



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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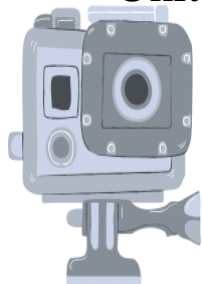


DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**COURSE NAME: 19EET205/ MEASUREMENTS AND
INSTRUMENTATION**

II YEAR / IV SEMESTER

Unit 1 –MEASUREMENT OF VOLTAGE AND CURRENT



Topic: AMMETERS , VOLTMETERS

19EET205/M&I/Mrs.B.CHRISTYJULIET/ AP/EEE

01/15



Course outcome



Compare AC and DC meters along with its internal construction



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- **Various instruments used in practice:**
 - Following instruments used in day to day life in order to measure different quantity.

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

- For satisfactory operation of any indicating instrument, following three torques must be provided together appropriately:

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



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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



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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



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3. Damping Torque:

- Due to deflecting torque, pointer moves in one direction while due to controlling torque pointer moves in opposite direction.
- Due to these opposite torques, the pointer may oscillate in the forward and backward direction if the damping torque is not present.
- Damping torque brings the moving system to rest quickly in its final position.
- Damping torque acts only when the moving system is actually moving. If moving system is at rest, damping torque is zero.



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- **Critical Damping:**

- Depending on the magnitude of torque, damping may be classified as underdamped, overdamped or critically damped. Effect of damping on the deflection of the instrument is shown in fig.(1).
- If the instrument is underdamped, the pointer will come to rest after some oscillations.
- If the instrument is overdamped, pointer takes considerable time to obtain its final deflected position.
- If the damping is critical, without oscillation and in short time the pointer reach its final steady position.



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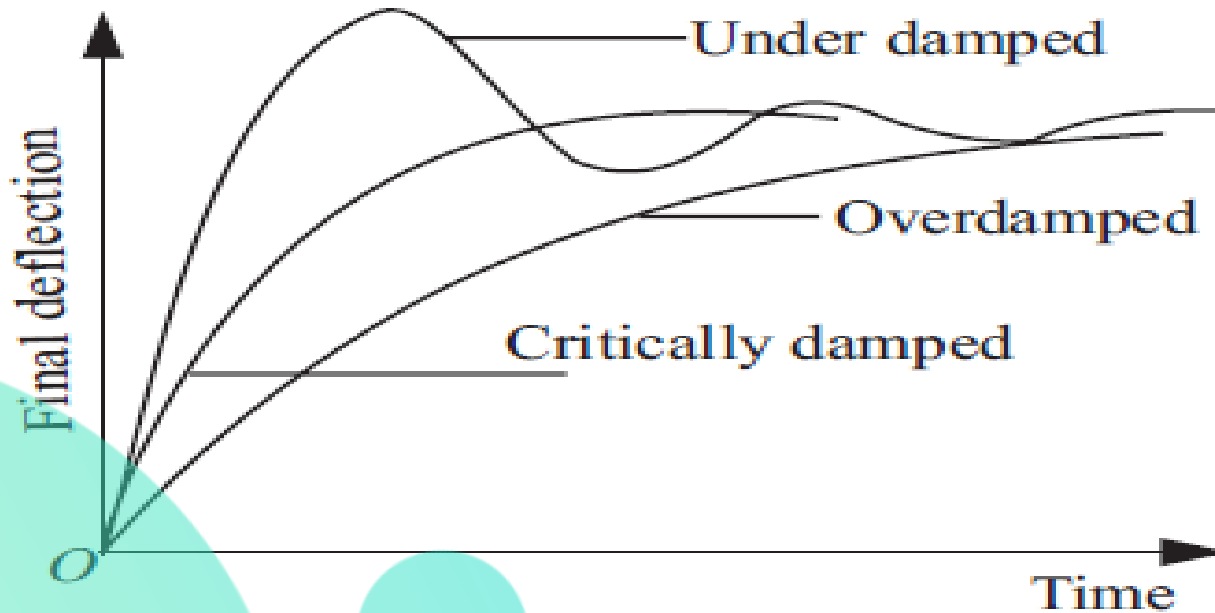


Fig.(1): Effect of damping on the deflection of instrument



Connection Diagrams

- **Connection diagram of an Ammeter:**
 - Ammeter is used for the measurement of current.
 - An ammeter is always connected in series with the load, the current through which is to be measured as shown in fig.(1).
 - Since the resistance offered by an ammeter is very small, its introduction in series with load does not alter the circuit conditions.



