

1. **Name the different essential torques in indicating instruments. (Remembering, CO1)**
  - Deflecting torque
  - Controlling torque
  - Damping torque
2. **Name the types of instruments used for making voltmeter and ammeter. (Remembering, CO1)**
  - PMMC type
  - Moving iron type
  - Dynamometer type
  - Hot wire type
  - Electrostatic type
  - Induction type.
3. **State the advantages of PMMC instruments. (Remembering, CO1)**
  - Uniform scale.
  - No hysteresis loss
  - Very accurate
  - High efficiency.
4. **State the disadvantages of PMMC instruments. (Remembering, CO1)**
  - Cannot be used for ac m/s
  - Some errors are caused by temperature variations.
5. **State the applications of PMMC instruments. (Remembering, CO1)**
  - Measurements of dc voltage and current
  - Used in dc galvanometer.
6. **How the range of instrument can be extended in PMMC instruments. (Remembering, CO1)**
  - In ammeter by connecting a shunt resistor
  - In voltmeter by connecting a series resistor.
7. **State the advantages of Dynamometer type instruments. (Remembering, CO1)**
  - Can be used for both dc and ac m/s.
  - Free from hysteresis and eddy current errors.
8. **State the advantages of Moving iron type instruments. (Remembering, CO1)**
  - Less expensive

- Can be used for both dc and ac
  - Reasonably accurate.
- 9. State the advantages of Hot wire type instruments. (Remembering, CO1)**
- Can be used for both dc and ac
  - Unaffected by stray magnetic fields
  - Readings are independent of frequency and waveform.
- 10. Define Measurement. (Remembering, CO1)**  
Measurement is the process of assigning a number to an attribute (or phenomenon) according to a rule or set of rules. The term can also be used to refer to the result obtained after performing the process.
- 11. SI (International System of Units) (Remembering, CO1)**  
The SI units for the four basic physical quantities: length, time, mass, and temperature are:
1. **metre (m)**: SI unit of length
  2. **second (s)**: SI unit of time
  3. **kilogram (kg)**: SI unit of mass
  4. **kelvin (K)**: SI unit of temperature

There are two types of SI units, base and derived units. Base units are the simple measurements for time, length, mass, temperature, amount of substance, electric current and light intensity. Derived units are made up of base units, for example, density is  $\text{kg/m}^3$ .

1. **What are the constructional parts of dynamometer type wattmeter? (Remembering, CO2)**
  - Fixed coil
  - Moving Coil
  - Current limiting resistor
  - Helical spring
  - Spindle attached with pointer
  - Graduated scale
2. **Write down the deflecting torque equation in dynamometer type wattmeter. (Remembering, CO2)**  
 $T_d \propto V I \cos \phi$
3. **State the disadvantages of Dynamometer type wattmeter. (Remembering, CO2)**
  - Readings may be affected by stray magnetic fields.
  - At low power factor it causes error.
4. **Name the errors caused in Dynamometer type wattmeter. (Remembering, CO2)**
  - Error due to pressure coil inductance
  - Error due to pressure coil capacitance
  - Error due to methods of connection
  - Error due to stray magnetic fields
  - Error due to eddy current.

5. **How the errors caused by p.c inductance is compensated. (Remembering, CO2)**  
By connecting a capacitor in parallel to the resistor.
6. **How the errors caused by methods of connection is compensated? (Remembering, CO2)**  
By using compensating coil.
7. **Name the methods used for power measurement in three phase circuits. (Remembering, CO2)**
  - (i) single wattmeter method
  - (ii) Two wattmeter method
  - (iii) Three wattmeter method.
8. **What are the special features to be incorporated for LPF wattmeter? (Remembering, CO2)**
  - Pressure coil circuit
  - Compensation for pressure coil current
  - Compensation for pressure coil inductance.
9. **Define Phantom loading. (Remembering, CO2)**  
Method by which energizing the pressure coil circuit and current coil circuits separately is called phantom loading.
10. **State the use of phantom loading. (Remembering, CO2)**  
Power loss is minimized.
11. **Name the methods used in Wattmeter calibration. (Remembering, CO2)**
  - By comparing with standard wattmeter.
  - By using voltmeter-ammeter method.
  - By using Potentiometer.
12. **What are the types of energy meters? (Remembering, CO2)**
  - Electrolytic meters
  - Motor meters.
  - Clock meters
13. **Name the constructional parts of induction type energy meter. (Remembering, CO2)**
  - Current coil with series magnet
  - Voltage coil with shunt magnet
  - Al disc
  - Braking magnet
  - Registering mechanism.
14. **How voltage coil is connected in induction type energy meter. (Remembering, CO2)**  
It is connected in parallel to supply and load.
15. **How current coil is connected in induction type energy meter. (Remembering, CO2)**  
It is connected in series to the load.

