling refrigerant • Purpose of recharging the system • Consequences of overcharging and undercharging <i>Skills</i> • Using digital weighing scale • Using manifold gauge • Observation skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen, notebook, recovery cylinder, air filter element, markin cloth, cleaning agent, brush, thimble, capacitor, wire, insulation tape and refrigerant

	Tools - Adjustable wrench, allen key set, screwdriver set, fin comb, spanner set, plier, wire stripper, crimping tool and cylinder valve opener Instrument - Manifold gauge, weighing scale and clamp on meter/multimeter Equipment - Recovery machine, vacuum pump, hand blower, ladder, high pressure washer gun and AC unit PPE - Safety gloves, safety boots, welding goggles, workshop dress and mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice with project-based learning - Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: - Practical demonstration/observation - Case study - Oral/viva-voce - Written test - Assignment - Project work - Rubrics

Module 3
on
Carrying out Water and Sanitary Services

MODULE INFORMATION

Occupation	Facility Management Technologist
Competency Area	Carry out Water and Sanitary services
Module Title	Carrying out Water and Sanitary services
Module Code	7119- L4-M3
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to install piping system, internal pipes & fittings, external pipes & fittings, water pump & storage, sanitary fixtures & fittings and laying soil & waste pipelines and servicing water, sanitary fittings & fixtures.
Nominal Duration	338 Hours
Certificate Level	Diploma
Pre-requisite	Completed Module 2
Learning Outcome	1.Install piping system 2.Perform pipe jointing 3.Install internal pipes & fittings 4.Install external pipes & fittings 5.Install water pump and storage 6.Install sanitary fixtures and fittings 7.Lay soil and waste pipelines 8.Service water, sanitary fittings and fixtures

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M3		
Learning Outcome 1	Install piping system		
Duration	Theory: 5 hours	Practical:15 hours	Total: 20 hours
Assessment Criteria	- Materials are estimated as per the job requirement following standard procedure - Pipes are cut as per the job requirement following standard procedure - Pipes are reamed as per the job requirement following standard procedure		
Contents	C1.01 Estimating materials Knowledge - Introduction to pipes - Types & sizes of pipes and their uses - Types & sizes of fittings and their uses - Advantages and disadvantages of different pipes - Importance of estimating and costing - Methods of estimation - Types of data required to estimate materials - Difference between detailed estimate and abstract of estimate Skills - Interpreting drawing - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C1.02 Cutting pipes Knowledge - Types of marking tools - Types of cutting tools - Part of cutting tools - Importance of body position while cutting pipe - Purpose of applying lubricant - Types of vice and their usage - Purpose of setting hacksaw blade in forward direction Skills - Hacksaw setting skills - Observation skills - Using pipe cutter Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity		

	• Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C1.03 Reaming pipe Knowledge • Purpose of reaming • Importance of checking the thickness of reamer • Types of reamers • Parts of reamer • Types of files and their uses Skills • Using file • Using reamer • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, pipe, fittings, drawing, BSR, hacksaw frame, hacksaw blade, lubricants and brush Tools • Scale, calculator, pipe cutter, marker, measuring tape, reamer, file, oil can, ratchet die set and spanner Equipment • Threading machine and pipe vice

	PPE • Safety gloves, safety boots, welding goggles, workshop dress and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M3		
Learning Outcome 2	Performing pipe jointing		
Duration	Theory: 12 hours	Practical: 24 hours	Total: 36 hours
Assessment Criteria	- CPVC pipe joint is performed as per job requirement following standard procedures - PPR pipe joint is performed as per the job requirement following standard procedure - PEX pipe joint is performed as per the job requirement following standard procedure - Copper pipe joint is performed as per the job requirement following standard procedure - HDPE pipe joint is performed as per the job requirement following standard procedure - PVC pipe joint is performed as per the job requirement following standard procedure		
Contents	C2.01 Performing CPVC pipe joint Knowledge - Types of pipe - Definition of CPVC pipe - Types of jointing compound used for CPVC pipe - Consequences of applying inadequate quantity of adhesive cement - Characteristics of CPVC pipe - Advantages and disadvantages of CPVC pipe - Importance of standard Dimension Ratio - Importance of pressure and temperature rating in CPVC Skills - Observation skills - Using pipe cutter - Using jointing compound - Using reamer Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C2.02 Performing PPR pipe joint Knowledge - Definition of PPR pipe - Sizes of PPR pipe and fittings - Advantages and disadvantages of using PPR pipe - Importance of maintaining heating temperature of PPR welding machine - Application of PPR pipes		

	Skills • Using PPR welding machine • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.03 Performing PEX pipe joint Knowledge • Definition of PEX pipe • Sizes of PEX pipe & fittings • Classes of PEX pipe • Advantages and disadvantages of PEX pipe • Application of PEX pipe Skills • Using crimping tools • Using expander • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.04 Performing copper pipe joint Knowledge • Definition of copper pipe • Advantages and disadvantages of copper pipe • Application of copper pipe • Types of copper pipes and their joints • Standard sizes and length of copper pipe Skills • Using soldering torch • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity
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	• Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.05 Performing HDPE pipe joint <i>Knowledge</i> • Introduction to HDPE • Types of HDPE pipes joint • Advantages and disadvantages of HDPE pipes • Importance of cleaning the heating plate prior to jointing • Importance of maintaining the correct temperature of the heating plate • Application of HDPE pipe • Standard length and sizes of HDPE pipes • Pressure unit of HDPE pipe <i>Skills</i> • Using heating plate • Observation skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C2.06 Performing PVC pipe joint <i>Knowledge</i> • Standard length and sizes of PVC pipe • Pros and cons of PVC pipe • Importance of rubber ring seal <i>Skills</i> • Using PVC pipe cutter • Observation skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
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Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, brush, rag/markin clothes, CPVC glue, marker, CVPC pipe & fitting, sand paper, PEX pipes & fittings, PPR pipes & fittings, thinning flux, copper pipes & fittings, washers, HDPE pipes & fittings, PVC pipes & fittings, lubricant and gasket Tools • Pipe cutter, reamer, measuring tape, expander, crimping tools, soldering torch, steel wire brush, punching tools, hammer, adjustable wrench, solvent, knife, PVC pipe cutter, file, hacksaw and lever puller PPE • Safety gloves, safety boots, welding goggles, workshop dress and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work • Rubrics

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M4		
Learning Outcome 3	Installing internal pipes and fittings		
Duration	Theory: 12 hours	Practical: 36 hours	Total: 48 hours
Assessment Criteria	- Layout is prepared as per job requirement following standard procedures - Channel is cut as per the job requirement following standard procedure - Waterproofing is applied as per the job requirement following standard procedure - Pipe is laid as per the job requirement following standard procedure - Diverter is installed as per the job requirement following standard procedure - Clamp is fixed as per the job requirement following standard procedure - Pressure test is performed as per the job requirement following standard procedure		
Contents	C3.01 Preparing layout Knowledge - Types of layout tools - Importance of layout - Importance of checking alignment - Importance of checking power cables before preparing layout Skills - Using laser level - Observation skills - Interpreting drawing Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C3.02 Cutting channel Knowledge - Purpose of channeling - Methods of cutting channel - Consequences of irregular cutting of the channel - Sizes of channeling Skills - Using angle grinder - Using tile cutter - Observation skills - Interpreting drawing Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment		

	• Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.03 Applying water proofing Knowledge • Definition of waterproofing • Types of waterproofing • Methods of waterproofing • Mixing ratio Skills • Using drilling machine • Observation skills • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.04 Laying pipe Knowledge • Methods of laying pipe • Purpose of laying hot and cold-water pipeline in parallel • Importance of trail fitting • Consequences of improper laying of pipe • Significance of installing hot water pipeline on the left-hand side Skills • Interpreting drawing • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.05 Installing diverter Knowledge • Definition of the diverter
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	• Parts of the diverter • Advantages and limitations of using a diverter • Difference between concealed stop cock and diverter • Types of diverters • Standard height of diverter • Importance of pressure balancing mechanisms adjustment in the diverter Skills • Using pipe wrench • Observation skills • Interpreting drawing • Using pipe cutter Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.06 Fixing clamp Knowledge • Definition of clamp and dowel • Types of clamps and dowels • Purpose of fixing clamp • Applications of clamp Skills • Using drilling machine • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C3.07 Conducting pressure test Knowledge • Methods of checking pressure • Importance of testing leakage • Importance of removing air from the test line Skills • Using hydrostatic test pump • Observation skills
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, mason thread, chalk, nails, chalk line, drawing, marker, screw, dowel, clamp, pipes & fitting, jointing compound, binding wire, male adapter, elbow, thread seal tape, diverter set, jug and bucket Tools • Spirit level, water level, measuring tape, hammer, chisel, knife, screw driver set, hacksaw, wrench, file, pipe cutter and pipe wrench Equipment • Laser level, angle grinder, tile cutter, drilling machine and hydrostatic test pump PPE • Safety gloves, safety boots, welding goggles, workshop dress and mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-Diploma-M3		
Learning Outcome 4	Installing external pipes and fittings		
Duration	Theory: 13 hours	Practical:35 hours	Total: 48 hours
Assessment Criteria	- Layout is prepared as per job requirement following standard procedures - Trenching is performed as per the job requirement following standard procedure - Bedding is performed as per the job requirement following standard procedure - Pipe is laid as per the job requirement following standard procedure - Valves are fixed as per the job requirement following standard procedure - Water meter is fixed as per the job requirement following standard procedure - Leak test is conducted as per the job requirement following standard procedure - Pipe is insulated as per the job requirement following standard procedure - Backfilling is performed as per the job requirement following standard procedure		
Contents	C4.01 Preparing layout Knowledge - Importance of checking alignment - Method of layout - Importance of checking power cable before preparing layout Skills - Observation skills - Interpreting drawing Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C4.02 Performing trenching Knowledge - Purpose of trenching - Method of trenching - Calculation on gradient and slopes Skills - Using spirit level - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste		

	• Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C4.03 Performing bedding Knowledge • Definition of bedding • Purpose of bedding • Types of bedding • Materials used for bedding • Types of ramming tools Skills • Using spirit level • Observation skills • Using soil compactor Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C4.04 Laying pipe Knowledge • Difference between direct and indirect water supply system • Types of distribution system • Purpose of support • Importance of pipe alignment • Importance of insulating pipe Skills • Using heating plate • Interpreting drawing • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C4.05 Fixing valve Knowledge • Definition of valves • Types of valves and their function
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	• Parts of valve • Purpose of fixing valve Skills • Observation skills • Using heating plate Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C4.06 Conducting leak test Knowledge • Importance of testing leakage • Methods of testing leakage Skills • Using leakage detector • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C4.07 Performing back filling Knowledge • Selection of materials for backfilling • Purpose of backfilling • Importance of compaction Skills • Using soil compactor • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	• Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, pegs, mason thread, drawing, nail, fine aggregate, water, soil/sand, pipes & fittings, jointing compound, thread seal tape, jute, zinc, valves, Teflon tape, insulating materials, cable tie, binding wire and fine soil/sand Tools • Measuring tape, try square, hammer, spade, knife, shovel, crowbar, pick axe, mallet, spirit level/water level, reamer, wrench, screw driver set, ratchet die set, pipe cutter, plier, binding hook and mud rammer Equipment • Soil compactor, manual heating plate and pipe vice PPE • Safety gloves, safety boots, welding goggles, workshop dress and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M3		
Learning Outcome 5	Install water pump and storage		
Duration	Theory: 5 hours	Practical:10 hours	Total: 15 hours
Assessment Criteria	- Pump and accessories are installed as per the job requirement following standard procedure - Pump is tested as per the job requirement following standard procedure - Tank component is fixed as per the job requirement following standard procedure		
Contents	C5.01 Installing pump and accessories Knowledge - Definition of water pump - Types of water pumps and their specifications - Parts & function of pump - Working principle of pumps - Advantages and disadvantages of pumps - Purpose of using check/foot valve - Dos and don'ts while installing a pump Skills - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C5.02 Testing pump Knowledge - Priming and its importance - Discharge calculation - Common problems in pump Skills - Interpreting manuals and catalogue - Observation skills - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations		

	- Ensuring to follow OHS rules and regulation C5.03 Install tank components Knowledge - Definition of storage tank - Types of storage tank - Components of storage tank and their function - Working principle of float valve - Calculation of water storage tank Skills - Observation skills - Using drilling machine Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials - CBLM - Hand-outs - Audio-visuals - Reference books - Manuals Learning facilities and infrastructures - Classroom with adequate facilities - Library - IT lab - Workshop Materials - Pen and paper, pegs, nuts & bolts, valves, pipes & fittings, jute, thread seal tape, zinc paste, hole saw cutter set, storage tank, tank nipple, valve, Tee, elbow, union, bucket, jug, soap, M seal and gasket tank nipple Tools - Wrench, screw driver set, hammer, plier, reamer and saw cut set Equipment - Water pump and drilling machine PPE - Safety gloves, safety boots, welding goggles, workshop dress and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration

	• Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M3		
Learning Outcome 6	Install sanitary fixtures and fittings		
Duration	Theory: 31 hours	Practical: 76 hours	Total: 107 hours
Assessment Criteria	- Layout is prepared as per the job requirement following standard procedure - Wash basin with sensor is installed as per the job requirement following standard procedure - Basin mixer is fixed as per the job requirement following standard procedure - Bottle trap is fixed as per the job requirement following standard procedure - European water closet pan is installed as per the job requirement following standard procedure - Asian water closet pan is installed as per the job requirement following standard procedure - Cistern is fixed as per the job requirement following standard procedure - Automatic urinal is installed as per the job requirement following standard procedure - Kitchen sink is fixed as per the job requirement following standard procedure - Sink mixer is fixed as per the job requirement following standard procedure - Bidet is installed as per the job requirement following standard procedure - Bath tub is installed as per the job requirement following standard procedure - Wall mixer is fixed as per the job requirement following standard procedure - CP fitting is fixed as per the job requirement following standard procedure - Cubical shower is installed as per the job requirement following standard procedure - Bathroom accessories are fixed as per the job requirement following standard procedure - Geyser is fixed as per the job requirement following standard procedure		
Contents	C6.01 Preparing layout Knowledge - Definition of sanitary fixture and fittings - Types of sanitary fixtures and fitting - Usages of sanitary fixtures and fittings - Importance of preparing layout Skills - Interpreting drawing - Observation skills - Numeracy skills - Using laser level Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation		

