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MOBILE PHONE TECHNICIAN

LEARNER GUIDE

National Vocational Certificate Level 1

Version 1 - November, 2019

NAVTTC

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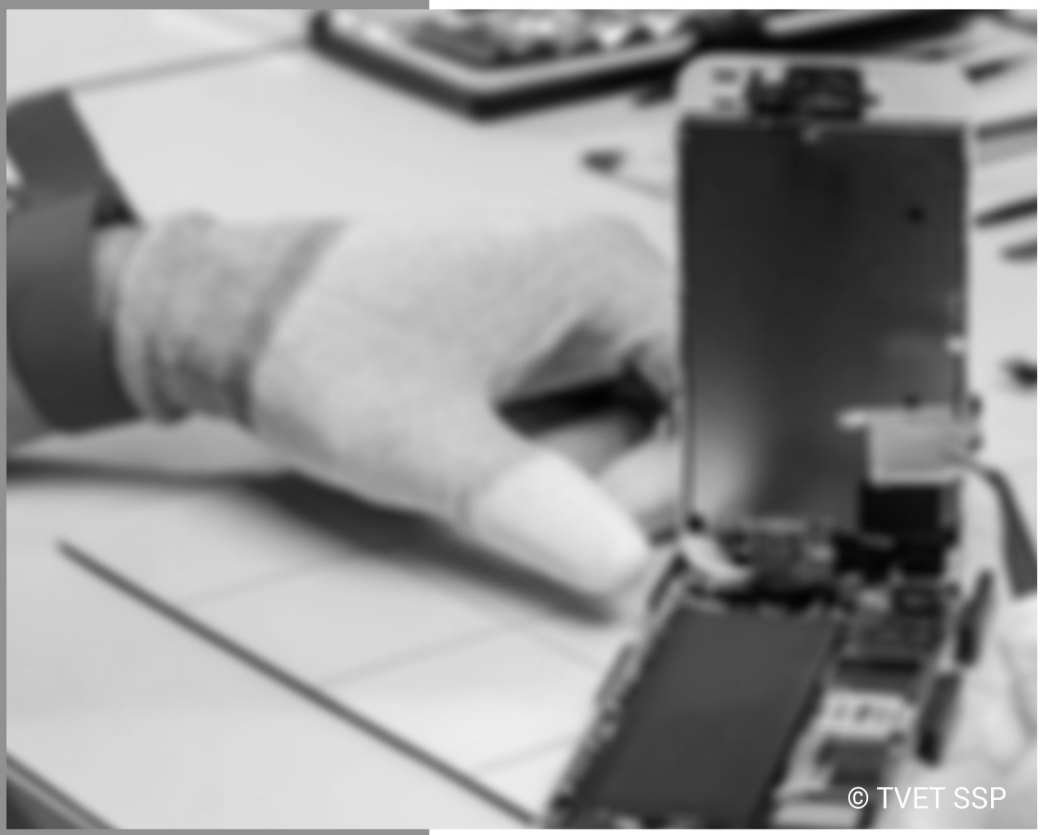

LEARNER GUIDE

National Vocational Certificate Level 1

Version 1 - November, 2019

Contents

Introduction

Welcome to the Learner's Guide for the ***Mobile Phone Technician*** Program. It will lead you towards successful completion of the program and to keep on further study or go straight into employment.

The ***Mobile Phone Technician*** program is to engage young people with a program of development that will provide them with the knowledge, skills and ability to start their career in Pakistan or seek their job across the borders. The program has been developed to address specific issues, such as the national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their customers.

The main elements of your learner's guide are:

- **Introduction:**
  - This includes a brief description of your guide and guidelines for you to use it effectively
- **Modules:**
  - The modules form the sections in your learner's guide
- **Learning Units:**
  - Learning Units/Tasks are the main sections within each module
- **Learning outcomes**:
  - Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - This is the main content of your learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) you will require to achieve learning outcomes stated in the curriculum
  - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules**:

  The summary of modules contains all the modules ,clustered together in the qualification level (level 1—4), along with their learning units ,aims and time frame

  Frequently asked questions:
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas and general information regarding the nature, duration, way of assessment, vertical and horizontal progression and future prospects of the training. This further helps you in preparing for your assessment.

- **Multiple choice questions for self-test**:

These are provided as an exercise at the end of your learner's guide to help you in preparing for your assessment.

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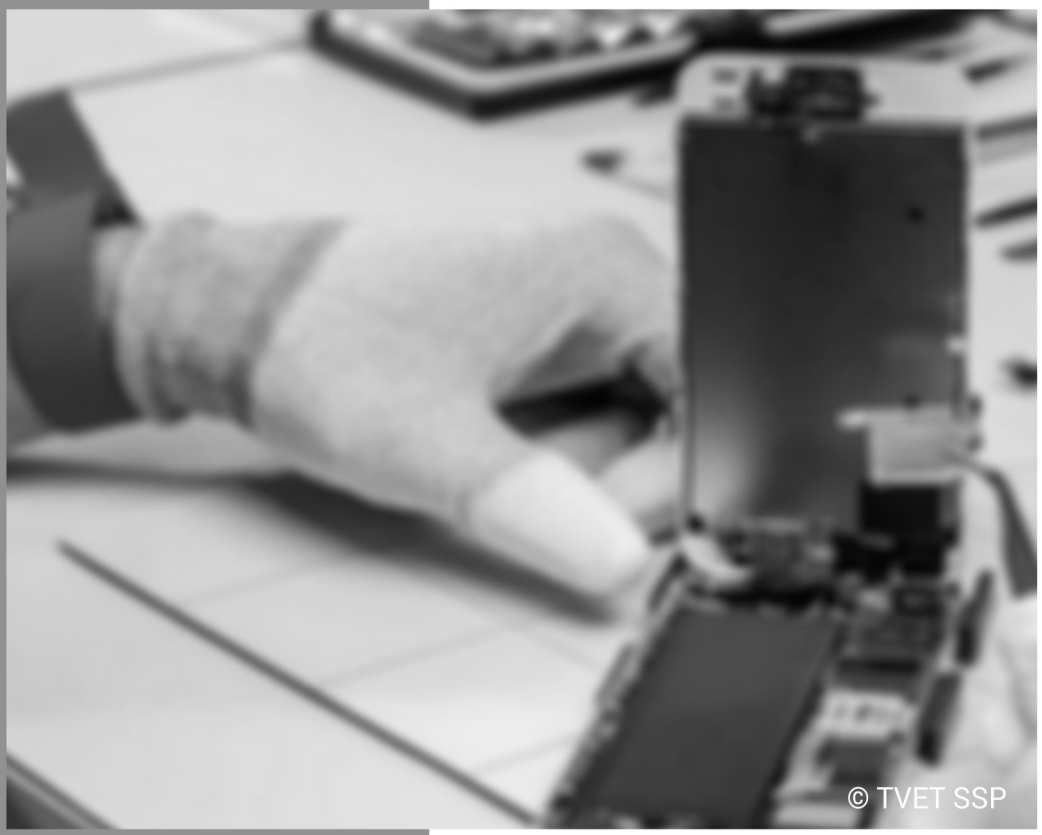

Module-A

LEARNER GUIDE

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Module A: Adopt Health and Safety

Objective: This module covers the skills and knowledge required to protect from all security threats by ensuring personal, workplace, Machines, tools and related equipment safety interpret environmental and co-relevant regulation.

