Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

ELECTRICAL LIGHTING AND POWER SOCKETS INSTALLATION

ELTLS301

INSTALL ELECTRICAL LIGHTING AND POWER SOCKETS

Competence

RQF Level: 3

Learning Hours 100

Credits: 10

Sector: Energy

Trade: Electrical Technology

Module Type: Specific

Curriculum: ENGELT3001- TVET Level 3 in Electrical Technology

Issue Date: April 2022

Purpose statement	This module describes the skills, knowledge and attitude required to lay electrical conduit systems, perform wiring / cabling and connections, install electrical lighting and power sockets. At the end of this module, learners will be able to fix electrical conduits and fittings, select the type of electrical conduits, fix electrical conduits and fittings, apply cables / wires cutting techniques, connect wires / cables, install ordinary switches, install electrical devices**,** install energy meter, clean the working area.
Learning to be assumed in place	SHE, Basics of Electricity and electronic, Electrical drawing, Bench work

Delivery modality

Training delivery		100%	Assessment		Total 100%
Theoretical content		30%	Formative assessment	30%	50%
Practical work:		70%		70%	
• Group project and presentation	20%				
• Individual project /Work	50%				
			Summative Assessment		50%

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Conduct site survey	1.1. Installation site is appropriately visited based on client information
	1.2. Electrical diagrams are properly sketched in line with electrical drawing standards
	1.3. Installation cost is effectively estimated in line electrical diagram.
2. Lay Electrical Conduit Systems	2.1. Electrical installation is well identified in accordance with their types.
	2.2. Chiselling is properly carried out in respect with the electrical diagram
	2.3. Conduits and their fittings are properly selected based on their size and the type of the electrical installation
	2.4. Conduits are properly shaped in line with the pre-determined sizes, conduits direction and deviation angle
	2.5. Electrical conduits and fittings are correctly fixed in line with the direction of application and pre-determined measures
3. Perform Wiring / Cabling and Connections	3.1. Wires /cables are properly selected in line with the current carrying capacity.
	3.2. Cables/wires are precisely cut in line with the measured dimensions and allocation devices.

	3.3. Cables / wires are connected in line with the wiring standards.
4. Install Electrical Lighting and Power Sockets	4.1. Tools, Materials and Equipment are properly selected in line with their types and application
	4.2. Switches are properly connected in line with instruction manual and wiring diagram
	4.3. Switches are properly fixed in line with the Electrical wiring diagram
	4.4. Lamps are properly connected and fixed in line with the required luminescence, types and electrical wiring diagram
	4.5. Sockets outlets are connected and fixed based on power consumption, wiring diagram and type of power socket connection
	4.6. Electrical bell is correctly connected and fixed according to their application and electrical diagram
	4.7. Energy meter is properly fixed in line with instruction manual and architectural diagram.
	4.8. Energy meter is properly connected to the installation in line with wiring diagram
5. Clean working area	5.1. Tools and equipment are properly cleaned in accordance with their nature.
	5.2. Working area is properly discharged in line with the cleaning techniques.
	5.3. Tools and materials are neatly Arranged in respect to their types and uses
	5.4. Waste is carefully disposed in respect with government regulations

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Conduct site installation survey 2. Lay Electrical conduits systems 3. Perform Wiring / Cabling and Connections 4. Install Electrical Lighting and Power Sockets 5. Clean working area
Learning outcome 1: Conduct installation site survey	**Learning hours: 5**

Indicative content

- **Identification of material consumption**
  - ✓ Power source location
  - ✓ Types of power supply
- **Electrical diagram drawing**
  - ✓ Measuring of dimensions
  - ✓ Cross-section area
- **Identification of activities**
  - ✓ Chiselling, Piping, wiring connection, Fixing, Testing, Replacing, Dissembling, Assembling, Insulation, Cleaning.
- **Identification of material consumption**
  - ✓ Pro-forma invoice

Resources required for the indicative content

Equipment	Powered Electrical screw driver, Multi-meter, Reverting machine, Electrical drilling machine, Electric grinder
Materials	Steel pipes, Plastic pipes (PVC), Wye Tee, Coupling, Single Tee, connectors, Elbow pipe (450), Elbow pipe (900), Pictures, Plastic Raw plug, Raw bolt, Spring toggle, Brolley fixing, Metallic trunks, Non-metallic trunks, junction box, Coupler, Partition, Horizontal Tee, Horizontal Bend, Wires and cables, Insulation tape, Screws, Wall plugs, Cable clips, Nails, Electrical fittings, Switches, Power sockets, Electric bells, Distribution boards, Circuit breakers, Electricity meters, Grounding kit
Tools	Pliers' kits, Junior hack saw, Internet, Reference books

