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Islamabad

FAN MANUFACTURING TECHNICIAN

LEARNER GUIDE

National Vocational Certificate Level 2

Version 1 - October, 2019

NAVTTC

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Contents

Introduction

Welcome to your Learner's Guide for the *Assistant Electrician* Programme. It will help you to complete the programme and to go on to complete further study or go straight into employment.

The *Assistant Electrician* programme is to engage young people with a programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The programme 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 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**:
  - This contains the summary of the modules that make up your learner's guide
- **Frequently asked questions**:
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. 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.

Modules

Module 5: 072200901 Measure basic electrical units in series and parallel circuits

Objective of the module: The objective of this module is to develop knowledge, skills and understanding required to measure basic electrical units in series and parallel circuits

Duration: 100 hours Theory: 20 hours Practical: 80 hours

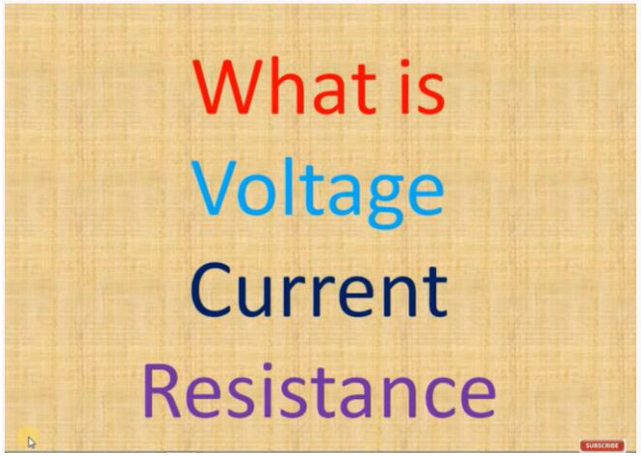
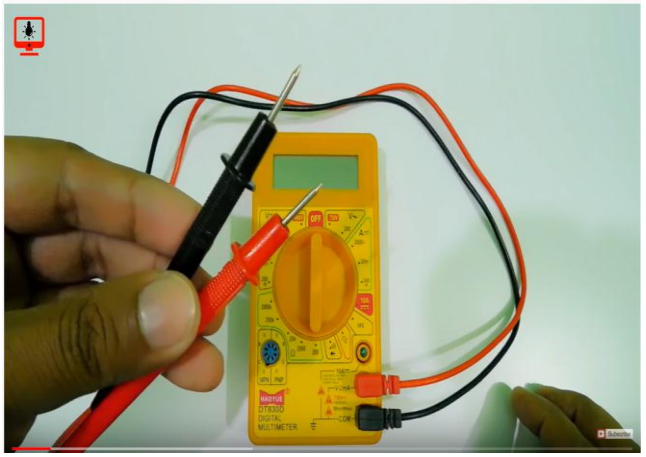
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Measure electrical current and resistance	**The trainee will be able to:** • Arrange tools, material and equipment for measurement of electric current • Construct series arrangement of resistances in a closed loop circuit • Construct parallel arrangement of resistances in a closed loop circuit • Perform measurement of electrical resistance in a series or parallel circuit • Perform measurement of alternating current in a series or parallel circuit • Perform measurement of direct current in a series / parallel circuit	• Define electric current (AC and DC) • Understand function of ampere meter (AC and DC) • Define resistance • Differentiate between series and parallel circuits • Understand function of ohm meter and ampere meter	• Ampere meter • Ohm meter • Resistance decade box • AC/DC supplies • Multimeter
LU2: Perform voltage measurement	**The trainee will be able to:** • Arrange tools, material and equipment for measurement of voltage • Perform measurement of AC Voltage in a series or parallel circuit • Perform measurement of DC voltage in a series or parallel circuit	• Define voltage • Knowledge about measurement of voltage in series and parallel circuits (AC and DC) using volt meter	• Volt meter • Series and parallel circuits • AC/DC power supply
LU3:	**The trainee will be able to:**	• Define electric power	• Watt meter