Duration: 90 Hours **Theory:20Hours** **Practice: 70Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Ensure use of personal protective equipment (PPE)	**Trainee will be able to:** • Arrange personal protective equipment as per requirements • Wear correct personal protective equipment • Store PPE at appropriate place after use.	**Personal Protective Equipment (PPE)** Personal Protective Equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to a variety of hazards. Examples of PPE include such items as gloves, foot and eye protection, protective hearing devices (earplugs, muffs) hard hats, respirators and full body suits. **Selecting PPE** All PPE clothing and equipment should be of safe design and construction, and should be maintained in a clean and reliable fashion. A technician requires PPE to meet the following standards: **Eye and Face Protection**: Many occupational eye injuries occur because workers are not wearing any eye protection while others result from wearing improper or poorly fitting eye protection. Trainers must be sure that	• Respirators cartridge • Silica gel • Camphor (kafoor) tablets • Complete PPE set

		their trainees wear appropriate eye and face protection and that the selected form of protection is appropriate to the work being performed and properly fits each worker exposed to the hazard. **Head Protection:** Wearing a safety helmet or hard hat is one of the easiest ways to protect a head from injury. Hard hats can protect from impact and penetration hazards as well as from electrical shock and burn hazards. **Hand and Foot Protection:** Workers who face possible hand, foot or leg injuries from falling or rolling should wear protective gloves or footwear. Also, employees whose work involves exposure to hot substances or corrosive or poisonous materials must have protective gear to cover exposed body parts, including hand legs and feet. If an employee's hand or feet may be exposed to electrical hazards, non-conductive gloves or footwear should be worn. On the other hand, workplace exposure to static electricity may necessitate the use **Life Saving Kits***:* Life Saving Kit is essential in every high voltage environment. Composed of various safety components including first aid kit, rescue rod, stretcher, set of fire resistant blankets, insulated matting and more it is a complete solution for every emergency at high voltage	

		environments. ***Insulated Gloves****:* Electrical insulating gloves are a critical lifesaving piece of personal protective equipment, and should be worn on or near exposure electrical parts. ***Insulated Matting***: Electrical insulating mats save lives of workers in case, accidental leakage of current while handling or maintaining live high voltage electric equipment. ***Earthing & Short Circuiting:*** *Earthing &short* circuiting *kits* are standard portable *earth kits* that are designed and tested for the high voltage work. Uses and importance of Personal Protective Equipment (PPE). Safety is a major issue for day laborers and skilled laborers. Each year, accidents happen frequently in the construction industry and often times it are due to the absence of Personal Protective Equipment (PPE) or failure to wear the provided PPE. PPE is equipment that will protect workers against health or safety risks on the job. The purpose is to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective to reduce these risks to acceptable levels. These hazard risks can be anything from wet floors to	

		falling debris and everything in between. PPE includes items such as protective helmets, eye protection, high-visibility clothing, safety footwear, safety harnesses and, sometimes, respiratory protective equipment. Let's explore some PPE commonly used on construction sites and their benefits:	
LU2. Maintain First-aid Box	**Trainee will be able to:** • Ensure availability of first aid box • Check first aid box for requisite items • Check expiry of medicines • Perform first aid treatment against electric shocks • Perform first aid treatment/bandages against minor injuries	A first aid kit is a collection of supplies and equipment that is used to give medical treatment. There is a wide variation in the contents of first aid kits based on the knowledge and experience of those putting it together. **The common kits used in the school and colleges may contain:** • Alcohol or nonalcoholic antiseptic wipes • Band-Aids • Cotton Balls • Cotton Swabs • Iodine • Bandages • Hydrogen Peroxide • Gauze • Saline • Dressings • Eyewash • Antiseptic solution • Rely spray	• Complete first add box •

LU3. Maintain Fire Extinguisher	**Trainee must be able to:** • Check expiry of fire extinguisher • Operate fire extinguisher • Replace fire extinguisher	A **fire extinguisher** is an active fire protection device used to extinguish or control small fires, often in emergency situations. It is not intended for use on an out-of-control fire **Types and Use of fire extinguisher** Whilst there are 5 main types of fire extinguisher, there are different versions of both the Water and Dry Powder extinguishers, meaning there are a total of 8 fire extinguisher types to choose from. The 8 types of fire extinguisher are: – Water – Water Mist – Water Spray – Foam – Dry Powder – Standard – Dry Powder – Specialist – Carbon Dioxide ('CO2') – Wet Chemical **How to use** PULL... Pull the pin. This will also break the tamper seal. AIM... Aim low, pointing the **extinguisher** nozzle (or its horn or hose) at the base of the **fire**. ... SQUEEZE... Squeeze the handle to release the **extinguishing** agent.	• Different types of fire extinguishers

		SWEEP... Sweep from side to side at the base of the **fire** until it appears to be out. This method is also called “PASS” **When replace** Manufacturers say most **extinguishers** should work for 5 to 15 years, but you might not know if you got yours three years ago or 13. So how can you be sure it will fire away? Atlanta fire chief Dennis L. Rubin recommends checking the pressure gauge monthly. “If the needle is in the green area, it's functional,” he says its ok otherwise replace it	
LU4. Attain health & safety training	**Trainee must be able to:** • Take required health and safety training • Manage Risk control in the work place area • Implement work hazardous material information system (WHMIS) • Adopt first aid treatment against the electric shock • Adopt first aid cardio respiratory, resuscitation and CPR	**Cardiopulmonary resuscitation (CPR)** is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest. It is recommended in those who are unresponsive with no breathing or abnormal breathing, CPR involves chest compressions for adults between 5 cm (2.0 in) and 6 cm (2.4 in) deep and at a rate of at least 100 to 120 per minute.[2] The rescuer may also provide artificial ventilation by either exhaling air into the subject's mouth or nose (mouth-to-mouth resuscitation) or	

	• Report Risk / hazard of the work place	using a device that pushes air into the subject's lungs (mechanical ventilation) Define hazards and types of hazards A hazard is any source of potential damage, harm or adverse health effects on something or someone under certain conditions at work. Basically, a hazard can cause harm or adverse effects (to individuals as health effects or to organizations as property or equipment losses). **Types of hazards:** Hazards generally fall into one of six groups: 1. **Physical**, fire. 2. **Chemical**. 3. **Ergonomic** 4. **Radiation** 5. **Psychological** 6. **Biological** **Risk and its types:** A chance of damage, injury, loss, or any other negative occurrence that is caused by external or internal vulnerabilities, and that may be avoided through preemptive action. • ***Construction risk:*** Risk of property damage during the building phase.	

