



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



19EET101 / BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

I YEAR / I SEMESTER

UNIT-I: ELECTRICAL CIRCUITS AND MEASUREMENTS

MEASURING INSTRUMENTS - INTRODUCTION



TOPIC OUTLINE



- Introduction
- Types of Instruments
 - M&I in EE
- Operation of Indicating Instruments
 - Evaluation





INTRODUCTION

- **Measurement:**

It is the act or result of **quantitative** comparison between a predefined standard and an unknown quantity.



- **Instrument:**

It is a device or mechanism used to determine the **present value** of a quantity under observation.



TYPES OF INSTRUMENTS

- **Classification based on the nature of operation:**

1. Indicating instruments
2. Recording instruments
3. Integrating instruments



➤ **Indicating instrument** indicate the instantaneous value of quantity under measurement.



TYPES OF INSTRUMENTS

- **Recording instrument** give a continuous record of variation of quantity being measured (such as voltage, frequency, power etc.). Recorders are commonly used in power plants, process industries.
- **Integrating instrument** is one which takes into consideration the period or the time over which the quantity is supplied. e.g. ampere-hour meter, energy meter.



TYPES OF INSTRUMENTS

- According to display, classified into Analog or Digital instruments:
 1. Analog instruments
 2. Digital instruments





TYPES OF INSTRUMENTS

- **Analog information** is continuous and stepless function of time.

Analog instruments are easy to understand, calibrate and maintain.

- **Digital information** is in form of discrete pulses or steps.

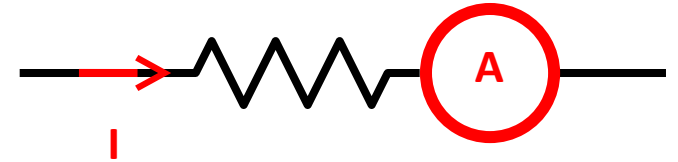
Digital instruments have higher resolution, high readability.



MEASUREMENTS IN EE

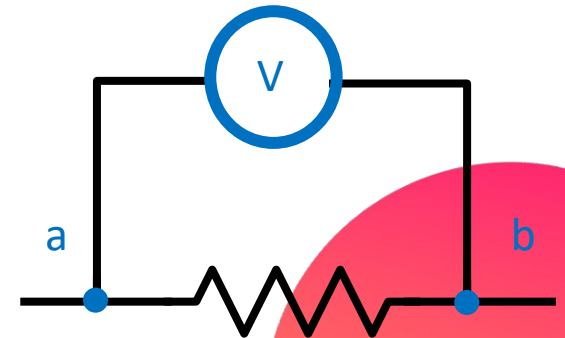
Ammeter:

- measures current (A)
- connected **in series**
(current must go through instrument)



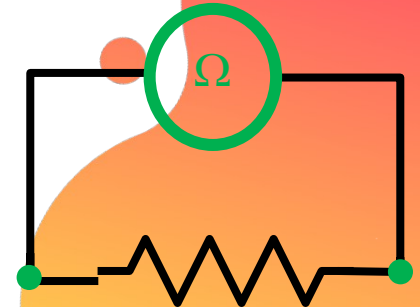
Voltmeter:

- measures potential difference (V)
- connected **in parallel**



Ohmmeter:

- measures resistance of an isolated resistor (not in a working circuit)