	C6.02 Installing wash basin with sensor Knowledge • Introduction to wash basin • Types of wash basin • Standard size of wash basin • Components of wash basin • Advantages and disadvantages of using a sensor • Types of sensor Skills • Observation skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.03 Fixing basin mixer Knowledge • Types of basin mixer • Parts of basin mixer • Purpose of basin mixer • Types and lengths of connection pipe • Sizes of connection pipe Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.04 Fixing bottle trap Knowledge • Definition of bottle trap • Types of bottle trap • Parts of bottle trap • Purpose of bottle trap
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	Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.05 Installing European water closet pan Knowledge • Definition of Water Closet (WC) • Types of European WC pan • Standard sizes of WC pan • Advantages and disadvantages of European WC pan Skills • Observation skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.06 Installing Asian water closet pan Knowledge • Types of Asian WC plan • Importance of providing bedding • Types of trap and their usage • Purpose of applying mortar/adhesive around the joints • Standard sizes of Asian WC pan • Differences between European WC pan and Asian WC pan Skills • Observation skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient
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	• Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.07 Fixing cistern Knowledge • Working principle of Cistern • Types of cisterns and their specification • Components of cistern and their usage Skills • Observation skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.08 Installing automatic urinal Knowledge • Importance of installing urinal sensor • Purpose of solenoid valve • Types of battery used in urinal sensor • Standard detection range of urinal sensor • Standard water discharge volumes • Purpose of air break in urinal sensor Skills • Observation skills • Interpreting drawing • Using drilling machine • Numeracy skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation C6.09 Fixing kitchen sink Knowledge - Definition of sink - Types of sink - Components of the sink - Purpose of sink - Standard sizes of sink Skills - Observation skills - Interpreting drawing Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C6.10 Fixing sink mixer Knowledge - Definition of sink mixer - Parts of sink mixer - Types of sink mixer - Purpose of sink mixer - Standard sizes of sink mixer - Importance of color code on the mixer Skills - Observation skills - Using drilling machine Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C6.11 Installing bidet Knowledge - Definition of bidet - Types of bidet and its component - Importance of drawing contour line before installation - Standard dimension of bidet
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	Skills • Observation skills • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.12 Installing bathtub Knowledge • Definition of bathtub • Types of bathtubs • Components of bathtub and their usage • Importance of using dry sand • Purpose of Jacuzzi • Difference between bathtub and jacuzzi Skills • Observation skills • Analytical skills • Interpreting drawing • Using drilling machine Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.13 Fixing wall mixer Knowledge • Definition of wall mixer • Types of wall mixers • Parts of wall mixer • Purpose of wall mixer • Importance of trail fitting Skills • Observation skills • Using angle grinder • Analytical skills
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.14 Fixing CP fittings <i>Knowledge</i> • Definition of bib cock, angle valve, shower head, and concealed stop cock • Types and purpose of bib cock, angle valve, and concealed stop cock • Parts of Bib cock, Angle Valve and Concealed stop cock <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C6.15 Installing cubical shower <i>Knowledge</i> • Definition of Cubical shower • Types of Cubical shower • Purpose of Cubical shower • Components of cubical shower • Standard dimension of cubical shower <i>Skills</i> • Observation skills • Analytical skills • Interpreting catalogue <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations
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	- Ensuring to follow OHS rules and regulation C6.16 Fixing bathroom accessories Knowledge - Types of bathroom accessories and their uses - Standard dimension of bathroom accessories Skills - Observation skills - Using drilling machine - Interpreting catalogue Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C6.17 Fixing geyser Knowledge - Type of geysers - Standard dimension for installing Geyser - Working principle of geyser - Components of geyser Skills - Observation skills - Using drilling machine - Interpreting drawing Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulations
Learning Conditions	Learning materials - CBLM - Hand-outs - Audio-visuals - Reference books - Manuals Learning facilities and infrastructures - Classroom with adequate facilities - Library

	• IT lab • Workshop Materials • Pen, pencil, notebook, sanitary fixtures, drawing, chalk line, mason thread, teflon tape, basin sensor, connection pipe, waste coupling, hose pipe, basin mixer set, bottle trap, M seal, white cement, hacksaw blade, WC pan, sand, gravel, screw, adhesive, dowel, traps, bricks, cistern, bracket, drill bit, urinal pot, urinal sensor, kitchen sink, sink mixer, bidet components, fine dry sand, brick, cement, bath tub, fittings, pipes, silicon sealant, wall mixer set, grinder blade, bib cock, valve, concealed stop cock, cubical set, TP holder, soap tray, towel rail, glass shelf, mirror, brush holder, soap dispenser, anchor bolt and geyser set Tools • Measuring tape, water level/spirit level, pipe wrench, screwdriver set, plier, hammer, spade, trowel, wooden float, cable drum and chisel Equipment • Laser level, drilling machine, bath tub and angle grinder PPE • Safety gloves, safety boots, welding goggles, workshop dress and mouth mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M4		
Learning Outcome 7	Lay soil and waste pipelines		
Duration	Theory: 4 hours	Practical: 9 hours	Total: 13 hours
Assessment Criteria	- Layout is prepared as per the job requirement following standard procedure - Pipe (stack) is laid as per the job requirement following standard procedure - Inspection chamber is connected as per the job requirement following standard procedure		
Contents	C7.01 Preparing layout Knowledge - Types of soil and waste pipes and fittings - Importance of checking alignment - Types of marking tools and materials - Types of layouts and their importance Skills - Observation skills - Using spirit level Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C7.02 Laying pipes (stack) Knowledge - Definition of stacks - Types of stacks and their application - Purpose of providing ventilation - Calculation of sewerage value - Sizes of soil and waste pipeline - Importance of aligning pipeline - Importance of maintaining the gradients Skills - Observation skills - Using drilling machine - Using spirit level - Numeracy skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE		

	• Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C7.03 Connecting inspection chamber Knowledge • Types of inspection chambers and their application • Importance of maintaining gradient/slope in outlet and inlet • Location of inspection chamber • Purpose of benching Skills • Observation skills • Analytical skills • Using spirit level Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, notebook, pipes & fittings, drawing, BSR, mason thread, marker, chalk line, clamp, drill bit, nail, hacksaw blade, binding wire, dowel, screw, jointing compound and inspection chamber Tools • Spirit level, ladder, screwdriver set, hacksaw frame, hammer, spade, shovel, trowel and measuring tape Equipment • Drilling machine PPE • Safety gloves, safety boots, welding goggles, workshop dress and mask

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Water and Sanitary services		
Module Code	7119-L4-M3		
Learning Outcome 8	Servicing water, sanitary fittings and fixtures		
Duration	Theory: 17 hours	Practical: 29 hours	Total: 46 hours
Assessment Criteria	- Blockage is cleared as per the job requirement following standard procedure - Leakage is fixed as per the job requirement following standard procedure - Valve is serviced as per the job requirement following standard procedure - CP fittings are serviced as per the job requirement following standard procedure - CP mixer is serviced as per the job requirement following standard procedure - Cistern is serviced as per the job requirement following standard procedure - Pump is serviced as per the job requirement following standard procedure - Tank is serviced as per the job requirement following standard procedure - Record is maintained as per the job requirement following standard procedure		
Contents	C8.01 Clearing blockage Knowledge - Types of pipeline faults - Importance of checking pipeline fault - Causes and remedies of pipeline fault - Importance of checking pipeline blockage - Causes and remedies of pipeline blockage - Importance of cutting off supply line before clearing the blockage - Types of blocks clearing tools Skills - Observation skills - Numeracy skills - Analytical skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensure to follow environmental rules and regulations - Ensuring to follow OHS rules and regulation C8.02 Fixing leakage Knowledge - Causes and remedies of leakages Skills - Observation skills - Analytical skills Attitude, safety and environmental concern - Being efficient in using resources - Being vigilant and patient - Having work ethics and integrity - Proper handling of tools, materials and equipment - Having sense of ownership and accountability		