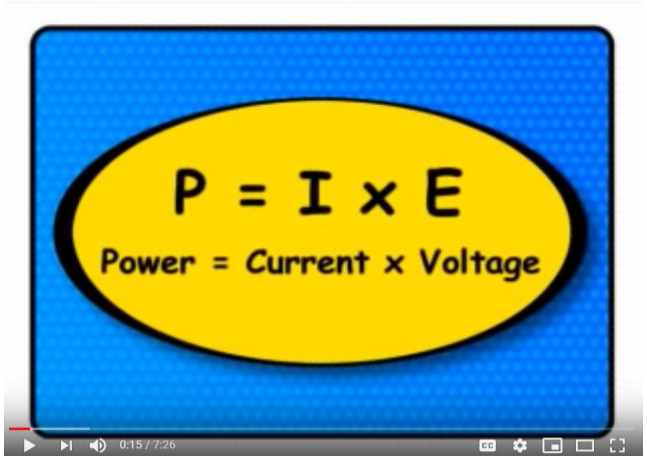
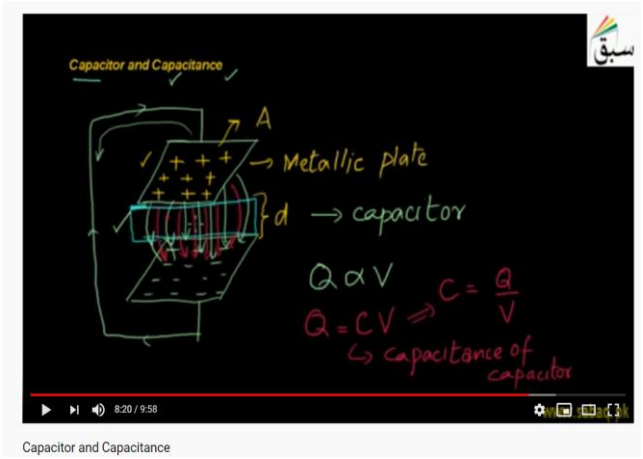
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
Measure electrical power	• Arrange tools, material and equipment for measurement of electrical power • Perform measurement of electrical power for the series or parallel circuit	• Knowledge about measurement of electric power in series and parallel circuits using watt meter	• AC/DC power supply • Different types of load (lamp, fan, electric iron, single phase motor)
LU4: Perform capacitor and inductor measurement	**The trainee will be able to:** • Arrange tools, material and equipment for measurement of capacitor or inductor • Perform measurement of capacitor or inductor with LCR meter • Perform open circuit or short circuit test for the capacitor	• Define capacitor and capacitive reactance • Define inductor and inductive reactance • Knowledge about measurement of capacitance and inductance by LCR meter • Describe capacitor open circuit and short circuit testing procedure	• Capacitors of different values • Inductors of different values • LCR meter • Ohm meter • Multimeter
LU5: Perform low voltage transformer test	**The trainee will be able to:** • Arrange tools, material and equipment for the transformer test • Perform open circuit or short circuit test for the low voltage transformer	• Understanding about low voltage transformers and their step up and step down functions • Describe transformer open circuit and short circuit testing procedure	• Low voltage transformer • Ampere meter • Volt meter • Ohm meter • Multimeter
LU6: Construct rectifier circuit	**The trainee will be able to:** • Arrange tools, material and equipment for the rectifier circuit • Construct half wave and full wave rectifier circuit • Construct bridge arrangement from diodes for full	• Knowledge about rectifier (diode) • Understanding about half wave and full wave (centre tapped and bridge) rectifier circuits	• Step down transformer • Capacitors of different values • Diodes of different values • Resistors of different