		• ***Environmental risk:*** Risk of environmental damage caused by the solar yard or equipment related to renewable energy. • ***Operational risk:*** Risk of unscheduled plant closure due lack of resources, equipment damages or component failures. • ***Technology risk:***Risk of components generating less electricity over time than expected. • ***Political and regulatory risk:*** Risk of a change in policy that may affect the renewable energy sector. • ***Climate and weather risk*****:** Risk of changes in electricity generation due to lack of sunshine or snow covering solar panels for long periods of time. • ***Sabotage, terrorism and theft risk:*** Risk that all or parts of the solar system will be subject to sabotage, terrorism or theft and thus generate less electricity than planned. • ***Physical risk:*** Risks associated with personal saftey and well being while working in the related sector Take these actions immediately while waiting for medical help: • Turn off the source of electricity, if possible. If not, move the source away from you and the person, using a dry, no conducting object made of cardboard, plastic or wood.	

		• Begin CPR if the person shows no signs of circulation, such as breathing, coughing or movement. • Try to prevent the injured person from becoming chilled. • Apply a bandage. Cover any burned areas with a sterile gauze bandage, if available, or a clean cloth. Don't use a blanket or towel, because loose fibers can stick to the burns.	
LU5. Ensure Safety of Tools & Equipment	**Trainee must be able to** • Ensure insulation of tools and equipment • Store tools and equipment safely • Clean tools on a regular basis before storing.	• **Physical –** Slippery floors, objects in walkways, unsafe or misused machinery, excessive noise, poor lighting, fire. • **Chemical –** Gases, dusts, fumes, vapors and liquids. • Define electrical hazards The main hazards of working with electricity are: • electric shock and burns from contact with live parts • injury from exposure to arcing, fire from faulty electrical equipment or installations • explosion caused by unsuitable electrical apparatus or static electricity igniting flammable vapours or dusts, for example in a spray paint booth	

LU6. Adopt Environmental Regulation	**Trainee must be able to** • Check applicable permits on job site • Ensure work friendly environment • Adopt environmental regulations	The Occupational Health and Safety Regulation (OHSR) contains legal requirements that must be met by all workplaces under the inspectional jurisdiction of Workplace Occupational safety and health (OSH), also commonly referred to as occupational health and safety (OHS), occupational health,[1] or workplace health and safety (WHS), is a multidisciplinary field concerned with the safety, health, and welfare of people at work. **Safety management system** (SMS) is a comprehensive management system designed to manage safety elements in the workplace. It includes policy, objectives, plans, procedures, organization, responsibilities and other measures. The SMS is used in industries that manage significant safety risks, including aviation, petroleum, chemical, electricity generation and others	
LU7. Adopt company policies & procedures	**Trainee must be able to** • Ensure company policy and procedures • Adopt company procedures	• Knowledge and understanding of company policy and procedures.	Company Policy mannual
LU8. Prepare for emergencies	**Trainee must be able to** • Take emergency response training • Ensure emergency exercise	An emergency action plan (EAP) is a written document required by particular OSHA standards. The purpose of an EAP is to facilitate and organize	• Grey bandage • Blades • Antiseptic • Cotton rolls

	• Adopt first aid cardio respiratory, resuscitation and CPR	employer and employee actions during workplace emergencies. Well-developed emergency plans and proper employee training (such that employees understand their roles and responsibilities within the plan) will result in fewer and less severe employee injuries and less structural damage to the facility during emergencies • Importance of safety drills A **safety drill** is a method of practicing how a building would be evacuated in the event of a fire or other emergency ensuring safety of oneself and co – workers. Usually, the building's existing fire alarm system is activated and the building is evacuated as if the emergency had occurred. Generally, the time it takes to evacuate is measured to ensure that it occurs within a reasonable length of time, and problems with the emergency system or evacuation procedures are identified to be remedied. • Importance of Emergency Exit An **emergency exit** in a structure is a **special exit** for emergencies such as a fire: the combined use of regular and special exits allows for faster evacuation, while it also provides an alternative if the route to the regular exit is blocked by fire, etc.	• Paracetamol Tab • Metronidazole (Flagyl) Tab • Saniplast • Snake bite kit • Burn kit

		For National Fire Protection Agency (NFPA) rules for Fire Safety. Login to: https://www.nfpa.org/Codes-and-Standards/All-Codes-and-Standards/List-of-Codes-and-Standards	
LU9. Respond to emergencies	• Follow emergency plan • Communicate instructions to co workers • Assess risk and determine course of action • Operate emergency equipment and supplies	**Basic First Aid for Bleeding** Cover the wound with gauze or a cloth and apply direct pressure to stop the blood flow. Don't remove the cloth. Add more layers if needed. The cloth will help clots form to stop the flow. **Basic First Aid for Burns** • Flush the burned area with cool running water for several minutes. Do not use ice. • Apply a light gauze bandage. • Do not apply ointments, butter, or oily remedies to the burn. • Take ibuprofen or acetaminophen for pain relief if necessary. • Do not break any blisters that may have formed. **Basic First Aid for Fractures** • Don't try to straighten it.	

		• Stabilize the limb using a splint and padding to keep it immobile. • Put a cold pack on the injury, avoiding placing ice directly on the skin. • Elevate the extremity. • Give anti-inflammatory drugs like ibuprofen or naproxen. **Basic First Aid for Cardiac Arrest** Immediately start chest compressions regardless of your training. Compress hard and fast in the center of the chest, allowing recoil between compressions. Hand this task over to those who are trained if and when they arrive. If you are trained, use chest compressions and rescue breathing. An AED should be applied and used. But it is essential not to delay chest compressions, so finding one should be commended to someone else while you are doing chest compressions.	

Examples and illustrations

https://www.youtube.com/watch?v=ggJo6m8NZtA

https://www.youtube.com/watch?v=loQ9Dbsy2ag

https://www.youtube.com/watch?v=KQU1ccVdwIY

https://www.youtube.com/watch?v=w4jHpHoYZhk

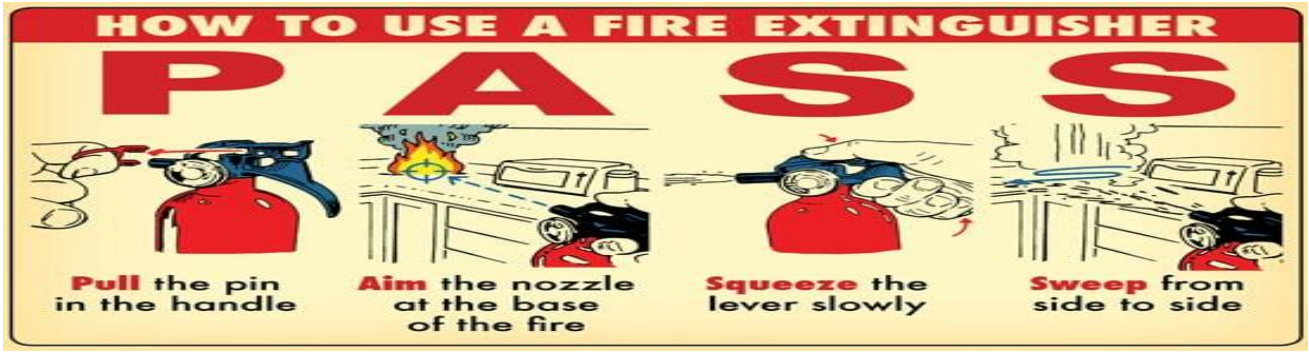
Emergency notices:

Sign	Description
	Fire Extinguisher sign - displayed next to all fire extinguishers to easily identify the location of the nearest extinguisher.
	Fire Alarm Call Point sign - located at all fire alarms.
	Fire Hose Reel sign – located at all fire hose points.
	Fire Blanket sign - located at all fire blanked locations
	In Case of Fire, Do Not Use the Lift sign - displayed at all lifts alongside the 'Use Stairs' sign to indicate safe escape route.