	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.03 Servicing valve Knowledge • Importance of servicing valve • Purpose of applying lubricant to the parts of the valve • Importance of inspecting the internal parts of valve • Causes and the remedies of valve failure Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.04 Servicing Chrome Plated (CP) fittings Knowledge • Purpose of using CP fittings in the hot water pipeline • Causes and remedies of faulty CP fittings Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.05 Servicing CP mixer Knowledge • Importance of regular servicing of CP mixer • Types of tools used for servicing CP mixer • Causes and remedies of faulty CP mixer Skills • Observation skills • Analytical skills
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	<i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.06 Servicing cistern <i>Knowledge</i> • Causes and remedies of faulty cistern <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.07 Servicing pump <i>Knowledge</i> • Causes and remedies of faulty water pump <i>Skills</i> • Observation skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation C8.08 Servicing tank <i>Knowledge</i> • Purpose of inspecting the tank components • Importance of tank servicing • Importance of disinfecting water tank • Cause and remedies of defects in water tank
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	Skills • Observation skills • Analytical skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Proper handling of tools, materials and equipment • Having sense of ownership and accountability • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure to follow environmental rules and regulations • Ensuring to follow OHS rules and regulation
Learning Conditions	Learning materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Materials • Pen and paper, notebook, markin clothes, pipes & fittings, plumber putty, brush, thread seal tape, lubricant, gaskets, O-rings, washers, aerators, rubber washer, oil, valve, seal, scrub brushes or sponges and non-toxic cleaning agent or mild detergent Tools • Wrench, plunger, screwdriver set, pipe cutter, hacksaw, allen key set, plier, auger snake and bucket/container Equipment • Water testing kit and ladder PPE • Safety gloves, safety boots, welding goggles, workshop dress and mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Case study

	• Oral/viva-voce • Written test • Assignment • Project work
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Module 4
on
Carrying out Installation and Servicing of Fire Safety and Protection System

MODULE INFORMATION

Occupation	Facility Management Technologist
Competency Area	Carry out Installation and Servicing of Fire Safety and Protection System
Module Title	Carrying out Installation and Servicing of Fire Safety and Protection System
Module Code	7119- L4-M4
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to install fire alarm & detection system, install fire hydrant system and servicing fire suppression system.
Nominal Duration	114 Hours
Certificate Level	Diploma
Pre-requisite	Completed Module 3
Learning Outcome	1.Install fire alarm and detection system 2.Install fire suppression system 3.Service fire suppression system

Module Title	Carrying out Installation and Servicing of Fire Safety and Protection System		
Module Code	7119- L4-M4		
Learning Outcome 1	Install fire alarm and detection system		
Duration	Theory:8 hours	Practical:16 hours	Total: 24 hours
Assessment Criteria	• Fire detector is installed as per the job requirement following standard procedure • Manual call point is installed as per the job requirement following standard procedure • Audible and visual sounder are installed per the job requirement following standard procedure • Alarm panels are installed is used as per the job requirement following standard procedure		
Content	D1.01 Installing fire detector Knowledge • Introduction to fire safety (Fire triangle) • Causes of fire • Classification of fire • Purpose of fire detector • Operation of fire detector • Classification of fire detector • Fire signage Skills • Interpreting drawing • Using drilling machine • Observation skills Attitude, safety and environmental concern • Effective time management • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D1.02 Installing manual call point Knowledge • Purpose of manual call point • Types of manual call point • Operation of manual call point Skills • Interpreting drawing • Using drilling machine • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation		

	D1.03 Installing audio and visual sounder Knowledge • Purpose of audio and visual sounder • Types of audio and visual sounder • Features and specification • Operation of audio and visual sounder Skills • Using drilling machine • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D1.04 Installing alarm panel Knowledge • Purpose of alarm panel • Types of alarm panel • Operation of alarm panel Skills • Using drilling machine • Observation skills Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, notebook, fire detector, communication cable, manual call point, audio & visual sounder, mounting bracket, screw, drill bit and wire Tools • Electrical hand tool set Equipment • Alarm panel, ladder and drilling machine

	PPE • Safety boots, safety gloves, safety helmet, ear muff, safety goggles, insulation gloves, respiratory mask, mask and workshop dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Fire Safety and Protection System		
Module Code	7119- Diploma-M4		
Learning Outcome 2	Install fire suppression system		
Duration	Theory:19 hours	Practical:47 hours	Total: 66 hours
Assessment Criteria	- Layout is prepared as per the job requirement following standard procedure - Fire hydrant is installed as per the job requirement following standard procedure - Water tank is installed as per the job requirement following standard procedure - Jockey pump is installed as per the job requirement following standard procedure - Hose reel system is installed per the job requirement following standard procedure - Riser is installed is used as per the job requirement following standard procedure - Fire extinguisher is used as per the job requirement following standard procedure		
Content	D2.01 Preparing layout Knowledge - Introduction to fire suppression system - Components of fire suppression system and its function Skills - Interpreting drawing - Observation skills Attitude, safety and environmental concern - Effective time management - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation D2.02 Installing water tank Knowledge - Capacity of tank Skills - Using drilling machine - Observation skills Attitude, safety and environmental concern - Effective time management - Being efficient in using resources - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation D2.03 Installing jockey pump Knowledge - Definition of jockey pump - Working principle of jockey pump - Components of jockey pump and its function		

	Skills • Using drilling machine • Observation skills • Using plumbing tools Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D2.04 Installing fire hydrant Knowledge • Introduction to fire hydrant system • Operation of fire hydrant • Types of fire hydrant • Components of fire hydrant Skills • Using drilling machine • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D2.05 Installing hose reel system Knowledge • Introduction to hose reel system • Purpose of hose reel • Components of hose reel • Application of hose reel Skills • Interpreting drawing • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D2.06 Installing riser Knowledge • Introduction to riser system • Components of riser system and sprinkler system • Types of riser and sprinkler system • Purpose of sprinkler system • Purpose of gauges and valves
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	Skills • Using drilling machine • Observation skills • Interpreting drawing Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D2.07 Using fire extinguisher Knowledge • Classification of fire • Methods of fire extinguishment • Components of fire extinguisher • Working principle of fire extinguisher • Types of fire extinguisher • Requirements for installing fire extinguisher • Importance of routine maintenance of fire extinguisher • Emergency contact numbers Skills • Observation skills • Interpreting manual Attitude, safety and environmental concern • Being efficient in using resources • Being vigilant and patient • Having work ethics and integrity • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, paper, notebook, marker, pipe, collecting breeching, dividing breeching, hose pipe, suction hose, lever, cement, sand, aggregate, seal & gasket, paint, paint brush, teflon tape, jointing compounds, welding rod, nozzle, branch pipe, hose reel, bracket, screw, dowel, gate valve, clamp, sprinkler head, drain valve, control valve and sealant

