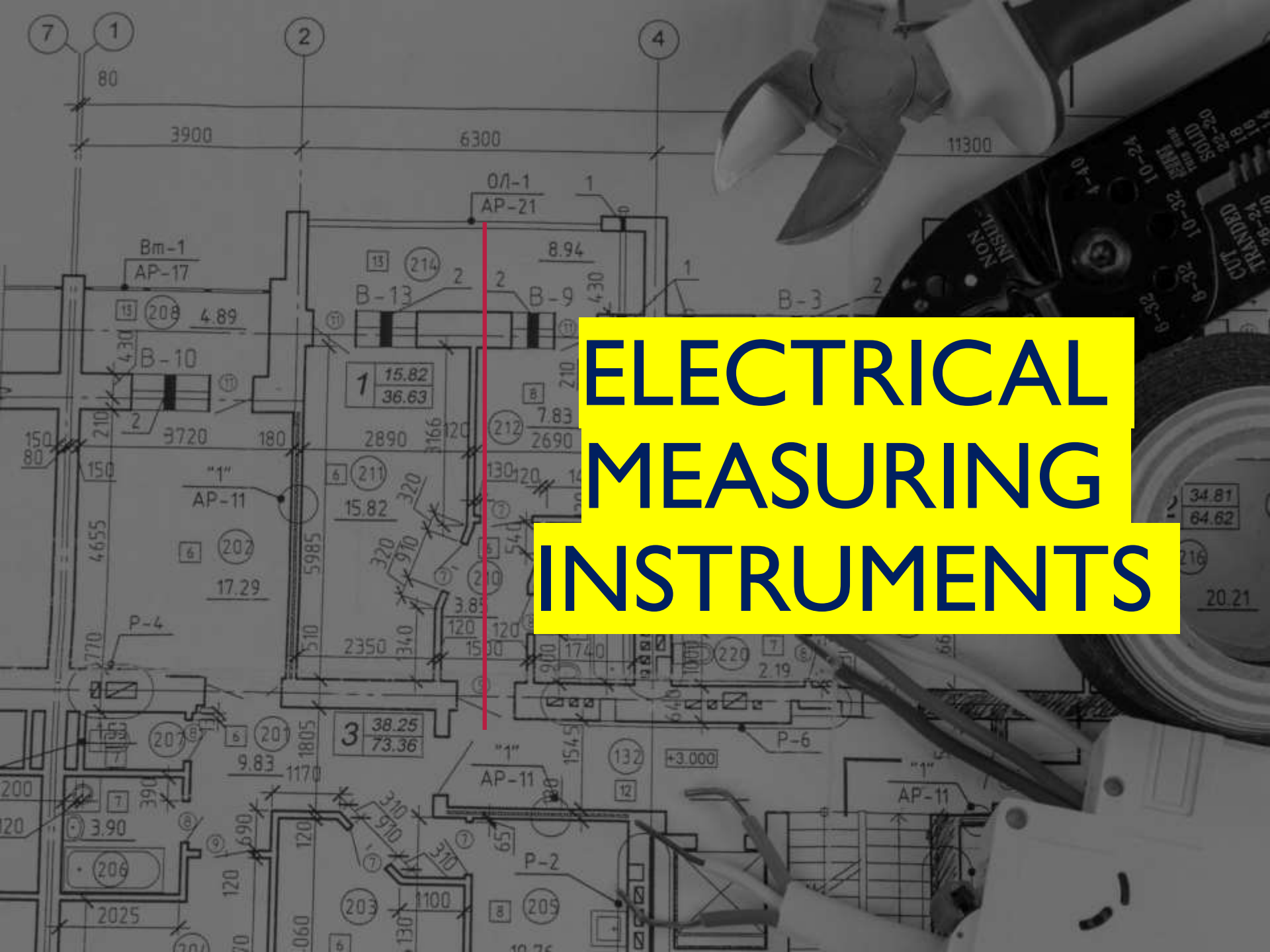
ELECTRICAL
MEASURING
INSTRUMENTS

2 IMPORTANCE OF ELECTRICAL MEASUREMENT

- Electrical measurement helps in analyzing circuit performance.
- It ensures equipment operates within safe limits.
- It helps in detecting faults and errors.
- Without measurement, electrical control is not possible.

3 ELECTRICAL QUANTITIES MEASURED

- Current indicates flow of electric charge.
- Voltage provides electrical pressure.
- Resistance opposes current flow.
- Power shows rate of energy use.
- Energy shows total electrical work done.

4 UNITS OF MEASUREMENT

- Current is measured in amperes.
- Voltage is measured in volts.
- Resistance is measured in ohms.
- Power is measured in watts.
- Energy is measured in kilowatt-hours.

5 CLASSIFICATION OF INSTRUMENTS

- Instruments are classified based on function and usage.
- This helps in selecting proper instruments.
- Main types include absolute and secondary instruments.
- Secondary instruments are most commonly used.

6 ABSOLUTE INSTRUMENTS

- Absolute instruments give value using physical constants.
- They do not require calibration.
- Used mainly in laboratories.
- Not suitable for routine use.