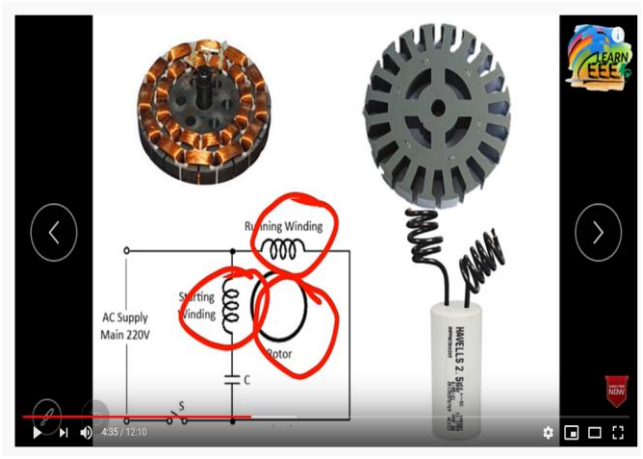
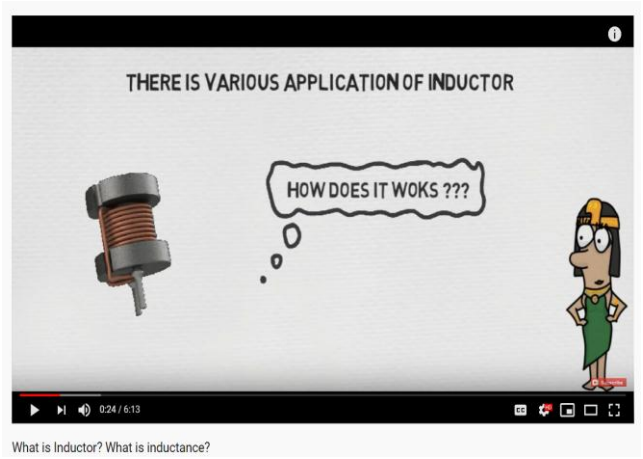
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	wave rectification • Measure output voltage of rectifier with oscilloscope	• Understanding about usage of oscilloscope for frequency and voltage measurement	values • Oscilloscope • Bread board • AC/DC Power supply

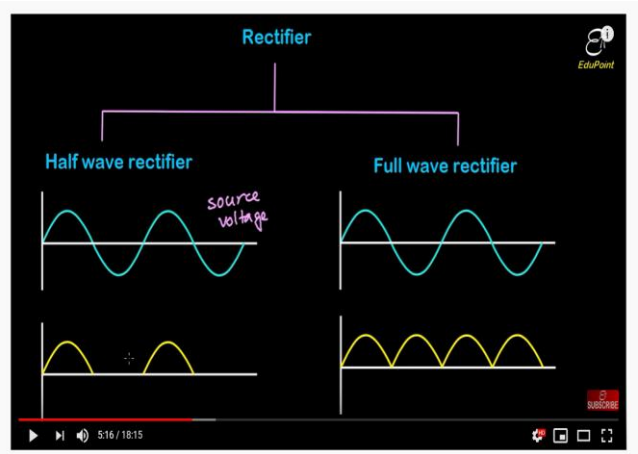
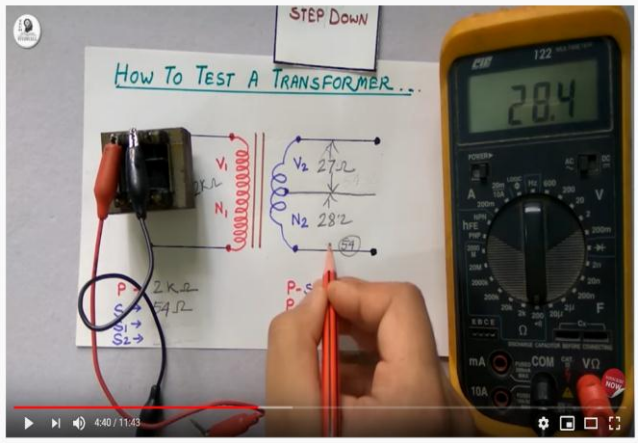
Examples and illustrations

VIDEOS:

	What is voltage, current, resistance? https://www.youtube.com/watch?v=8j0BxGl4_Z0
	How to use A Digital Multimeter Measure Voltage, Resistance, Current? https://www.youtube.com/watch?v=Mzyw2sotpMU

	Electrical power measurement https://www.youtube.com/watch?v=cfd-QOVa8pw
 Capacitor and Capacitance	Capacitor and capacitance introduction https://www.youtube.com/watch?v=jpU4uoM1Xdo

	Why Capacitor Used in Ceiling Fan? https://www.youtube.com/watch?v=nFZRLuS39XY
	What is inductor and inductance? https://www.youtube.com/watch?v=2VEUHfpbi64