	Tools • Spade, shovel, trowel, chain wrench, pipe wrench, hydrant wrench, hacksaw, ratchet die set, measuring tape, pipe cutter, screwdriver set, hammer and spanner set Instrument • Flow meter and pressure gauge Equipment • Computer, welding machine, drilling machine, tank, circular saw, jockey pump and fire extinguisher PPE • Safety boots, safety gloves, safety helmet, ear muff, safety goggles, insulation gloves, respiratory mask, dust mask and workshop dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Installation and Servicing of Fire Safety and Protection System		
Module Code	7119- L4-M4		
Learning Outcome 3	Service fire suppression system		
Duration	Theory:6 hours	Practical:18 hours	Total: 24 hours
Assessment Criteria	• Detection system is serviced as per the job requirement following standard procedure • Hydrant system is serviced as per the job requirement following standard procedure • Fire extinguisher is serviced per the job requirement following standard procedure		
Content	D3.01 Servicing detection system Knowledge • Common faults and remedies in detection system • Importance of routine maintenance • Importance of testing functionality Skills • Observation skills Attitude, safety and environmental concern • Effective time management • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D3.02 Servicing hydrant system Knowledge • Common faults and remedies in hydrant system • Importance of maintaining documentation Skills • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation D3.03 Servicing fire extinguisher Knowledge • Importance of servicing extinguisher • Importance of updating service log book Skills • Interpreting drawing • Observation skills Attitude, safety and environmental concern • Effective time management • Being efficient in using resources • Ensuring appropriate use of PPE • Ensuring proper disposal of waste		

	Ensuring to follow OHS rules and regulation
Learning Conditions	Learning Materials - Competency Based Learning Materials (CBLM) - Hand-outs - Audio Visuals - Reference books - Manuals Learning facilities and infrastructure - Classroom with adequate facilities - Information Technology (IT) lab - Library - Workshop Materials - Pen, paper, notebook, marker, detector, audio & visual sounder, wires and sprinklers PPE - Safety boots, safety gloves, safety helmet, ear muff, safety goggles, insulation gloves, respiratory mask and workshop dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial visit/training - Guided practice - Group practice with project-based learning - Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: - Practical observation - Oral/viva-voce - Written test - Assignment - Project work

Module 5
on
Carrying out Integration and Monitoring of control systems in Building
Management System (BMS)

MODULE INFORMATION

Occupation	Facility Management Technologist
Competency Area	Carry out Integration and Monitoring of Control Systems in Building Management System (BMS)
Module Title	Carrying out Integration and Monitoring of Control Systems in Building Management System (BMS)
Module Code	7119-L4-M5
Module Description	This module is structured to provide learners with the knowledge, skills and right attitude required to monitor Building Management System (BMS), interpret, perform wellness check and troubleshoot various types of control systems linked to BMS
Nominal Duration	206 Hours
Certificate Level	Diploma
Pre-requisite	Completed 7119-Diploma-M4
Learning Outcome	1. Perform installation of PLC 2. Integrate various types of control systems linked to Building Management system (BMS) 3. Perform monitoring of Building Management System (BMS) 4. Perform Building Management system (BMS) wellness check

Module Title	Carrying out Integration and Monitoring of Control Systems in Building Management System (BMS)		
Module Code	7411-L4-M5		
Learning Outcome 1	Perform installation of PLC		
Duration	Theory: 12 hours	Practical: 45 hours	Total: 57 hours
Assessment Criteria	• PLC hardware is installed as per standard procedures • PLC unit is connected with input and output device as per the standard procedures • Connection of PLC module with input and output device is tested as per standard procedures • PLC software is installed as per the standard procedures • Communication between PLC and programmer is established as per standard procedure		
Contents	E1.01 Installing PLC software Knowledge • Introduction to PLC • History of PLC • Types of PLC's • Advantages & disadvantages of PLC • Application of PLC • PLC Architecture • Scan cycle • Memory mapping of PLC • CPU specifications • Introduction to PLC Software's • Operating System and Hardware Requirements Skills • ICT skills • Using PLC software • Communication skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste E1.02 Perform programming of PLC Knowledge • Numbering system • Logic gates and its applications • Operation of limit switch and sensor • Types of PLC programming language • Types of relay Skills • ICT skills • Using PLC software • Communication skills		

	<i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste E1.03 Installing PLC hardware <i>Knowledge</i> • Components of PLC and its functions <i>Skills</i> • ICT skills • Using Multimeter • Communication skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste E1.04 Connecting PLC unit with input and output devices <i>Knowledge</i> • Types of I/O devices • Types of I/O modules • Types of sensors • Wiring of sensors with input module • Specification of I/O modules <i>Skills</i> • ICT skills • Using Multimeter • Communication skills <i>Attitude, safety and environmental concern</i> • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste E1.05 Establishing communication between PLC and Programmer (PC) <i>Knowledge</i> • Types of communication system • Communication parameters <i>Skills</i>
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	• Using PLC software • ICT skills • Communication skills • Control wiring skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling and storage of tools, materials and equipment • Ensuring appropriate use of PPE • Ensuring to follow OHS rules and regulations • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • CBLM • Hand-outs • Audio-visuals • Reference books • Manuals Learning Facilities and Infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Materials • wires, screw, communication cable, MCB, push button, limit switch, sensor, wooden board, push button box, contactor, indicator lamp, indicator box, din rail, fuse, terminal block and relay Tools • Pliers, wire stripper, screwdriver set, Allen key set and electrician knife Instrument • Multimeter Software • PLC software Equipment • PLC CPU, Switching Mode Power Supply (SMPS) and Computer set PPE • Safety gloves, safety boots, safety helmet, safety goggles, workshop dress and mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning

Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work
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Module Title	Carrying out Integration and Monitoring of Control Systems in Building Management System (BMS)		
Module Code	7119- L4-M5		
Learning Outcome 2	Integrate various types of control systems linked to Building Management system (BMS)		
Duration	Theory: 22 hours	Practical:24 hours	Total: 46 hours
Assessment Criteria	• BMS schematic layout diagram is interpreted following standard procedure • Energy management system is interpreted following standard procedure • Lighting control system is interpreted following standard procedure • HVAC control system is interpreted following standard procedure • Security and surveillance system is interpreted following standard procedures • Fire safety and protection system is interpreted following standard procedures • Public Addressing (PA) system is interpreted following standard procedures		
Content	E2.00 Introduction to BMS Knowledge • Introduction to Building Management System (BMS) • System architecture and configuration of BMS • Components of BMS • Function of BMS • Benefits of using BMS E2.01 Interpreting BMS schematic layout diagram Knowledge • Definition of controllers/sensors/actuators used in BMS • Working of controllers/sensors/actuators used in BMS • Types of controllers/sensors/actuators used in BMS • Types of communication cable • Basic BMS Communication protocol Skills • Observation skills • Numeracy skills • Basic ICT skills • Interpreting circuit diagram Attitude, safety and environmental concern • Effective time management • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation E2.02 Integrating lighting control system Knowledge • Components of lighting control system and its functions • Illuminance required based on type of occupancy • Working of lighting actuator Skills • Observation skills • Numeracy skills • Basic ICT skills • Interpreting schematic diagram		

	• Using of multimeter <i>Attitude, safety and environmental concern</i> • Effective time management • Proper handling of tools, equipment & lighting control system • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E2.03 Integrating AC control system <i>Knowledge</i> • Working of AC control system • Components of AC control system and its functions • Types of AC control systems <i>Skills</i> • Observation skills • Analytical skills • Numeracy skills • ICT skills • Interpreting schematic diagram <i>Attitude, safety and environmental concern</i> • Effective time management • Proper handling of tools and equipment • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E2.04 Integrating security and surveillance system <i>Knowledge</i> • Components of security and surveillance system and its functions <i>Skills</i> • Observation skills • ICT skills • Interpreting schematic diagram <i>Attitude, safety and environmental concern</i> • Proper handling of tools and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	E2.05 Integrating Fire safety and protection system Knowledge • Working of fire safety and protection system Skills • Observation skills • Numeracy skills • ICT skills • Interpreting schematic diagram Attitude, safety and environmental concern • Proper handling of tools and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E2.07 Integrating Public Addressing (PA) system Knowledge • Working of PA system • Components of PA system Skills • Observation skills • ICT skills • Interpreting schematic diagram Attitude, safety and environmental concern • Proper handling of tools and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, Pencil, checklist, wire, sensors, actuator, LAN cable, communication cable, connector and notebook