Sign	Description
	Fire Door Keep Shut sign - displayed on each side of all fire doors to ensure safety.
	Fire Exit sign - displayed along all designated fire escape routes (with arrows) and above all emergency exits (without arrows).
	Fire Assembly Point - a pictogram or written sign displayed at the outside point of assembly where people must gather after evacuation.
	In Case of Fire, Use Stairs sign - an information sign displayed next to lifts and at the top of staircases so people know not to use the lift for safety reasons.

Main types of portable extinguishers, their uses and colour coding

WATER	POWDER	FOAM	CARBON DIOXIDE (CO_2)	WET CHEMICAL
For wood, cloth, coal, plastics, paper, textile, and other solid material fires.	For solid material, liquid, gas, and electrical fires.	For solid material and liquid fires.	For liquid and electrical fires.	For fires that involve cooking oils and fats.
				
NOT SUITABLE FOR all other types of fires.	**NOT SUITABLE FOR chip or fat pan fires or metal fires** (unless it is M28 or L2)	**NOT SUITABLE FOR gas, metal, electrical, or chip and fat pan fires.**	**NOT SUITABLE FOR gas, metal, or chip and fat pan fires.**	**NOT SUITABLE FOR other types of fires** (use a more appropriate extinguisher).



First aid equipment

Accident and incident log

JUST CONNECTIONS

Accident and Incident Log

Partners for Inclusion

Date & Time	Who was involved	What happened	Outcome	A & I Form completed by	Who was responsible for taking to office & when	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	
					Print Name	
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					Date	
					Print Name	
					Sign	
					Date	

Accident & Incident log uploaded to web June 2014

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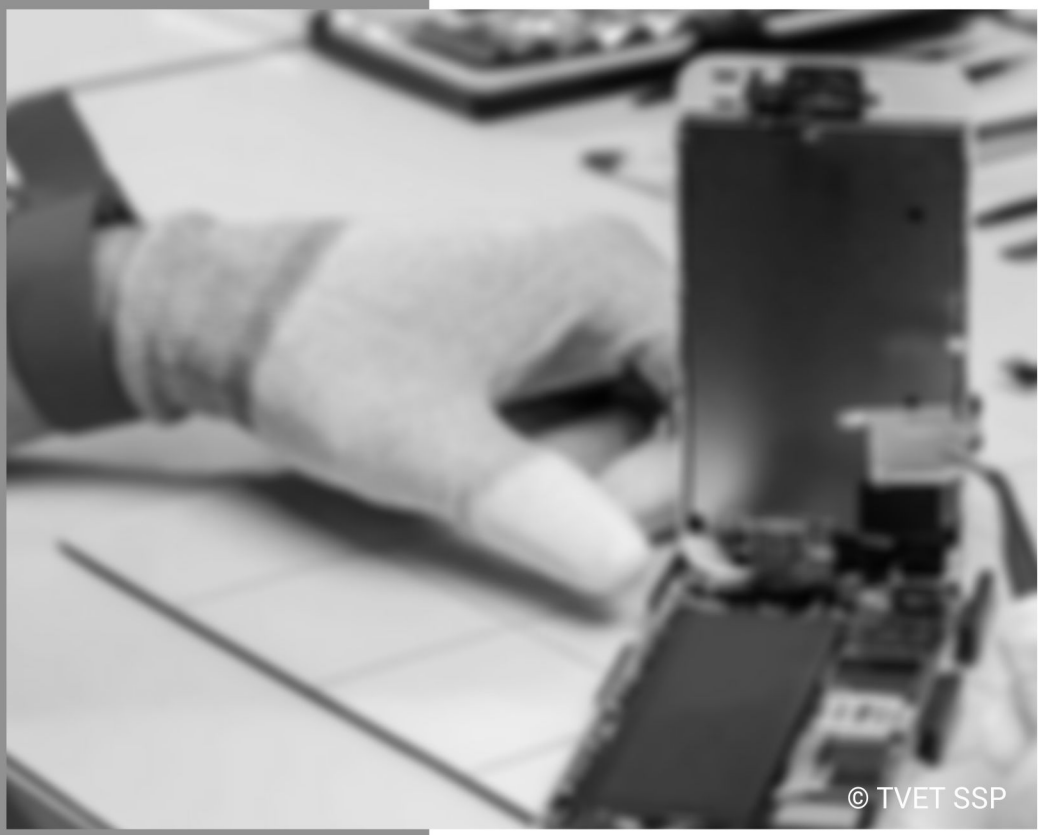

Module-B

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Module B: Maintain Tools and Equipment

Objective: This module covers the skills and knowledge required for identification and maintenance of tools and equipment, calibration techniques of measuring instruments ,Insulation of tools /equipment and their inventory management.

Duration: 60 Hours **Theory:10 Hours** **Practice: 50 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Arrange Tools & Equipment	• Identify tools and equipment • Prepare list of tools and equipment as per requirement • Check specifications of measuring Instruments • Collect tools and equipment from store	**1. Soldering Iron** A soldering iron is used to solder small components like capacitor, resistor, diode, transistor, regulator, speaker, microphone, display etc. A 50 watt soldering iron is good enough for most mobile phone repairing job. **2. Soldering Station** A soldering station has 2 units – a station and an iron. It has option to control temperature depending on the heat requirement of the soldering job being done **3. PCB Holder / PCB Stand** A PCB (*Printed Circuit Board*) holder or PCB stand is used to hold different types of PCB of a mobile phone while soldering or repairing. **4. Solder Wire** Solder wire is used to solder electronic components, ICs or jumper. Composition of most solder wire is Tin / Lead in the ratio	All tools and equipment's

		60:40 or 63:37 **5. Multimeter** A multimeter can be analog or digital. In mobile phone repairing, mostly a digital multimeter is used to find faults, check track and components. Always buy a good quality reliable ESD-Safe digital Multimeter for mobile repairing works. **6. Antistatic Mat (ESD Mat)** An ESD Mat or Antistatic Mat is laid or placed on the table or workbench where mobile repairing is done. The mat is grounded using a grounding cord or normal grounding wire. This prevents damage from static electricity. **7. Microscope or Magnifier** These used to see a magnified view of PCB or electronic components. These are available in different zoom options like 2X, 3X, 5X, 10X etc. Many microscopes can also be connected to a computer or a monitor. **8. Magnifying Lamp** It is used to see the magnified view of the PCB of a mobile phone. Most magnifying lamps also have light. Magnifying lamps are available in different magnification such as 3x, 4x, 5x, 10x, 50x etc.	