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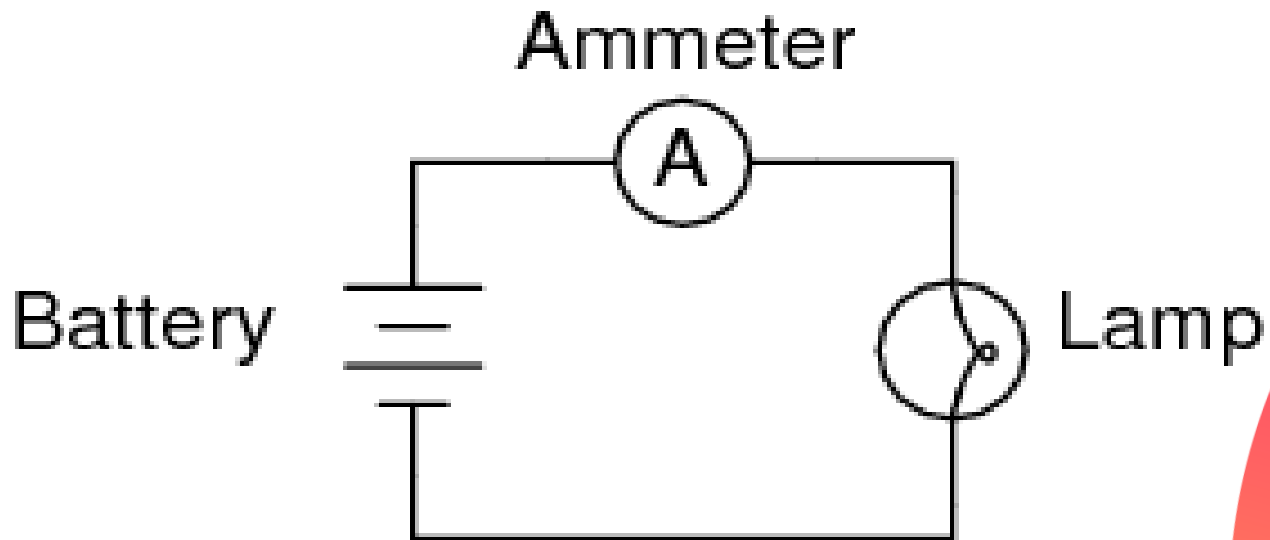


Fig.(1): connection of an ammeter



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- **Connection diagram of a voltmeter:**
 - A voltmeter is used for the measurement of voltage (potential difference).
 - So it is connected across the points between which the potential difference is to be measured.
 - A voltmeter has a high resistance, so it draws very small current. The connection of a voltmeter is as shown in fig.(2).



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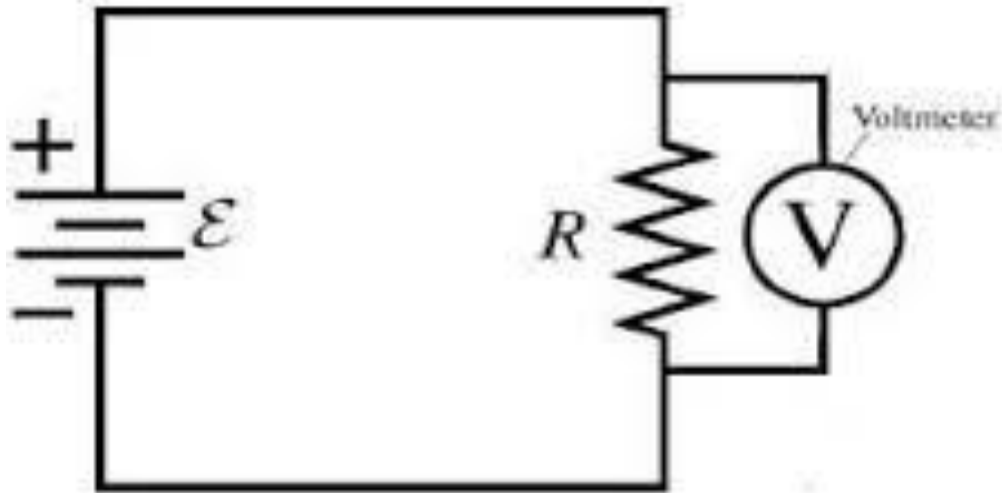


Fig.(2): connection diagram of voltmeter



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- Comparison of Ammeter and Voltmeter:

Sr.No.	Parameter	Ammeter	Voltmeter
1.	Quantity measured	Current	Voltage
2.	Connected in	Series with load	Parallel with load
3.	Resistance	Low	High
4.	Connection Diagram	Refer fig.(1)	Refer fig.(2)



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- **Types of instruments used for Voltmeter and Ammeters:**
 - The practically used ammeters and voltmeters can be of the following two types:
 1. Permanent ,magnet moving coil (PMMC) type
 2. Moving iron (MI) type
 3. Hot wire type
 4. Induction type