INSTRUMENTS IN EE

- **Various instruments used in practice:**

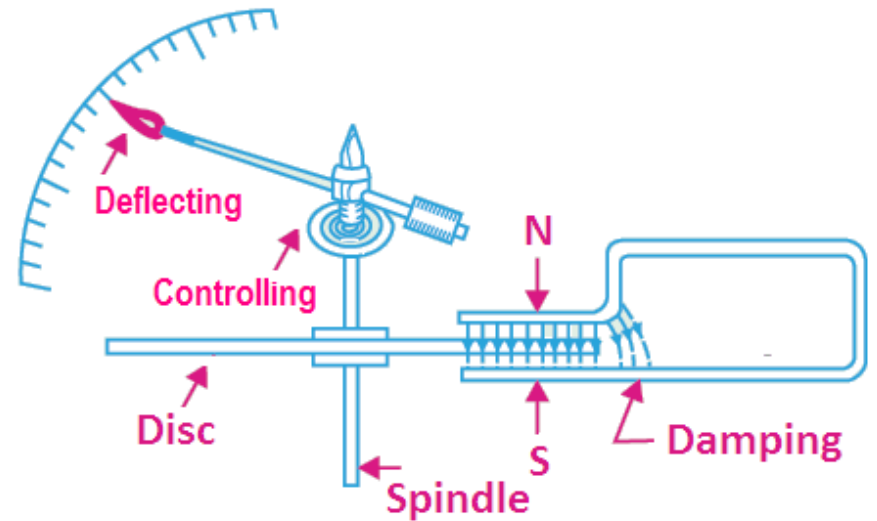
Sr. No.	Name of the instruments	Quantity measured
1.	Voltmeter	AC or DC voltage
2.	Ammeter	AC or DC current
3.	Wattmeter	AC power (Watt)
4.	Energy meter	Energy (Watt hour)



OPERATION OF INDICATING INSTRUMENTS

Satisfactory operation of any indicating instrument, - three torques must act together appropriately:

1. Deflecting torque
2. Controlling torque
3. Damping torque





OPERATION OF INDICATING INSTRUMENTS



1. Deflecting Torque:

- It causes the moving system of the instrument to move from its position of rest.
- Deflecting torque is produced by using any one of the following effects of electric current:
 - i. Magnetic effect
 - ii. Electromagnetic induction effect
 - iii. Heating effect
 - iv. Electrostatic effect



OPERATION OF INDICATING INSTRUMENTS

2. Controlling Torque:

- It **limits the movement** of moving systems. It also ensures that magnitude of deflection is always the same for the given value of input quantity under measurement.
- Controlling torque acts in the opposite direction to that of the deflecting torque.
- At steady state,

Deflecting torque = Controlling torque



OPERATION OF INDICATING INSTRUMENTS

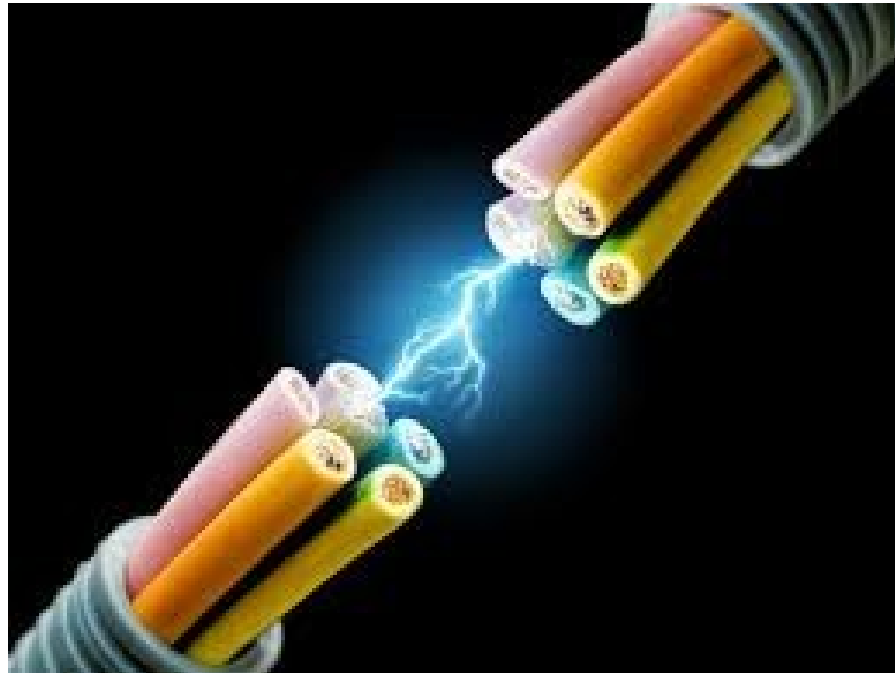


3. Damping Torque:

- Deflecting torque, pointer moves in one direction while for controlling torque pointer moves in opposite direction.
- Due to these opposite torques, the **pointer may oscillate** in the forward and backward direction
- Damping torque brings the moving system to rest quickly in its final position.
- If moving system is at rest, damping torque is zero.



RECAP....



...THANK YOU