Facilitation techniques / learning activities	• Individual and group work • Practical exercise • Group discussion • Brainstorming • Physical demonstration • Simulation • Practical Workshops • Displaying pictures • Further research on internet
Formative assessment methods	• Written assessment • Oral presentation • Performance assessment • Product based assessment

Learning outcome 2: Lay Electrical Conduit Systems	**Learning hours: 20**
Indicative content	

- **Types of Electrical installation explanation**
  - ✓ Flush mounted / semi-built
  - ✓ Surface mounted / wall-mounted
  - ✓ Water proof
- **Chiselling for conduits and fittings placement**
  - ✓ Measuring and marking area of conduits placement
  - ✓ Measuring and marking area of fittings placement
  - ✓ Chiselling tools and equipment
  - ✓ Chiselling procedures.
- **Conduits and their fittings**
  - ✓ Types of electrical conduits
  - ✓ Sizes of electrical conduits
- **Electrical conduits shaping**
  - ✓ Tools and Equipment
  - ✓ Conduits' direction

- ✓ Deviation angle
- ✓ Measuring and cutting conduits

✓ Pipe curves

✓ Trunking shapes

- **Making electrical conduits joints**

✓ Types of joints

✓ Application of joints

- ✓ Conduits and fittings fixing procedures

Resources required for the learning outcome	
Equipment	Ladder, Drilling machine, Electrical screw drivers
Materials	New / Existing house to be installed, Steel pipes, Plastic pipes (PVC), Wye Tee, Coupling, Single Tee, Connectors, Elbow pipe (450), Elbow pipe (900), Pictures, Plastic Raw plug, Rawl bolt, Spring toggle, Brolley fixing, Metallic trunks, Non-metallic trunks, Junction box, Coupler, Partition, Horizontal Tee, Horizontal Bend
Tools	Chisel, Sprit Level, tape measure, Hammer, Cordless Drill & Bits, Safety glass, Face shield, Safety shoes, insulating (rubber) gloves, Insulating sleeves, Hard hats, Flame-resistant (FR) clothing, Marker pen, Video, Pictures
Facilitation techniques / learning activities	• Group discussion, Trainer guided, Cooperative, brainstorming, Research on internet, Displaying pictures, Demonstration by video
Formative assessment methods	• Written assessment, Performance assessment

Learning outcome 3: Perform Wiring / Cabling and Connections	Learning hours: 20
Indicative content	
• **Description of** ✓ Types of cables / wires ✓ Sizing of cables / wires ✓ Cable current carrying capacity • **Connection of cables / wires** ✓ Tools and equipment ✓ Measuring cables / wires ✓ Cutting techniques ✓ Termination and connection	
Resources required for the indicative content	
Equipment	Powered Electrical screw driver, Multi-meter, Reverting machine, Electrical drilling machine, Electric grinder
Materials	Steel pipes, Plastic pipes (PVC), Wye Tee, Coupling, Single Tee, connectors, Elbow pipe (450), Elbow pipe (900), Pictures, Plastic Raw plug, Raw bolt, Spring toggle, Brolley fixing, Metallic trunks, Non-metallic trunks, junction box, Coupler, Partition, Horizontal Tee, Horizontal Bend, Wires and cables, Insulation tape, Screws, Wall plugs, Cable clips, Nails, Electrical fittings, Switches, Power sockets, Electric bells, Distribution boards, Circuit breakers, Electricity meters, Grounding kit
Tools	Pliers' kits, Junior hack saw, Internet, Reference books
Facilitation techniques / learning activities	• Individual and group work, Practical exercise, Group discussion, brainstorming, Physical demonstration, simulation, Practical Workshops, Displaying pictures, Further research on internet
Formative assessment methods	• Written assessment, Oral presentation, Performance assessment, Product based assessment

Learning outcome 4: Install Electrical Lighting and Power Sockets	Learning hours: 50

Indicative content

- **Description of tools , materials and equipment**
  - ✓ Tools and their uses
  - ✓ Equipment and their application
  - ✓ Types of switches and their function
  - ✓ Types of sockets outlet and their function
  - ✓ Types of electrical bells and their application
- **Connection of ordinary switches**
  - ✓ Electrical circuit diagram
  - ✓ Electrical wiring diagram
  - ✓ Cables / Wires Insulation
- **Fixing ordinary electrical switches**
  - ✓ Fixing techniques
- **Testing of switching system**
  - ✓ Testing instruments
  - ✓ Switching operation
  - ✓ Testing techniques
- **Fixing and testing electrical lightings**
  - ✓ Luminescence
  - ✓ Types of lamps
  - ✓ Techniques of fixing
  - ✓ Light testing
- **Fixing and connecting sockets outlet**
  - ✓ Power consumption
  - ✓ Power socket connections (Ring & Radial)
  - ✓ Fixing techniques
- **Testing sockets outlet**
  - ✓ Testing instruments
  - ✓ Testing techniques
- **Fixing and connecting of electrical bell**
  - ✓ Application of electrical bell
  - ✓ Connection techniques
  - ✓ Fixing techniques
- **Fixing and connecting energy meter**
  - ✓ Types of energy meter
  - ✓ Fixing techniques