	Half wave and full wave rectifier circuit explanation https://www.youtube.com/watch?v=yaUMBKjkOjg
	Transformer Testing with Multimeter https://www.youtube.com/watch?v=D0OQvuux6CE

(How to use Multimeter for voltage, current and resistance measurement)

http://www.dynamoelectricinc.com/2017/12/11/use-multimeter-measure-voltage-current-resistance/

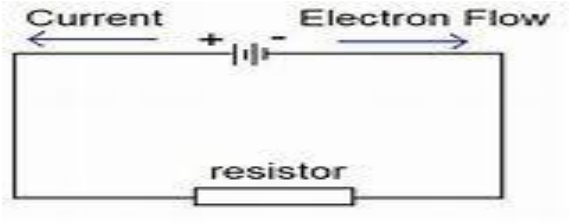
Explanation of voltage, resistance and ohm's law

https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law/all

LU1: Measure electrical current and resistance.

Electrical current: The SI unit of **electric current** is the ampere, which is the flow of **electric** charge across a surface at the rate of one coulomb per second. The ampere (symbol: A) is an SI base unit: **Electric current** is **measured** using a device called an ammeter.:

RESISTANCE.



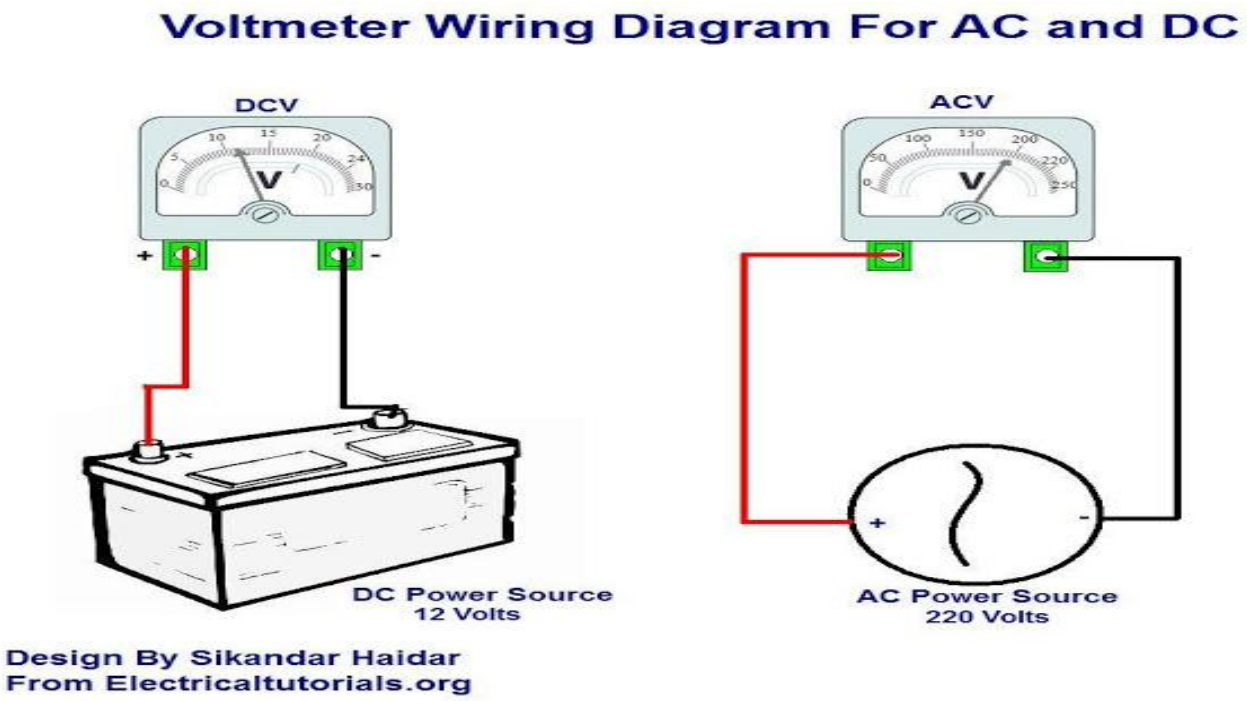
The electrical resistance is defined as the **difficulty occurs in the flow of electrons**. The conductor has free electrons. When the voltage or potential difference is applied across the conductor, the free electrons start moving in the particular direction. It is measured in ohms by using an ohm meter.
Reference: circuitglobe.com/electrical-resistance.html

LU2: Perform voltage measurement

Voltage (electric pressure) is a potential difference between two points for the flow of electron.