**16. Why a disc is used in induction type energy meter. (Remembering, CO2)**

Aluminum is a non-magnetic metal.

**17. What is the purpose of registering mechanism. (Remembering, CO2)**

It gives a valuable number proportional to the rotations.

**18. What is the purpose of braking mechanism. (Remembering, CO2)**

It provides necessary braking torque.

**19. Define creeping. (Remembering, CO2)**

Slow but continuous rotation of disc when pc is energized and cc is not energized.

**20. State the reason why holes are provided in Aluminum disc. (Remembering, CO2)**

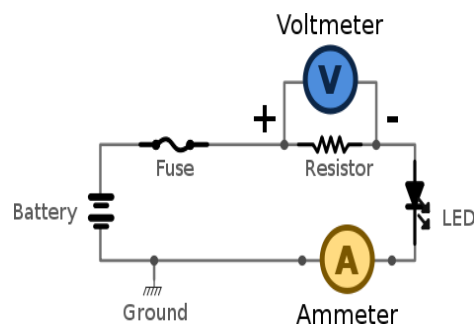
To avoid creeping holes are provided on both sides of Al. disc.

**21. Define voltmeter. (Remembering, CO2)**

A **voltmeter** is an instrument used for measuring the electrical potential difference between two points in an electric circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit; digital voltmeters give a numerical display of voltage by use of an analog to digital converter.

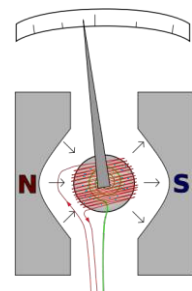
**22. Draw a schematic diagram of voltmeter and ammeter with a simple circuit. (Remembering, CO2)**

The voltmeter symbol is seen in this example circuit diagram. A voltmeter (V) and an ammeter (A) are shown measuring a voltage and a current respectively, in a simple series circuit.



**23. Define Analog Voltmeter. (Remembering, CO2)**

Voltmeters operating on the electrostatic principle use the mutual repulsion between two charged plates to deflect a pointer attached to a spring. Meters of this type draw negligible current but are sensitive to voltages over about 100 volts and work with either alternating or direct current.



A moving coil galvanometer of the 'Arson' type.

- The red (left two) wire carries the current to be measured.
- The restoring spring is shown in green (Right).
- N and S are the north and south poles of the magnet.

**24. Classify the types of Voltmeters. (Remembering, CO2)**

- Analog voltmeter
- Digital voltmeter

- Vacuum Tube Voltmeter
- Potentiometer

## 25. Define Electrical Measurements. (Remembering, CO2)

Electrical measurements is the set of the methods, devices and calculations aimed to measure electrical quantities.

### Measurable independent and semi-independent electrical quantities comprise:

- Voltage by the means of voltmeter
- Electric current by the means of ampermeter
- Electrical resistance and electrical conductance by the means of ohmmeter
- Electrical reactance and susceptance by the means of ohmmeter
- Magnetic flux
- Electrical charge by the means of electrometer
- Magnetic field by the means of Hall sensor
- Electric field
- Electrical power by the means of electricity meter
- S-matrix by the means of network analyzer (electrical)
- Electrical power spectrum by the means of spectrum analyzer

### Measurable dependent electrical quantities comprise:

- Inductance defined as frequency proportional coefficient for reactance
- Capacitance defined as reciprocal frequency proportional coefficient for reactance
- Electrical impedance defined as vector sum of electrical resistance and electrical reactance
- Phase between current and voltage and related quality factor
- Electrical spectral density
- Electrical phase noise
- Electrical amplitude noise
- Transconductance
- Transimpedance
- Electrical power gain
- Voltage gain
- Current gain
- Frequency

## 26. Define Electronics Measurements. (Remembering, CO2)

In electronics, a meter is an instrument for displaying the magnitude of one of a wide variety of quantities in electrical circuits. The term can refer to either an electronic component that is part of a larger device, or a free-standing test instrument.

- A multimeter is a general-purpose test instrument.
- A voltmeter is a specialized meter measuring voltage.
- An ammeter is a specialized meter measuring electric current.
- An ohmmeter is a specialized meter measuring electrical resistance.
- A wattmeter is a specialized meter measuring electric power.
- A capacitance meter is a test instrument measuring capacitance.
- An LCR meter is a test instrument that measures inductance, capacitance, and resistance.
- An electrometer is a test instrument measuring electric charge.