✓ Connecting techniques	
Resources required for the indicative content	
Equipment	Powered Electrical screw driver, Multi-meter, Reverting machine, Electrical drilling machine, Electric grinder
Materials	Steel pipes, Plastic pipes (PVC), Wye Tee, Coupling, Single Tee, connectors, Elbow pipe (450), Elbow pipe (900), Pictures, Plastic Raw plug, Raw bolt, Spring toggle, Brolley fixing, Metallic trunks, Non-metallic trunks, junction box, Coupler, Partition, Horizontal Tee, Horizontal Bend, Wires and cables, Insulation tape, Screws, Wall plugs, Cable clips, Nails, Electrical fittings, Switches, Power sockets, Electric bells, Distribution boards, Circuit breakers, Electricity meters, Grounding kit
Tools	Plier's kit, Pipe bender, Channel locks, Torpedo, Level, Punch down tool, voltage tester, File or reamer, Needle nose pliers, Linesmen's pliers, Phillips screw driver, Hack saw, Wire stripper, All-purpose tools, Hammer, Magnetic level, Plug/Outlet Tester, Voltage detector, Retractable Utility Knife, Cordless Drill & Bits, Tool belt and pouches, Internet, Safety glass, Face shield, Safety shoes, insulating (rubber) gloves, Insulating sleeves, Hard hats - Flame-resistant (FR) clothing
Facilitation techniques / learning activities	• Individual and group work, Practical exercise, Group discussion, Brainstorming, Physical demonstration, Simulation, Practical Workshops, Further research on internet
Formative assessment methods	• Written assessment, Oral presentation, Performance assessment, Product based assessment

Learning outcome 5 : Clean the working area	Learning hours: 5
Indicative content	
• **Cleaning techniques** ✓ Tools ✓ Equipment ✓ Work area • **Steps for arrangement of tools, material and equipment** • **Remove waste**	
Resources required for the indicative content	
Equipment	Electrical equipment, Electrical drilling machine
Materials	Paraffin, thinner, Books, Broom, Plastic Raw plug, Rawl bolt, Spring toggle, Brolley fixing, Electrical screw drivers, Metallic trunks, Non-metallic trunks, Junction box, Coupler, Partition, Horizontal Tee, Horizontal Bend, Internet, Pictures
Tools	Scraper, Electrical tools, Personal protective equipment, Flip chart, Marker pen, Video, Pictures, stripping plier, Side cutter plier, Combination plier, long nose plier, Electrician knife, measuring tape, Screw drives, Hammer, Spirit level, Crimping tools, Safety glass, Face shield, Safety shoes, insulating (rubber) gloves, Insulating sleeves, Hard hats, Flame-resistant (FR) clothing
Facilitation techniques/ learning activities	• Individual and group work, Brainstorming, Group discussion on cleaning the work area, Discussion on tools and materials arrangement, Simulation of cleaning tools and equipment, showing video on cleaning the work area, Practical exercise on remove waste
Formative assessment methods	• Written assessment, Oral presentation, Performance assessment

Integrated / Summative assessment

Integrated situation

Murenzi Construction Enterprise company located in Rwamagana District is conducting project of 150 Residential buildings for Vulnerable people in Gishari sector. Each house to be constructed comprise 1 living room, 1 bed room, 1 kitchen and a long corridor, it has been noted that during the design, adequate Electrical installation and its facilities have not been planned. During the meeting conducted by both parties, the company has been urged to update the design and contract for overcoming the gap. Based on the lack of person with enough skills to resolve the issue, the company is recruiting external agents to support them in finding and implement the solution. All buildings will be constructed and equipped in the same way. You are one of the recruited people and you are required to start the process from the scratch to the needed operation of one sampled house. As agreed within the resolution meeting, all electrical components should be built within the wall surface, supply will be taken from the electrical support located within 35 m from the building site. Installation should include both lighting and ability to connect the devices each room. All requirements must be submitted to the project manager within 10 hours. The following statements describe the needful information as captured based on the architectural plan.