It is also called electro motive force. Its unit is volt **(v).**

Voltages are measured by volt meter.



Reference: principals of electrical engineering by engr ghulam mohau-ud-din

LU3: Measure electrical power

The rate of work done is called electric power.

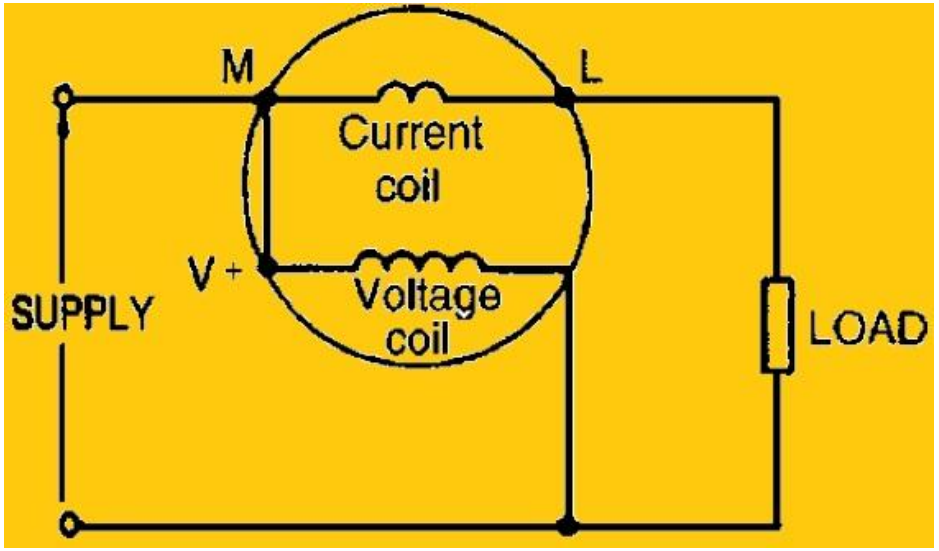
OR

The product of voltage and current is called electric power.

It is denoted by “P”