		9. Hot Air Blower A hot air blower is also called SMD (*Surface Mount Device*) rework station and SMD repair system. It has control to regulate or manage temperature and flow of hot air. Always buy a good quality ESD-Safe hot air blower. **10. Mobile Phone Repairing Tool Kit** A mobile repair electronic tool kits consists of most of the small tools need for most electronic repairing jobs. Most such tools consists of soldering iron, desoldering pump, solder wire, desoldering wick, precision screwdrivers, tweezers etc. So, there is no need to buy all these tools individually. **11. Precision Screwdriver** Precision screwdriver is used to unscrew and remove and tighten screws while assembling and dissembling a mobile phone. Precision screwdrivers of sizes T4, T5, T6 and forehead are good and sufficient for most mobile repairing job. **12. Mobile Phone Opener** These are used to open the housing or body of a mobile phone. Mobile phone openers are available in different shapes and are made of different material like tough plastic or metal. You must always use a non-metallic and ESD-Safe mobile	

		phone openers to avoid any damage due to static electricity. **13. ESD-Safe Cleaning Brush** These are used for cleaning the PCB of a mobile phone while repairing. It is important to buy only ESD-Safe cleaning brushes. **14. Tweezers** Tweezers are needed to hold electronic components, ICs, jumper wire etc. while soldering and DE soldering. Again I suggest to buy and use only an ESD-Safe tweezers **15. DC Power Supply** Regulated DC (Direct Current) power supply is used to supply DC current to a mobile phone. Most repair person used DC power supply to switch ON a mobile phone without battery. It can also be used as a battery booster to boost battery of a cell phone. It can also be used as a multimeter **16. BGA Kit** A BGA Repair Kit is used to Reball and repair ball-type ICs. BGA stands for Ball Grid Array. **17. IRDA or Infrared Workstation** This machine is similar to hot air blower. Only difference is that it gives heat through infrared. It is very precise and gives heat only where it is needed thus preventing	

		any damage to nearby electronic components on a PCB. **18. Jumper Wire** Jumper wire is a thin laminated or coated copper wire used to jumper from one point to another on the track of a mobile phone while repairing. Most people doing the work of mobile repairing do jumper to solve many problems **19. Solder Paste** This is solder in molted semi-solid form. It looks like paste. Solder paste is mainly used for Reballing of ICs. **20. Paste Flux** This is flux in paste form. Paste flux is used while soldering and desoldering. Main purpose of flux is to remove oxides and other impurities from the PCB Track and from leads of electronic components for better soldering and electrical conductivity. **21. Cleaning Sponge** This is used to clean tip of soldering iron while soldering. **22. Blade Cutter** This is used to remove lamination from jumper wire. It can also be used for several other purposes.	

		23. De soldering Wire De soldering wire or De solder wire is used to remove excess solder from track of PCB. Goot is world renowned manufacturer and supplier of De soldering wire.	
LU2. Maintain Tool Kit	• Check Physical Condition of Tools & Equipment before use • Perform preventive maintenance as per standards • Perform corrective maintenance (If required) • Clean Tools and equipment after use • Place tools and equipment at appropriate place	**Corrective maintenance** can be defined as a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or asset can be restored to an operational condition within the tolerances or limits established for in-service operations. **While Preventive maintenance** (PM) has the following meanings: 1. The care and servicing by qualified personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects. 2. Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from	Nil

		occurring The steps of corrective maintenance are, following failure, diagnosis – elimination of the part, causing the failure – ordering the replacement – replacement of the part – test of function and finally the continuation of use. The basic form of corrective maintenance is a step-by-step procedure. The object's failure triggers the steps. Modern technologies as the use of Industry 4.0 features reduce the inherant drawbacks of corrective maintenance **The Cleaning Process:** 1. This should be done outside. 2. Scrap off any caked on mud or dirt using a putty knife. 3. Using the hose with nozzle set on its most powerful stream; rinse the tools off thoroughly, removing all dirt, mud and other debris. 4. Wipe the tools down thoroughly with the old towels. 5. If there is any rust on the metal parts of your tools, rub the rust off briskly with the steel wool, rinse and dry again. You may want to wear working gloves for this as steel wool can be rough on your hands. 6. If you are storing your tool for the season or for an extended length of time, pour a small amount of household oil (i.e. WD-40, 3-in-1	

		Household Oil, etc.) on a soft rag and rub over all exposed metal parts on your tools to apply a thin coat. This will help prevent rust and is generally a good idea to do once every six months even if you are not storing your tools.	
LU3. Insulate Tools and Equipment	• Select insulated tools and equipment • Ensure insulation of tools and equipment as per standards	• Insulated tools are designed to protect you against injury in the event that you make contact with an energized source • Insulated tools are important when conducting any work that needs to be completed “hot” or on a live circuit. Insulation tools offer significant protection for situations where it may not always be possible to disconnect the circuit, for example when working on a railway line that needs to remain active.	Nil
LU4. Calibrate measuring instruments	• Check calibration status of the measuring tools • Perform calibration of measuring tools as per standards • Record Calibration test results	**Calibration** is a comparison between a known **measurement** (the standard) and the **measurement** using your **instrument**. Typically, the accuracy of the standard should be ten times the accuracy of the **measuring device** being tested. ... For the **calibration** of the scale, a **calibrated** slip gauge is used • Calibration techniques of measuring instruments A **measuring instrument** needs to be checked, using a **calibration** process that	All stander measuring tools and equipment’s

		measures an object with known standard. Any shown deviation for this **measurement** is called a **measurement** uncertainty. The smaller the deviation, the more accurate the **measuring instrument** is **measuring**. • **Record the test** After calibration done record the test results in a safe document for future used or reports.	
LU5. Manage Inventory of tools and equipment.	• Check number of tools and equipment as per record • Report for faulty tools and equipment • Generate demand for defective tools and equipment • Maintain record of all tools and equipment.	First of all check all the tools and equipment's and if observed any of them faulty, then pick and take that tool aside. Enlist all the faulty tools and equipment's and generate demand for new tools/equipment	Paper and pin