7 SECONDARY INSTRUMENTS

- Secondary instruments give direct readings.
- They require calibration.
- They are easy to use.
- Examples include ammeter and voltmeter.

TYPES OF SECONDARY INSTRUMENTS

- Indicating instruments show instant readings.
- Recording instruments record values over time.
- Integrating instruments measure total quantity.
- Each type has specific applications.

9 INDICATING INSTRUMENTS

- Indicating instruments use pointer and scale.
- They show immediate value.
- Used in panels and labs.
- They are simple and quick to read.

10 RECORDING INSTRUMENTS

- Recording instruments record variations continuously.
- They are used in power stations.
- They help analyze system behavior.
- Useful for long-term monitoring.

11 INTEGRATING INSTRUMENTS

- Integrating instruments measure total quantity over time.
- They do not show instant value.
- Energy meter is an example.
- Used mainly for billing.

12 MAIN PARTS OF MEASURING INSTRUMENTS

- Deflecting system causes pointer movement.
- Controlling system restricts movement.
- Damping system avoids oscillation.
- Indicating system displays the reading.

13 DEFLECTING SYSTEM

- It produces deflection when current flows.
- It converts electrical energy into motion.
- It works on magnetic or electrostatic effect.
- It decides sensitivity.

14 CONTROLLING SYSTEM

- It controls pointer movement.
- It brings pointer back to zero.
- Spring and gravity controls are used.
- It ensures stable readings.

15 DAMPING SYSTEM

- It prevents pointer oscillation.
- It helps pointer settle quickly.
- Air friction and eddy current are common.
- It improves accuracy.

16 AMMETER

- Ammeter measures electric current.
- It is connected in series.
- It has very low resistance.
- It prevents voltage drop.

17 CONSTRUCTION OF AMMETER

- It uses moving coil or moving iron system.
- It has shunt resistance.
- It has a pointer and scale.
- It shows current directly.

18 VOLTMETER

- Voltmeter measures voltage.
- It is connected in parallel.
- It has high resistance.
- It draws very little current.

19 CONSTRUCTION OF VOLTMETER

- It is similar to ammeter.
- It uses high series resistance.
- It protects from excess current.
- It displays voltage safely.

20 AMMETER VS VOLTMETER

- Ammeter measures current.
- Voltmeter measures voltage.
- Ammeter has low resistance.
- Voltmeter has high resistance.

21 GALVANOMETER

- It detects small currents.
- It is highly sensitive.
- It is used in laboratories.
- It cannot measure large currents.

22 CONVERSION OF GALVANOMETER

- Using shunt converts it to ammeter.
- Using series resistance converts it to voltmeter.
- This increases usefulness.
- It is a basic engineering concept.

23 WATTMETER

- Wattmeter measures electrical power.
- It works in AC and DC circuits.
- It has current and voltage coils.
- It measures real power.

24 ENERGY METER

- It measures electrical energy consumption.
- It is used in homes and industries.
- It records energy over time.
- It is used for billing.

25 TYPES OF ENERGY METERS

- Single-phase meters are used in homes.
- Three-phase meters are used in industries.
- Digital meters are accurate.
- Smart meters enable monitoring.

26 MOVING COIL INSTRUMENTS

- They are used only for DC.
- They are very accurate.
- They have uniform scale.
- They are costly.

27 MOVING IRON INSTRUMENTS

- They are used for AC and DC.
- They are rugged.
- They have non-uniform scale.
- They are used in panels.

DIGITAL MEASURING INSTRUMENTS

- They display readings digitally.
- They are highly accurate.
- They reduce human error.
- They are widely used.

ADVANTAGES OF DIGITAL INSTRUMENTS

- They have high accuracy.
- They are easy to read.
- They eliminate parallax error.
- They are compact.

DISADVANTAGES OF DIGITAL INSTRUMENTS

- They are expensive.
- They require power supply.
- They are sensitive.
- They are complex.

ANALOG MEASURING INSTRUMENTS

- They use pointer and scale.
- They are simple.
- They are cheaper.
- They are good for learning.

32 ERRORS IN MEASUREMENT

- Instrumental errors occur due to defects.
- Observational errors are human errors.
- Environmental errors are due to conditions.
- Errors must be minimized.

33 CALIBRATION

- It compares instrument with standard.
- It ensures accuracy.
- It is done regularly.
- It is important in industries.

34 SAFETY PRECAUTIONS

- Never overload instruments.
- Use correct range.
- Ensure insulation.
- Handle carefully.

35 APPLICATIONS

- Used in laboratories.
- Used in industries.
- Used in power stations.
- Used in research.

ROLE IN ENGINEERING EDUCATION

- It improves practical understanding.
- It builds confidence.
- It links theory and practice.
- It prepares students for industry.

BENEFITS OF ACCURATE MEASUREMENT

- It ensures safety.
- It improves efficiency.
- It reduces losses.
- It improves performance.

38 SUMMARY

- Ammeter measures current.
- Voltmeter measures voltage.
- Wattmeter measures power.
- Energy meter measures energy.

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THANK YOU