	Tools • Pliers, screw driver set, crimping tools, cable tester and wire stripper Instruments • Multi-meter and pressure gauge Equipment • Building Management System and components, Firefighting and suppression system, AC system, security and surveillance system and computer set/laptop PPE • Safety shoes, workshop dress, safety goggles, anti-static wrist band and safety gloves
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Integration and Monitoring of Control Systems in Building Management System (BMS)		
Module Code	7119- Diploma-M6		
Learning Outcome 3	Perform monitoring of Building Management System (BMS)		
Duration	Theory: 14 hours	Practical:34 hours	Total: 48 hours
Assessment Criteria	- Real-time parameters of Building management System (BMS) are monitored as per the job requirement following standard procedure - Real-time energy usage is monitored as per the job requirement following standard procedure - Readiness of fire alarm system is monitored per the job requirement following standard procedure - Efficiency of Heating, Ventilation and Air Conditioning (HVAC) system is monitored as per the job requirement following standard procedure - The functioning of security and surveillance system is monitored as per the job requirement following standard procedures		
Content	E3.01 Monitoring real-time parameters of Building Management System (BMS) Knowledge - Parameters of BMS - Common causes of malfunctioning of sensors and actuators - Importance of following market trends Skills - Observation skills - Numeracy skills - ICT skills - Using of multimeter Attitude, safety and environmental concern - Effective time management - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to follow OHS rules and regulation E3.02 Monitoring real-time energy usage and consumption Knowledge - Types of energy management system - Importance of monitoring energy usage and consumption Skills - Observation skills - Numeracy skills - ICT skills - Interpreting graphs Attitude, safety and environmental concern - Effective time management - Having integrity and work ethics - Efficient use of materials - Proper handling of instruments - Ensuring to follow OHS rules and regulation		

	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Proper handling of tools, equipment & BMS components E3.03 Monitoring fire alarm system <i>Knowledge</i> • Parameters related to firefighting and suppression system <i>Skills</i> • Observation skills • Numeracy skills • ICT skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Effective time management • Proper handling of tools, equipment & firefighting and suppression system • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E3.04 Monitoring efficiency of AC system <i>Knowledge</i> • Parameters of AC system <i>Skills</i> • Observation skills • Analytical skills • ICT skills • Numeracy skills • Using pressure gauge • Using multimeter <i>Attitude, safety and environmental concern</i> • Effective time management • Proper handling of tools, equipment, HVAC system & BMS components • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E3.05 Monitoring security and surveillance system <i>Knowledge</i> • Parameters related to security and surveillance system <i>Skills</i> • Observation skills • ICT skills • Analytical skills <i>Attitude, safety and environmental concern</i>
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	• Proper handling of tools, equipment & security and surveillance system components • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, Pencil and checklist Equipment • Computer equipped with BMS software PPE • Safety shoes and Workshop dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out Integration and Monitoring of Control Systems in Building Management System (BMS)		
Module Code	7119- L4-M6		
Learning Outcome 4	Perform Building Management System (BMS) wellness check		
Duration	Theory: 25 hours	Practical:30 hours	Total: 55 hours
Assessment Criteria	• Sensors/actuators/controllers are checked following standard procedure • Alarm and time programmes/status is checked following standard procedure • All cables and connectors are checked following the standard procedure • Cleanliness of BMS components is maintained following standard procedure • Operation of BMS output devices is checked following standard procedure • Functionality of system software is checked following standard procedure • System's operational controls are checked following the standard procedure		
Content	E4. 01 Checking sensors/actuators/controllers Knowledge • Purpose of checking sensors/actuators/controllers Skills • Observation skills • ICT skills Attitude, safety and environmental concern • Effective time management • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to follow OHS rules and regulation E4.02 Checking alarm and time programmes/status Knowledge • Types of alarm and its purpose • Status of alarm • Purpose of time programmes Skills • Observation skills • ICT skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Efficient use of materials • Proper handling of instruments • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Proper handling of tools and equipment E4.03 Checking cables and connectors Knowledge • Types of cables and its purpose • Types of connectors		

	Skills • Observation skills • Using crimping tool Attitude, safety and environmental concern • Effective time management • Proper handling of tools, equipment & materials • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E4.04 Maintaining cleanliness of BMS components Knowledge • Importance of cleaning BMS components Skills • Observation skills Attitude, safety and environmental concern • Effective time management • Proper handling of tools and equipment • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E4.05 Checking operation of BMS output devices Knowledge • Importance of checking operation of BMS output devices Skills • Observation skills • Numeracy skills • ICT skills • Using of multimeter Attitude, safety and environmental concern • Proper handling of tools and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E4.06 Checking functionality of system software Knowledge • Types of BMS software and its purpose • Features of BMS software • System backup and restore functionality
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	Skills • Observation skills • Numeracy skills • ICT skills Attitude, safety and environmental concern • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E4.07 Checking system's operational controls Knowledge • Importance of checking system's operational controls Skills • Observation skills • Numeracy skills • ICT skills • Using of multimeter Attitude, safety and environmental concern • Proper handling of tools and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste E4.08 Troubleshooting Building Management System Knowledge • Common faults and remedies of BMS Skills • Observation skills • ICT skills • Using of multimeter Attitude, safety and environmental concern • Proper handling of tools, materials and equipment • Effective time management • Having integrity and work ethics • Proper handling and storage of tools • Efficient use of materials • Ensuring to follow OHS rules and regulation • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning Materials • Competency Based Learning Materials (CBLM) • Hand-outs

	• Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Materials • Pen, Pencil, checklist, notebook, sensors, actuators, controllers, cables, connectors, markin cloth and disinfectant Tools • Pliers, screw driver set, pipe wrenches and wire stripper Instruments • Multi-meter and crimping tool Equipment • Building Management System and components, Firefighting and suppression system, AC system, security and surveillance system and computer set/laptop PPE • Safety shoes, workshop dress, safety goggles, anti-static wrist band and safety gloves
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial visit/training • Guided practice • Group practice with project-based learning • Individual practice with problem-based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical observation • Oral/viva-voce • Written test • Assignment • Project work