Examples and illustrations

https://www.youtube.com/watch?v=41DlPm1858w

https://www.youtube.com/watch?v=ElX6ig8jExM

https://www.youtube.com/watch?v=bjXbZKeLxW8

https://www.youtube.com/watch?v=asLbNVa0oHI

Complete set of electrical tools and equipment’s

Mobile repairing tools and equipment’s

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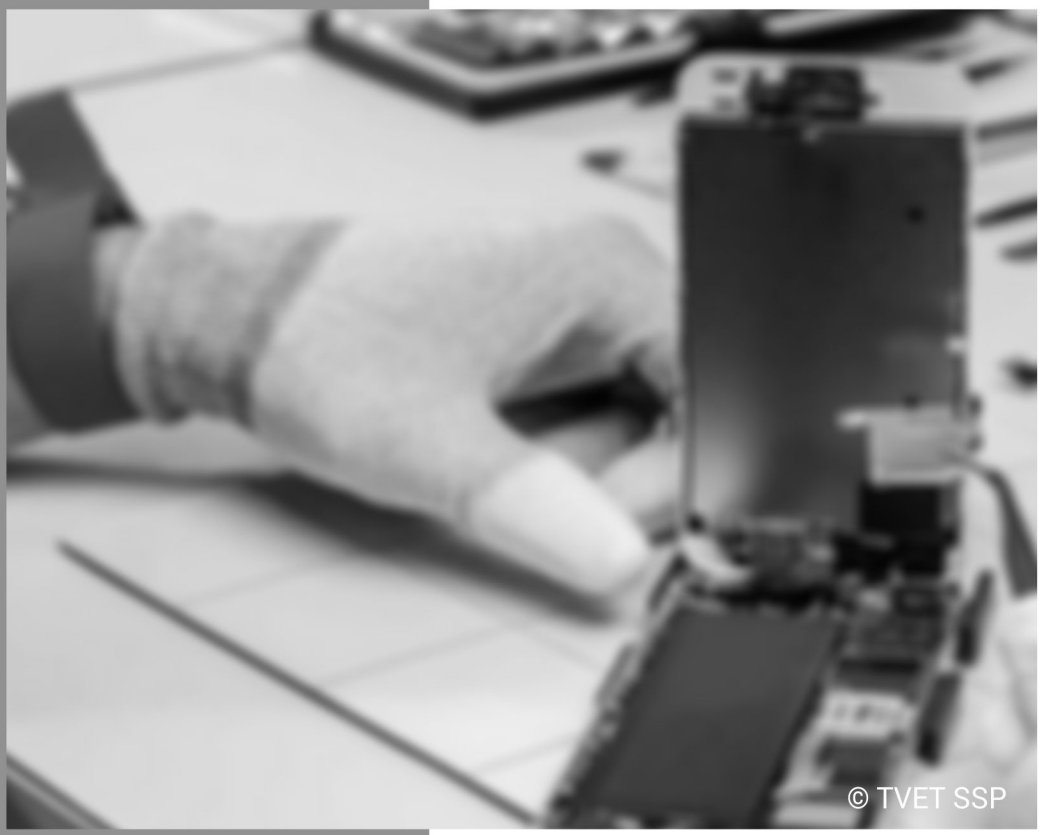


Module-C
LEARNER GUIDE
National Vocational Certificate Level 1

Version 1 - November, 2019

Module C: Measure Basic Electrical & Electronics *Units in Series/Parallel Circuits*.

Objective: This module covers the skills and knowledge required to Measure Electrical Current and Resistance, Perform Voltage Measurement, Measure Electrical Power, Perform-Capacitance and inductance measurement/Test, Perform Low voltage Transformer test and Construct a rectifier circuit

Duration: 150Hours **Theory: 30 Hours** **Practice: 120 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Measure Electrical Current and Resistance	• Arrange tools, material and equipment for measurement of electric current • Construct series arrangement of resistances in a closed loop circuit • Construct Parallel arrangement of resistances in a closed loop circuit • Perform measurement of Electrical resistance in a series / Parallel circuit • Perform measurement of Alternating current in a series / Parallel circuit	An **electric current** is a flow of electric charge. In electric circuits this charge is often carried by moving electrons in a wire. The **electrical resistance** of an electrical circuit ~~conductor~~ is a measure of the difficulty of passing an electric current through that circuit . It explains the relationship between voltage (amount of electrical pressure) and the current (flow of electricity). With more resistance in a circuit, less electricity will flow through the circuit. In direct-current (DC) circuits, Ohm's Law is simple and linear. Suppose a resistance having a value of *R* Ohms carries a current of *I* amperes. Then the voltage across the resistor is equal to the product *IR*. There are two corollaries. If a DC power source providing *V* volts is placed across a resistance of *R* ohms, then the current through the resistance is equal to *V/R* amperes. Also, in a DC circuit, if *V* volts appear across a component that carries *I* amperes, then the	(1) Project board (2) Jumper wires (3) Wiro board (4) 1/4watt resistors (5) Variable resistors (6)

	• Perform measurement of Direct Current in a series / Parallel circuit	resistance of that component is equal to *V/I* Ohms.	
LU2. Perform Voltage Measurement	• Arrange tools, material and equipment for measurement of Voltage • Perform measurement of AC Voltage in a series / Parallel circuit • Perform measurement of DC Voltage in a series / Parallel circuit	**Voltage:** is the pressure from an electrical circuit's power source that pushes charged electrons (current) through a conducting loop, enabling them to do work such as illuminating a light. The international system unit (SI) of voltage is volt. Voltage is either Alternating Current (AC) voltage or Direct Current (DC) voltage. *Alternating Current Voltage* (represented on a digital multimeter by $\tilde{V}$ **)** It reverses direction at regular intervals. Commonly produced by utilities via generators**,** where mechanical energy rotating motion powered by flowing water, steam, wind or heat is converted to electrical energy. *DC Voltage* (represented on a digital multimeter by $\overline{\overline{V}}$ and $\overline{\overline{mV}}$): It travels in a straight line and in one direction only.	(1) Analog multi-meter (2) Digital multi-meter (3) Variable DC power supply (4) Variable AC power supply

		Commonly produced by sources of stored energy such as **batteries.** Sources of DC voltage have positive and negative terminals. Terminals establish polarity in a circuit, and polarity can be used to determine if a circuit is DC or AC. It is commonly used in battery-powered portable equipment (flashlights, cameras). Use of multi-meter for AC and DC voltage The most common piece of electrical test equipment is a meter called the multi-meter. Multi-meters are so named because they have the ability to measure a multiple of variables: voltage, current, resistance, and often many others, some of which cannot be explained here due to their complexity ***Procedural Steps*** There are three different sockets on the multi-meter face into which we can plug our *test leads*. Test leads are nothing more than specially-prepared wires used to connect the meter to the circuit under test. The wires are coated in a color-coded (either black or red) flexible insulation to prevent the user's hands from contacting the bare conductors, and the tips of the probes are sharp, stiff pieces of wire the black test lead *always* plugs into the black socket on the multimeter: the one marked "COM" for "common." The red test lead plugs into either the red socket marked for voltage and resistance, or the red socket marked for current, depending on which quantity you intend to measure with the multimeter The two test leads are plugged into the appropriate	