Its unit is watt and it is measured by watt meter

Watt meter connection

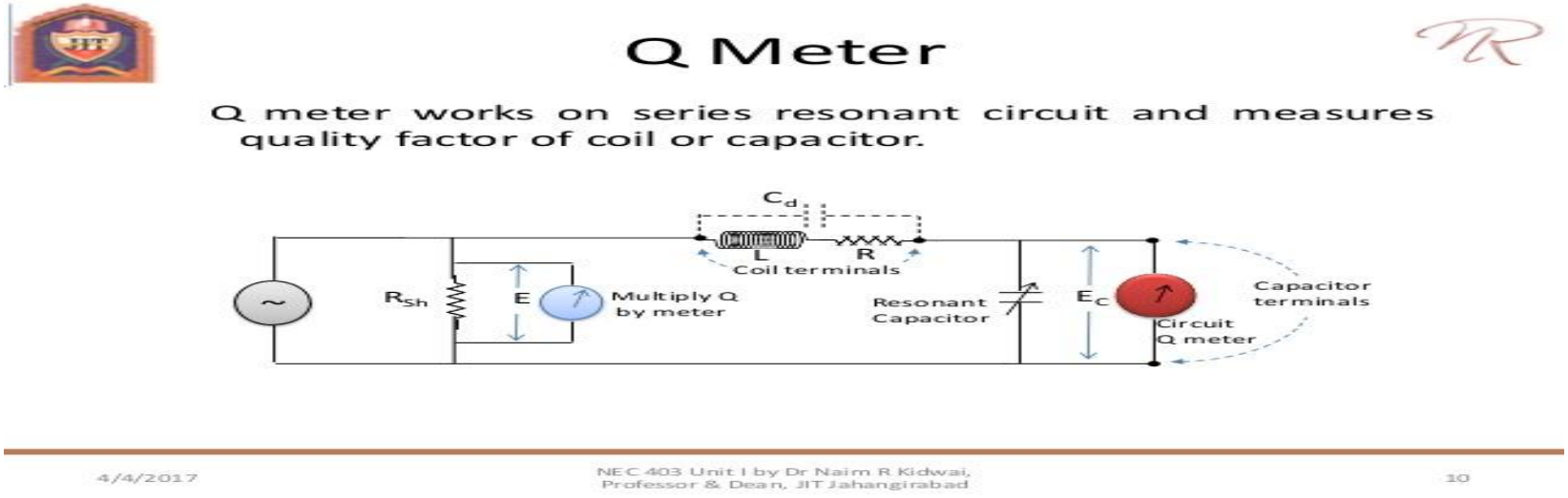


Reference: principals of electrical engineering by engr ghulam mohau-ud-din

LU4: Perform capacitor and inductor measurement

What is a Capacitor?

The capacitor is an electrical component that is made up of two conductors alienated by an insulator. When a potential difference is supplied to both the terminals, an electric field is formed and electric charges are stored. Based on the characteristics, the capacitor is widely used to build electronic circuits. As a die electric substance, any non-conducting substance can be used. But, some of the preferred dielectric materials are Teflon, Mylar, porcelain, mica and cellulose. A capacitor is defined based on the material chosen like electrode or dielectric. The dielectric material is mainly used to help in storing the electrical energy. The capacitor's value can be determined by the size of the terminals, the distance between the two terminals and the kind of material used.



https://**en.wikipedia.org**/wiki/Electrical_impedance

What is an inductor?

An inductor or coil or choke is a two terminal device which is used to build various circuits. The main function of an inductor is used to store energy in a magnetic field. It consists of a wire, generally twisted into a coil. When a current flow through this coil, then temporarily stores the in the coil. An absolute inductor is equivalent to a short circuit for direct current, and grants an opposed force to alternating current that depends on the current's frequency. The opposition to a flow of current of an inductor is associated with the frequency of the flowing current through it. Sometimes, these devices indicated to as "coils" because the most of the inductor physical construction is designed with coiled sections of wire.