ANNEXES

Annex I: Time Distribution

Facility Management Technology Diploma					
Module	Learning outcomes	Tasks	Theory (hours)	Practical (hours)	Total (hours)
A. Perform electrical system services	A1: Apply basic electrical theory	A1.01 Verify characteristics of AC and DC	4	6	10
		A1.02 Measure resistance	2	3	5
		A1.03 Measure voltage	1	3	4
		A1.04 Measure current	1	3	4
		A1.05 Measure power	2	4	6
		A1.06 Measure energy	1	5	6
		A1.07 Measure frequency	0.5	1	1.5
	Sub Total		11.5	25	36.5
	A2: Verify DC circuit	A2.01 Verify ohms law	2	4	6
		A2.02 Verify characteristics of series circuit	2	4	6
		A2.03 Verify characteristics of parallel circuit	2	4	6
		A2.04 Verify characteristics of combined circuit	2	4	6
	Sub Total		8	16	24
	A3: Verify characteristics of AC circuit	A3.01 Check phase sequence (Three phase supply)	1	2	3
		A3.02 Verify characteristics of balanced load in star connection	4	4	8
		A3.03 Verify characteristics of unbalanced load in star connection	4	4	8
		A3.04 Verify characteristics of balanced load in delta connection	4	4	8
		A3.05 Verify characteristics of resistive load	4	4	8
		A3.06 Verify characteristics inductive load	4	4	8
		A3.07 Verify characteristics capacitive load	4	4	8
		A3.08 Verify characteristics of RL series circuit	4	4	8
		A3.09 Verify characteristics RC series circuit	4	4	8
		A3.10 Verify characteristics LC series circuit	4	4	8
		A3.11 Verify characteristics RLC series circuit	4	4	8
		A3.12 Verify characteristics RL parallel circuit	4	4	8
		A3.13 Verify characteristics RC parallel circuit	4	4	8
		A3.14 Verify characteristics LC parallel circuit	4	4	8
		A3.15 Verify characteristics RLC parallel circuit	4	4	8
	Sub Total		57	58	115
	A4: Apply basic electronic theory	A4.01 Verify characteristics of diode	8	6	14
		A4.02 Verify characteristics of Zener diode	2	6	8
		A4.03 Verify characteristics of transistor as a switch	3	6	9
		A4.04 Verify characteristics of transistor as an amplifier	3	6	9
		A4.05 Verify characteristics of half wave rectifier	2	6	8
		A4.06 Verify characteristics of full wave rectifier	2	6	8
		A4.07 Verify filter circuit	2	6	8
		A4.08 Verify characteristics of inverter	2	6	8

Sub Total		24	48	72
A5: Install electrical systems	A5.01 Prepare Tee joint	0.5	2	2.5
	A5.02 Prepare straight joint	0.5	2	2.5
	A5.03 Prepare Rat tail joint	0.5	2	2.5
	A5.04 Perform surface wiring for lighting and power circuit	3	18	21
	A5.05 Perform concealed wiring for lighting and power circuit	3	18	21
	A5.06 Perform distribution box wiring	4	8	12
	A5.07 Install earthing	2	12	14
	A5.08 Install building LA	1	12	13
	A5.09 Install surveillance system	3	12	15
	A5.10 Install security system	3	15	18
Sub Total		20.5	101	121.5
A6: Perform installation test	A6.01 Perform continuity test	1	3	4
	A6.02 Perform IR test	1	3	4
	A6.03 Perform polarity test	1	3	4
	A6.04 Perform soil resistivity test	1	5	6
	A6.05 Perform soil resistance test	1	3	4
Sub Total		5	17	22
A7: Service electrical systems	A7.01 Troubleshoot lighting circuits	2	10	12
	A7.02 Troubleshoot power circuits	2	10	12
	A7.03 Service earthing system	2	10	12
Sub Total		6	30	36
A8: Install solar PV system	A8.01 Install mounting structures	3	5	8
	A8.02 Install PV panel	3	5	8
	A8.03 Perform wiring of PV panel	3	5	8
	A8.04 Install DC distribution board	3	5	8
	A8.05 Install controller	3	5	8
	A8.06 Install battery	3	5	8
	A8.07 Install inverter	3	5	8
	A8.08 Install AC distribution board	3	5	8
	A8.09 Install energy meter (Bi-directional)	3	5	8
	A8.10 Commission PV system	4	4	8
Sub Total		31	49	80
A9: Service solar PV system	A9.01 Perform inspection of solar PV system	2	6	8
	A9.02 Service PV modules	2	6	8
	A9.03 Service battery	2	6	8
	A9.04 Service inverter/controller	2	6	8
	A9.05 Service protective devices	2	6	8
Sub Total		10	30	40
A10: Install backup power supply	A10.01 Install changeover switch	1	5	6
	A10.02 Install UPS	3	15	18
	A10.03 Install Generator set	3	15	18
Sub Total		7	35	42
A11: Service backup power supply	A11.01 Replace fuel filter	1	5	6
	A11.02 Change coolant	1	5	6
	A11.03 Replace air filter	1	3	4
	A11.06 Change engine oil	2	6	8
	A11.07 Clean fuel tank	1	6	7
	A11.08 Service UPS	1	5	6
Sub Total		7	30	37
A12: Set up Audio Visual system	A12.01 Perform wiring of audio system	3	9	12
	A12.02 Perform wiring of visual system	3	9	12
	A12.03 Test performance	4	4	8
Sub Total		10	22	32

	Total Duration (A)		197	461	658
B: Carryout servicing of air conditioni ng system	B1: Perform copper tubing works	B1.01 Perform tube cutting	1	3	4
		B1.02 Perform tube flaring	1	5	6
		B1.03 Perform tube swaging	1	5	6
		B1.04 Perform tube bending	1	5	6
		B1.05 Perform tube brazing	1	11	12
	Sub Total		5	29	34
	B2: Install Air Conditioner	B2.01 Prepare for installation of air conditioner	1	2	3
		B2.02 Install indoor unit	3	9	12
		B2.03 Install outdoor unit	3	9	12
		B2.04 Perform leak test	2	4	6
		B2.05 Perform vacuuming	1	5	6
		B2.06 Commission air conditioner	1	2	3
	Sub Total		11	31	42
	B3: Service Air conditioner	B3.01 Perform pump down/recovery	1	5	6
		B3.02 Service indoor unit	1	11	12
		B3.03 Service outdoor unit	1	11	12
		B3.04 Troubleshoot electrical faults	2	4	6
		B3.05 Troubleshoot mechanical fault	2	4	6
		B3.06 Charge refrigerant	2	4	6
	Sub Total		9	39	48
	Total Duration (B)		25	99	124
C: Carryout water and sanitation services	C1: Install piping system				0
		C1.02 Estimate materials	3	9	12
		C1.03 Cut pipes	1	3	4
		C1.04 Ream pipe	1	3	4
	Sub Total		5	15	20
	C2: Perform pipe jointing	C2.01 Perform CPVC pipe joint	2	4	6
		C2.02 Perform PPR pipe joint	2	4	6
		C2.03 Perform PEX pipe joint	2	4	6
		C2.04 Perform copper pipe joint	2	4	6
		C2.05 Perform HDPE pipe joint	2	4	6
		C2.06 Perform PVC pipe joint	2	4	6
	Sub Total		12	24	36
	C3: Install internal pipes and fittings	C3.01 Prepare layout	2	4	6
		C3.02 Cut channel	2	4	6
		C3.03 Apply water proofing	2	4	6
		C3.04 Lay pipes	2	4	6
		C3.05 Install diverter	2	10	12
		C3.06 Fix clamp	1	5	6
		C3.07 Conduct pressure test	1	5	6
	Sub Total		12	36	48
	C4: Install external pipes and fittings	C4.01 Prepare layout	2	4	6
		C4.02 Perform trenching	2	10	12
		C4.03 Perform bedding	2	10	12
		C4.04 Lay pipe	2	3	5
		C4.05 Fix valve	2	3	5
		C4.06 Conduct leak test	2	2	4
		C4.07 Perform back filling	1	3	4
	Sub Total		13	35	48
	C5: Install water pump and storage tank	C5.01 Install pump and accessories	2	4	6
		C5.02 Test pump	1	2	3
		C5.03 Fix tank components	2	4	6
	Sub Total		5	10	15