		sockets on the meter for voltage, and the selector switch has been set for DC “V”. Now place these two leads where voltage is measure	
LU3. Measure Electrical Power	• Arrange tools, material and equipment for measurement of Electrical Power • Perform Measurement of Electrical Power for the series / Parallel circuit	**Electric power** is the rate, per unit time, at which electrical energy is transferred by an electric circuit. The SI unit of power is the watt, one joule per second. **$P=IV$ or $P=I^2R$** In the above equations **P** stands for power **I** stands for current **V** stands for Voltage **Method series** First, we use Ohm's law (V = I × R), to **find** the current through the resistor. The voltage across the resistor is V = 9 V. The resistance of the resistor is R = 100 ?. Then, we can use the **power** rule (P = I × V), to **find** the **power** dissipated by the resistor **Parallel** Total **power** is equal to the sum of the **power** of each component. (This is the same as with series circuits). The same voltage exists across each branch of a **parallel circuit** and is equal to the source voltage. The current through a **parallel**branch	(1) Digital oscilloscope (2) Multi-meter (3) Resistors(different values (4) Project board (5) Jumper wires

		is inversely proportional to the amount of resistance of the branch.	
LU4. Perform capacitance and inductance measurement/Test	• Arrange tools, material and equipment for measurement of Capacitor / Inductor • Perform measurement of Capacitor / Inductor with LCR meter • Perform Open circuit / Short Circuit test for the Capacitor	Charge storing capability of a **capacitor** is called **capacitance** of **capacitor**. **Definition**: **Capacitance of a capacitor** is **defined** as the ratio of the charge stored on any of the plates of **capacitor** to the potential between the plates. **Inductance** of a Coil. **Inductance** is the name given to the property of a component that opposes the change of current flowing through it and even a straight piece of wire will have some **inductance**. **Inductors** do this by generating a self-induced emf within itself as a result of their changing magnetic field. The most common kinds of capacitors are: • Ceramic capacitors have a ceramic dielectric. • Film and paper capacitors are named for their dielectrics. • Aluminum, tantalum and niobium electrolytic capacitors are named after the material used as the anode and the construction of the cathode (electrolyte) • Polymer capacitors are aluminum, tantalum or niobium electrolytic capacitors with conductive polymer as electrolyte Types of Inductors and Applications	(1) Capacitors and inductors of different values (2) LCR meter (3) Project board (4) Jumper wires (5) Multi-meter (6) Logic probs

		• Air Core Inductor. • Iron Core Inductor. • Ferrite Core Inductor. Soft Ferrite. Hard Ferrite. • Iron Powder Inductor. • Laminated Core Inductor. • Bobbin based inductor. • ToroidalInductor. • Multi-layer Ceramic Inductors • **Measuring techniques of capacitance** □ Visually inspect the capacitor. If leaks, cracks, bulges or other signs of deterioration are evident, replace the capacitor. □ Turn the dial to the Capacitance Measurement mode (⊣⊢). The symbol often shares a spot on the dial with another function. In addition to the dial adjustment, a function button usually needs to be pressed to activate a measurement. Consult your multimeter's user manual for instructions. □ For a correct measurement, the capacitor will need to be removed from the circuit. Discharge the capacitor as described in the warning above.	

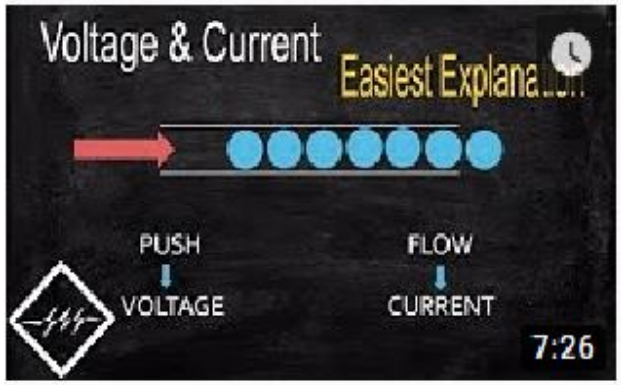
LU5. Perform Low voltage(step-down) transformer test	• Arrange tools, material and equipment for the transformer test • Perform Open circuit / Short Circuit test for the Low voltage Transformer	A transformer is a static electrical device that transfers electrical energy between two or more circuits. A varying current in one coil of the transformer produces a varying magnetic flux, which, in turn, induces a varying electromotive force across a second coil wound around the same core. Electrical energy can be transferred between the two coils, without a metallic connection between the two circuits **Testing techniques of open/short circuit low voltage(step-down) transformer** Transformer are normally test using multi-meter for this purpose set multi-meter on continuity and check for open circuit on both sides of transformer	(1) multi-meter (2) digital logic probe
LU6. Construct rectifier circuit and DC regulated power supply	• Arrange tools, material and equipment for the Rectifier circuit • Construct half wave / Full wave rectifier circuit • Construct bridge arrangement from diodes for full wave rectification • Measure Output voltage of rectifier with Oscilloscope. • Construct 5 volt regulated DC power supply.	**Conductors** Conductors are generally substances which have the property to pass different types of energy. In the following, the conductivity of electricity is the value of interest **Insulators** Those material which have very few free charge (free electrons) to conduct electricity and hence almost nonconductive for electricity is called insulators	(1) Diodes (2) Transformer (3) Digital oscilloscope (4) Variable AC power supply (5) Project board (6) Jumper wires (7) Solder wire (8) Solder iron

	• Measure Output voltage of regulated DC power supply with Oscilloscope.	**Semiconductors** Semiconductors are solids whose conductivity lies between the conductivity of conductors and insulators Conductivity of semiconductors depended on different physical parameters like temperature lights etc. A diode is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power(Mainly used for switching or amplification purposes). It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal	

		Different Types of Diodes. • Backward Diode. • Gunn Diode. • Laser Diode. • Light Emitting Diode. • Photodiode. • PIN Diode. • PN Junction Diode. **Different Types of transistor** There are many types of transistor normally these two types are commonly use (1) Bi polar junction transistor(BJT) (2) Field effect transistor(FET) (3) Uni junction transistor(UJT) A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as *rectification*, there are two types of rectifier circuit (1) Half wave rectifier (2) Full wave rectifier	

		Oscilloscope: An oscilloscope is a laboratory instrument commonly used to display and analyze the waveform of electronic signals. In effect, the device draws a graph of the instantaneous signal voltage as a function of time. **regulated power supply** A regulated power supply is an embedded circuit; it converts unregulated AC (Alternating Current) into a constant DC. ... Its function is to supply a stable voltage (or less often current), to a circuit or device that must be operated within certain power supply limits	

Examples and illustrations



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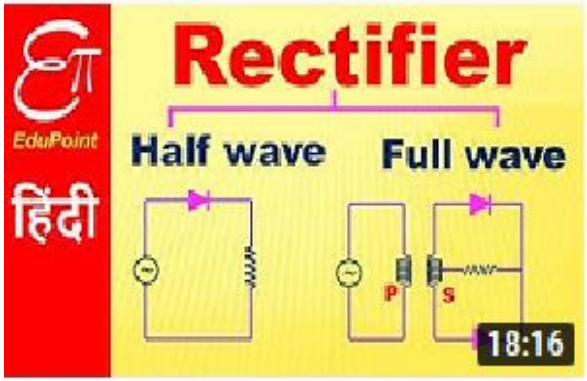