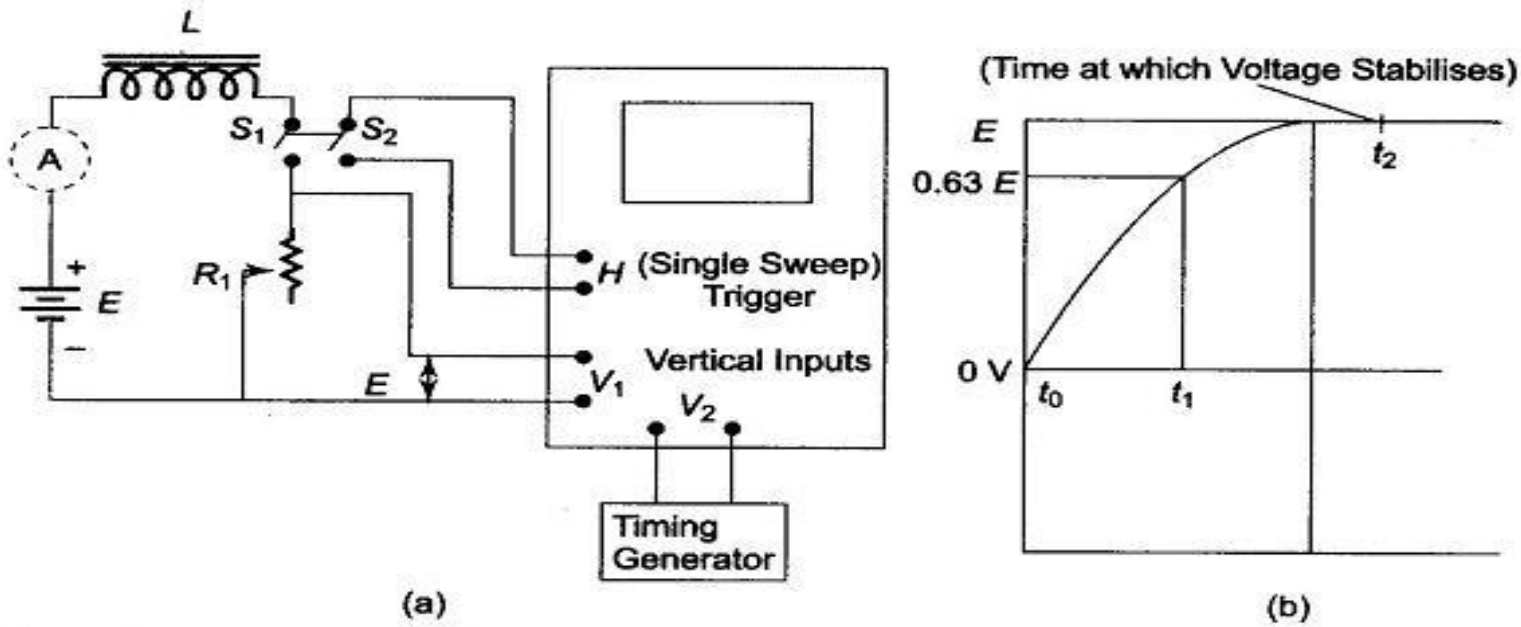
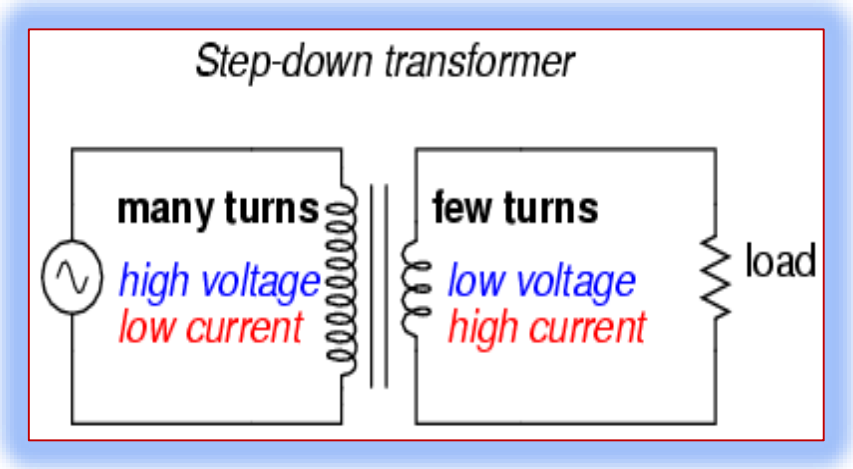


Fig. 7.39 (a) Setup for Inductance Measurement (b) Display Curve

https://en.wikipedia.org/wiki/Electrical_impedance

LU5: Perform low voltage transformer test

A transformer which converts high voltages (220) into low voltages (6-24) is called low voltage transformer.



Reference: principals of electrical engineering by engr. ghulam mohau-ud-din

LU6: Construct rectifier circuit

A rectifier is an electrical device that converts alternating current, which periodically reverses direction, to direct current, which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches

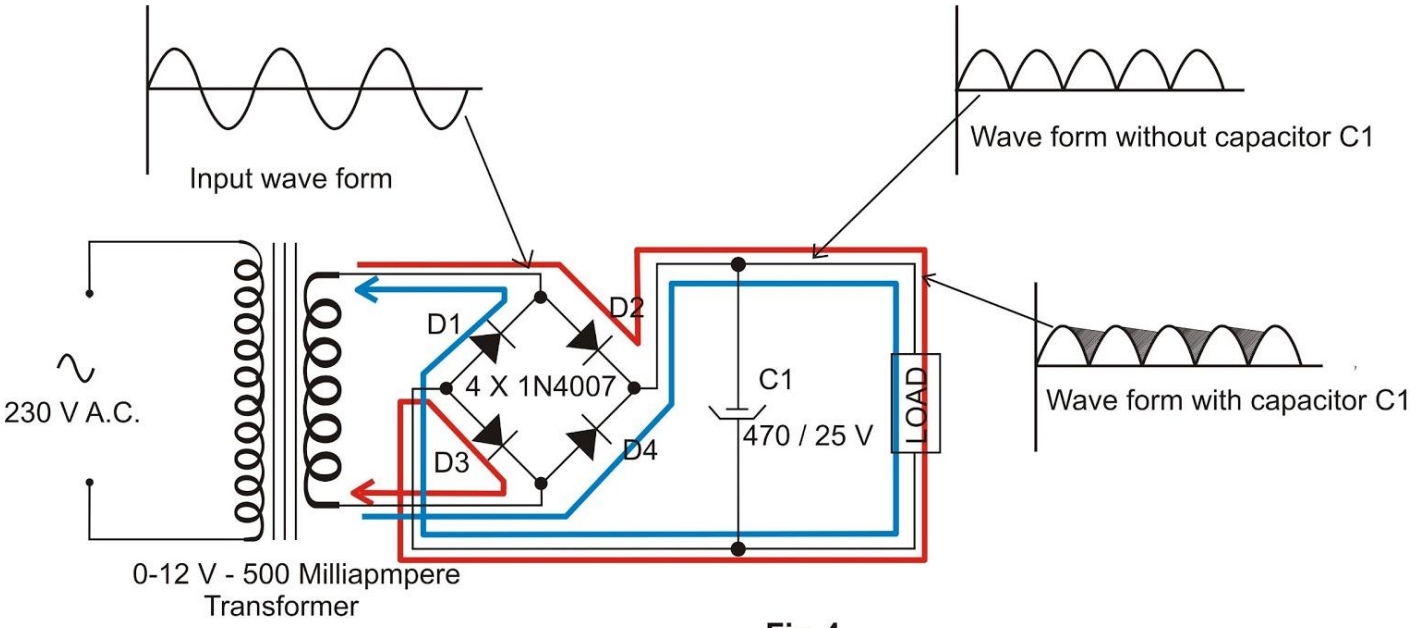


Fig-4

Module summary

Module Title and Aim	Learning Units	Timeframe of modules
Module 5: Measure basic electrical units in series and parallel circuits. **Aim:** The aim of this module is to develop knowledge, skills and understanding required to measure basic electrical units in series and parallel circuits	**LU1:** Measure electrical current and resistance **LU2:** Perform voltage measurement **LU3:** Measure electrical power **LU4:** Perform capacitor and inductor measurement **LU5:** Perform low voltage transformer test **LU6:** Construct rectifier circuit	100 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 8th 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 Fan Manufacturing Technician (Winder). You shall be able to progress further to National Vocational Certificate Level-4 in Fan Manufacturing Technician (Supervisor); 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 220 Hours
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 criteria for equivalence and 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 the fan manufacturing industries in the winding shop to assist winder
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 or other products. You may need additional skills on entrepreneurship to support your initiative.

Test Yourself (Short & Multiple Choice Questions)

1.	What is resistance?	
2.	Which instrument is used to measure electrical resistance?	
3.	What is current?	
4.	What is voltage?	
5.	What is electric power?	
6.	Which instrument is used to measure electric power?	
7.	What is rectifier?	
8.	What is capacitor?	
9.	What are the basic three electrical quantities? a) Resistance, Capacitance, Inductance b) Power, Voltage, Conductance c) Voltage, Current, Resistance(Impedance) d) Current, Reluctance, Inductance	
10.	In case of Short Circuit, _____ Current will flow in the Circuit. a) Zero. b) Very Low c) Normal d) Infinite	
11.	A 240V, 60W lamp has a working resistance of: a) 1400Ω	

	b) 60Ω c) 960Ω d) 325Ω	
12.	Voltage drop is the: a) Maximum potential b) Potential difference between two points c) Voltage produced by a source d) Voltage at the end of a circuit	
13.	SI unit of charge is: a) coulomb b) ampere c) voltage d) watt	

National Vocational and Technical Training Commission (NAVTTC)

Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
+92 51 9044 322
+92 51 9044 322
info@navttc.org
www.navttc.org