	C6: Install sanitary fixture and fittings	C6.01 Prepare layout	2	3	5
		C6.02 Install washbasin with sensor	2	4	6
		C6.03 Fix basin mixer	1	3	4
		C6.04 Fix bottle trap	1	3	4
		C6.05 Install European water closet pan	2	4	6
		C6.06 Install Asian water closet pan	1	5	6
		C6.07 Fix cistern	2	3	5
		C6.08 Install automatic urinal	2	4	6
		C6.09 Install kitchen sink	2	4	6
		C6.10 Fix sink mixer	1	3	4
		C6.11 Install bidet	2	3	5
		C6.12 Install bathtub	3	12	15
		C6.13 Fix wall mixer	2	2	4
		C6.14 Fix CP fittings	1	3	4
		C6.15 Install cubical shower	3	12	15
		C6.16 Fix bathroom accessories	2	4	6
		C6.17 Fix geyser	2	4	6
	Sub Total		31	76	107
	C7: Lay soil and waste pipelines	C7.01 Prepare layout	1	3	4
		C7.02 Lay pipes (stack)	1	3	4
		C7.03 Connect inspection chamber	2	3	5
		Sub Total	4	9	13
	C8: Service water, sanitary fittings and fixtures	C8.01 Clear blockage	2	4	6
		C8.02 Fix leakage	2	4	6
		C8.03 Service valve	3	3	6
		C8.04 Service CP fittings	2	3	5
		C8.05 Service CP mixers	2	3	5
		C8.06 Service cistern	2	4	6
		C8.07 Service pump	2	4	6
		C8.08 Service tank	2	4	6
	Sub Total		17	29	46
	Total Duration (C)		104	234	338
D: Carryout installatio n and servicing of fire safety and protectio n system	D1: Install fire alarm and detection system	D1.01 Install fire detector	2	4	6
		D1.02 Install manual call point	2	4	6
		D1.03 Install audible and visual sounders	2	4	6
		D1.04 Install alarm panels	2	4	6
		Sub Total	8	16	24
	D2: Install fire suppression system	D2.01 Prepare layout	3	3	6
		D2.02 Install tank	2	4	6
		D2.03 Install pump	2	4	6
		D2.04 Install fire hydrant	4	14	18
		D2.05 Install hose reel system	2	4	6
		D2.06 Install sprinkler system	4	14	18
		D2.07 Use fire extinguisher	2	4	6
	Sub Total		19	47	66
	D3: Service fire suppression system	D3.01 Service detection system	2	4	6
		D3.02 Service hydrant system	2	10	12
		D3.03 Service fire extinguisher	2	4	6
	Sub Total		6	18	24
	Total Duration (D)		33	81	114
E: Carry out integratio n and monitorin g of control	E1: Perform installation of PLC	E1.01 Install PLC software	3	6	9
		E1.02 Perform basic PLC programming	2	18	20
		E1.03 Install PLC hardware	2	6	8
		E1.04 Connect PLC unit with input and output devices	3	9	12
		E1.05 Establish communication between PLC and programming device	2	6	8

systems in Building managem ent system	Sub Total		12	45	57
	E2: Perform monitoring of Building Management System	E2.01 Monitor real time parameters of Building Management System	6	8	14
		E2.02 Monitor the real time energy usage	4	4	8
		E2.03 Monitor of fire alarm system	4	4	8
		E2.04 Monitor the efficiency of AC system	4	4	8
		E2.05 Monitor the functioning of security and surveillance system	4	4	8
	Sub Total		22	24	46
	E3: Interpret various types of control systems linked to Building Management system (BMS)	E3.01 Interpret BMS schematic layout diagram	4	4	8
		E3.02 Integrate lighting control system	2	6	8
		E3.03 Integrate AC control system	2	6	8
		E3.04 Integrate Security and Surveillance system	2	6	8
		E3.05 Integrate Fire safety and protection system	2	6	8
		E3.06 Integrate Public Addressing (PA) system	2	6	8
	Sub Total		14	34	48
	E4: Perform Building Management system (BMS) wellness check	E4.01 Check sensors/actuators/controllers	3	4	7
		E4.02 Check alarm and time programmes /status	3	3	6
		E4.03 Check all cables and connectors	2	4	6
		E4.04 Maintain cleanliness of BMS components	3	3	6
		E4.05 Check operation of BMS output devices	3	3	6
		E4.06 Check functionality of system software	3	3	6
		E4.07 Check system's operational controls	2	4	6
		E4.08 Troubleshoot BMS	6	6	12
	Sub Total		25	30	55
	Total Duration (F)		73	133	206
	Total		432	1008	1440

Annex III: Module Recognition

This is to verify that

Mr/Ms.....

has completed module on

.....

Covering following learning outcomes:

1.
2.
3.

Instructor:

Head of the Department:

.....

.....

Signature:

Signature:

Date: / / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Head of the Institute:

Trained Assessor (Institute)/Exam OC:

.....

.....

Signature:

Signature:

Date: / ... / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Annex IV: Lesson Plan
Lesson Plan

Course Title:		NC Level:
Module Code:		Duration:
Module Title:		
Learning Outcome:		
Skill/Task/Topic:		
Terminal Performance Objective:		
<i>(Note: Write narrative statement extracted from TPO of Task Sheet)</i>		
Enabling Objectives (Related knowledge):		
<i>By the end of the lesson learners will be able to:</i>		
i) ii) iii)		
What (Content/Activity)	Who (T/L)	How (Methods/ Media)
Duration (Min.)	Questions	
Introduction:		
Main body		
Conclusion		
Projects/Problems:		
Instructional Resources Plan		

Skills/Task/Topic:				
No. of Trainees:				
Sl. No.:	Instructional materials/resources	Specifications	Qty.	Remarks
Prepared by :		Signature	Date:	
Revised by:		Signature	Date:	
Approved by:		Signature	Date:	

Task sheet

TS-1/4: Practical Plan

TS-1/4: Practical Plan		
Course Title:		N C Level:
Module code:		Duration:
Module Title		
Learning outcome		
Skills/Task Title:		Task no:

Terminal Performance Objective:

Given:

Cue:

Who:

What:

Within:

How well:

—

—

—

Enabling Objectives (Related Skills):

By the end of a lesson, the learners will be able to:

i)

ii)

iii)

iv)

Activities	Who (T/L)	How (methods/ media)	Duration

Project/Assignment:**TS-2/4: Tool and Equipment required:**

<i>Sl no.</i>	<i>Particulars</i>	<i>Specifications</i>	<i>Qty.</i>	<i>Remarks</i>			
Training Materials required:							
<i>Sl no.</i>	<i>Particulars</i>	<i>Specifications</i>	<i>Qty.</i>	<i>Rate</i>	<i>Amount</i>	<i>Remarks</i>	
TS-3/4: Performance Guide							
Skill/Task:					Date:		
Directions: Use the following performances criteria to rate the learner. Check YES/NO to indicate whether the learner performed each step as indicated or not?							
Sl. No:	Steps					Yes	No
Note: Critical steps: All * marked steps should be carried out very carefully. For a quality performance guide, all items should be checked "YES"							

TS-4/4: Instruction and Drawing**General Instructions for Trainees**

- i)
- ii)
- iii)
- iv)

Drawing (if any)

Safety Precaution

- i)
- ii)
- iii)

Prepared by :	Signature	Date:
Revised By:	Signature	Date:
Approved by :	Signature	Date:

Annex V: Course Plan
Institutes letter head and Logo

(Trade)YEAR PLAN- _____ Semester_____ (Year)

Trade: NC Level:			Schedule																																								Total Hours																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Prepared by:

Verified & Approved by:

Date:

Monthly/Weekly Plan

Month:

Trade:

Trainer:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 01							
Week 02							
Week 03							
Week 04							
Week 05							

Developed by:

Approved by:

Date



For more information please contact:

Technical Trainers Training and Resource Center (TTTRC), DWPSD

Email: tttrd@moesd.gov.bt/dwpsd@moesd.gov.bt