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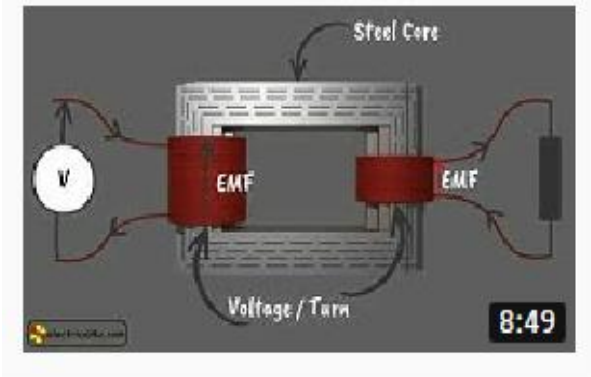

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Summary of the Modules:

Module Title and Aim	Learning Units	Timeframe of modules
Module 1: Adopt Health and Safety **Aim**: The aim of this module is to develop basic knowledge, skills and understanding of professional safety standards need to save yourself and public and private property also perform basic first Add treatment know about fire extinguisher PPE,s aware about company policies and procedure about safety	**LU1:**Ensure personal safety as first priority through the use of personal protective equipment's (PPE) **LU2:**know about first add treatment Maintain First-aid Box **LU3:**know about fire extinguisher and to Maintain Fire Extinguisher **LU4:**know about Attain health & safety training **LU5:** to Ensure Safety of Tools & Equipment **LU6:** To Adopt Environmental Regulation **LU7:** To Adopt company policies & procedures **LU8:** Make yourself Prepare for emergencies **LU9:** To prepare for quick Respond to emergencies	60 hours
Module 2:Maintain tools and equipment's **Aim:** it is important to know about tools and equipment's there proper use maintenance this module also give brief introduction of insulated and non-insulated tools and equipment's while the module also give idea of about importance of inventory of tools and equipment's	**LU1:** Students know about Arrangements of Tools & Equipment **LU2:** Give brief knowledge of Maintain Tool Kit **LU3:** what is Insulate Tools and Equipment and why the are insulated there proper use **LU4:** students should know about Calibrate measuring instruments **LU5:** know about Management of Inventory of tools and equipment.	120 hours

Module Title and Aim	Learning Units	Timeframe of modules
Module 3: Measure Basic Electrical & Electronics Units in Series/Parallel Circuits. **Aim:** This module discuss about basic electrical quantities and there measurements also we study about resistors capacitors, transformers diodes inductors there working functions and checking	**LU1:**Give brief knowledge of Measure Electrical Current and Resistance **LU2:** discuss about Voltage and its Measurement **LU3:**know about procedure of Measurements of Electrical Power **LU4:**Performcapacitance and inductance measurement/Test **LU5:**Perform Low voltage(step-down) transformer test **LU6:** Construct rectifier circuit and DC regulated power supply	60 hours

Frequently Asked Questions

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
3. What are the entry requirements for this course?	The entry requirement for this course is 10 th Grade or equivalent.
4. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-3 in Mobile phone technician program. You shall be able to progress further to National Vocational Certificate Level-4 in Mobile phone technician program; and take admission in a level-5, DAE or equivalent course. In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
5. If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?	You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.
6. What is the entry requirement for Recognition of Prior Learning program (RPL)?	There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.
7. Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?	There are no age restrictions to enter this course or take up the Recognition of Prior Learning program
8. What is the duration of this course?	The duration of the course work is 6 Month. (11 months)
9. What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These

	may vary according to the practices of certain institutes.
10. What is equivalence of this certificate with other qualifications?	As per the national vocational qualifications framework, the level-4 certificate is equivalent to Matriculation. The equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
12. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in Mobile phone technician industries ,workshops and you can start business in Mobile phones in house or internationally.
13. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.
15. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16. How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount.
17. Are there any alternative certificates which I can take up?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
18. What is the teaching language of this course?	The leaching language of this course is Urdu and English.

19. Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
21. Does this certificate enable me to work as freelancer?	You can start your small business of stitching leather garments, gloves of other products. You may need additional skills on entrepreneurship to support your initiative.

Test Yourself (Multiple Choice Questions)

MODULE 1

Please mark the correct one from the given options.

QNO1: Which of the following is correct for risk assessment?

A. It is a good idea to do, but not essential

B. It is a legal requirement and must always be carried out prior to starting the job

C. Only do it if the job is a big job

D. Only needs to be done for hazardous work

QNO2: What does a risk assessment tell you?

A. How to report accidents

B. Where the first aid box is and the first aiders

C. The working hours of the organization

D. How to do the job safely

QNO3: Why should regular inspections of the workplace take place?

A. To check whether the working environment is safe

B. To prepare for a visit from a

C. To check everyone is doing their job

D. To check that all staff are present and

Health Execution inspector	Safety	correct

QNO4: What is a hazard?

A. Anything with the potential to cause harm	C.	Where an accident is likely to cause harm
B. The likelihood of something going wrong	D.	An Accident waiting to happen

QNO5: Accidents are best prevented by:

A. The Health and Safety Executive	C.	Employers inspecting workplaces
C. People being aware of hazards and working in safe manner	D.	The Managing Director

QNO6: What is a Prohibition Notice?

A. When you finish the work you must not start again	C.	The work must stop immediately

B. Work is to stop for that day

D. You must complete this day's work and inform your supervisor

QNO7: Who would you expect to carry out a risk assessment in your workplace?

A. A competent person

C. Health and Safety Executive

B. General operative

D. The client

QNO8: The safety regulations require an employer to provide which of the following?

a. Toilet facilities

c. Hand tools

b. Personal protective equipment

d. Lunch

QNO9: An employer is responsible for which of the following persons?

a. Only for the employer's own personnel.

b. For everyone at the work place and for the local residents

c. Only for the employer's own and hired-in personnel

d. None of them

QNO10: For which actions is the risk of accident the highest?

a. Fashioning steel with an angle grinder.
b. Fashioning steel with a file.
c. Fashioning steel with a hammer
d. None of them

QNO11: Arrange Tools & Equipment it is important to know about

A. Identify ication of tool and Equipment's
B. Prepare list of tools And equipment
C. specifications of tool
D. none of them

QNO12: Before ~~to~~ use of tool make sure that tools are :

A. Insulated
B. Accurate
C. complete
D. all of them

QNO13: The unite of current is

A. volts
B. ohms
C. ampere
D. all of them

QNO14: Voltage is necessary for

A. flow of power
B. flow of current
C. flow of resistance
D. flow of resistance

QNO15: The opposing capacity of materials against the current flow is

a) Conductance

b) Inductance
c) Susceptance
d) Resistance

Answers Key	
Number	Correct Answer
1	B
2	D
3	A
4	A

5	C
6	B
7	A
8	B
9	B
10	A
11	A
12	D
13	C
14	B
15	D

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