- ✓ The kitchen comprises one lamp and two single phase outlet sockets. The lamp is controlled from two different positions.
- ✓ The living room comprises two lamps and one socket outlet. The lamps are controlled by from 3 different positions.
- ✓ The bedroom comprises one lamp and one outlet socket. The lamp is controlled from two different positions.
- ✓ The bathroom comprises one lamp and one socket outlet both controlled by bipolar switch.
- ✓ The corridor comprises two lamps controlled from two different positions.
- ✓ One bell controlled from the gate. Note that the installation should be protected against overload and short-circuit and the entire installation should be grounded.
- ✓ Tools, material and equipment should be identified and requested from the store.

Resources

Tools	Measuring tape, Hack saw, Screw drives, Hammer, Spirit level, Reverting machine, Electrical screw drivers, Electric grinder, Spirt level
PPE	Safety glass, Face shield, Safety shoes, insulating (rubber) gloves, Insulating sleeves, Hard hats, Flame-resistant (FR) clothing
Equipment	Electrical drilling machine, Digital Multimeter, Ladder
Materials / Consumables	Pipes, Pipe Fittings, Trunk's fittings, lamps, Power socket outlet, Trunks, Cable clips, Plastic Raw plugs, Raw bolt, Spring toggle, Brolley fixing, single core cable, stranded core cable

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: **Conduct site survey** **(15%)**	1.1. Installation site is appropriately visited based on client information	Installation information are appropriately gathered			2
	1.2. Electrical diagrams are properly sketched in line with electrical drawing standards	Electrical wiring diagram is properly sketched			10
	1.3. Installation cost is effectively estimated in line electrical diagram.	Installation cost is effectively estimated			3
Learning outcome 2: **Lay Electrical Conduit Systems** **(25%)**	2.1. Electrical installation is well identified in accordance with their types.	Electrical installation is properly identified			5
	2.2. Chiselling is properly carried out in respect with the Electrical Diagram	Electrical diagram is well interpreted			1
		Conduits and fitting's placement is correctly done			2
	2.3. Conduits and their fittings are properly selected based on their size and the type of the electrical installation	Pipes are correctly selected			1
		Trunking is correctly selected			1
		Fittings are properly selected			1
	2.4. Conduits are properly shaped in line with the pre-determined sizes, conduits direction and deviation angle	Measurements are properly done			1
		Pipes are properly cut			3
		Pipes are properly curved			1
		Deviation angle is properly made			2
		Trunkings are properly shaped			3
	2.5. Electrical conduits and fittings are correctly fixed in line with the direction of application and pre-determined measures	Pipe joints are properly done			3
		Conduits are correctly fixed			3
		Fittings are correctly fixed			3
Learning outcome 3: **Perform Wiring /**	**3.1.** Wires / cables are properly selected in line with the current carrying capacity**.**	Wires / cables are properly selected			2
	3.2. Cables /wires are precisely cut in line with the measured	Cables /wires are precisely cut			3

Cabling and Connections (15%)	dimensions and allocation devices.				
	3.3. Cables / wires are connected in line with the wiring standards.	Cables / wires are connected			10
Learning outcome 4: **Install Electrical Lighting and Power Sockets** **(60%)**	4.1. Tools, Materials and Equipment are properly selected in line with their types and application	Tools are properly selected			5
		Materials are properly selected			5
		Equipment is properly selected			5
	4.2. Switches are properly connected in line with instruction manual and wiring diagram	Switches are properly connected			10
	4.3. Switches are properly fixed in line with the Electrical wiring diagram	Switches are properly fixed			5
	4.4. Lamps are properly connected and fixed in line with the required luminescence, types and electrical wiring diagram	Lamps are properly connected and fixed			5
	4.5. Sockets are properly connected and fixed based on power consumption, wiring diagram and type of power socket connection	Sockets outlets are properly connected and fixed			5
	4.6. Electrical bell is correctly fixed according to their application and electrical diagram	Electrical bell is correctly connected and fixed			5
	4.7. Energy meter is properly fixed in line with instruction manual and architectural diagram.	Energy meter is properly fixed			5
	4.8. Energy meter is properly connected to the installation in line with wiring diagram	Energy meter is properly connected			10
Learning outcome 5: **Clean working area (5%)**	5.1. Tools and equipment are properly cleaned in accordance with their nature.	Tools and equipment are properly cleaned			1
	5.2. Working area is properly discharged in line with the cleaning techniques.	Working area is properly discharged			1
	5.3. Tools and materials are neatly Arranged in respect to their types and uses	Tools and materials are neatly arranged			1

	5.4. Waste is carefully disposed in respect with government regulations	Waste is carefully disposed			2
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

Reference:

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6. Troubleshooting&Raiparing Major Appliances, Third Edition by ERIC KLEINERT
7. Electrical technology(Sri C. Suryanarayana Reddy M.Tech)
8. Linsley, T. (2013). Basic electrical installation work. Routledge.
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