- A clamp meter is an AC current-measuring test instrument that clamps around a wire.
- A VU meter is a specialized meter measuring volume of audio signals.
- An EMF meter is a test instrument for measuring electromagnetic fields.
- An SWR meter is a test instrument for measuring the standing wave ratio of a radio transmitter and its antenna.
- An S meter is a component of a radio receiver that displays the received signal's strength.
- An electric meter and smart meter are instruments that measure the electric power delivered to a customer by a utility for billing purposes.
- A grid dip meter, or dip meter, is a test instrument for measuring the resonance frequency of radio circuits.
- A microwave power meter is a test instrument for measuring the power of microwave signals.
- A time domain reflectometer is a test instrument for finding faults in cables.
- A galvanometer is a mechanical moving-pointer type meter, especially an old one or its motive mechanism used as a component in other devices.

## **27. Measuring the B-Field**

Devices used to measure the local magnetic field are called magnetometers. Important classes of magnetometers include using a rotating coil, Hall effect magnetometers, NMR magnetometer, SQUID magnetometer, and a fluxgate magnetometer. The magnetic fields of distant astronomical objects can be determined by noting their effects on local charged particles. For instance, electrons spiraling around a field line produce synchrotron radiation which is detectable in radio waves.

## **28. State Electrometer. (Remembering, CO2)**

An electrometer is an electrical instrument for measuring electric charge or electrical potential difference. There are many different types, ranging from historical hand-made mechanical instruments to high-precision electronic devices. Modern electrometers based on vacuum tube or solid state technology can be used to make voltage and charge measurements with very low leakage currents, down to 1 femtoampere.

## **29. Define Instrument Transformer. (Remembering, CO2)**

Instrument transformers are used for measuring voltage and current in electrical power systems, and for power system protection and control where a voltage or current is too large to be conveniently used by an instrument, it can be scaled down to a standardized, low value. Instrument transformers isolate measurement, protection and control circuitry from the high currents or voltages present on the circuits being measured or controlled.

## **30. Define Current Transformer and Potential Transformer. (Remembering, CO2)**

- Current Transformer is a transformer designed to provide a current in its secondary coil proportional to the current flowing in its primary coil.
- Voltage transformers (VTs), also referred to as "potential transformers" (PTs), are designed to have an accurately-known transformation ratio in both magnitude and phase, over a range of measuring circuit impedances. A voltage transformer is intended to present a negligible load to the supply being measured. The low secondary voltage allows protective relay equipment and measuring instruments to be operated at a lower voltages.

**31. State the advantages of instrument transformers. (Remembering, CO2)**

- Used for extension of range
- Power loss is minimum
- High voltage and current can be measured.

**32. State the disadvantage of instrument transformers. (Remembering, CO2)**

Cannot be used for dc measurements.

**33. What are the constructional parts of current transformer? (Remembering, CO2)**

- Primary winding
- Secondary winding
- Magnetic core.

**34. Name the errors caused in current transformer. (Remembering, CO2)**

- Ratio error
- Phase angle error

**35. Define ratio error. (Remembering, CO2)**

The ratio of energy component current and secondary current is known as the ratio error.

**36. How the phase angle error is created. (Understanding, CO2)**

It is mainly due to magnetizing component of excitation current.

**37. State the use of potential transformer. (Remembering, CO2)**

- Used for m/s of high voltage
- Used for energizing relays and protective circuits.

**38. Name the errors caused in potential transformer. (Remembering, CO2)**

- Ratio error
- Phase angle error.

**39. How the CT and PT are connected in the circuits. (Understanding, CO2)**

CT is connected in series and PT is connected in parallel.

**40. Name the components of iron loss. (Remembering, CO2)**

- Eddy current loss
- Hysteresis loss.

**1. Define standardization. (Remembering)**

It is the process by which adjusting the current flows through the potentiometer coil to make the voltage across the std cell is equal.

**2. Classify resistance. (Remembering)**

- Low resistance
- Medium resistance
- High resistance

3. **What is the range of medium resistance? (Remembering)**  
Resistance of about 1 ohm to 100 kilohms is called medium resistance.
4. **Name the methods used for low resistance measurement. (Remembering)**
  - Ammeter–voltmeter method
  - Potentiometer method
  - Kelvin double bridge method
  - Ohmmeter method.
5. **Name the methods used for medium resistance measurement. (Remembering)**
  - Ammeter–voltmeter method
  - Substitution method
  - Wheatstone bridge method
  - Carey Foster bridge method.
6. **Where high resistance/s is required? (Remembering)**
  - Insulation resistance of cables
  - High resistance circuit elements
  - Volume resistivity of a material
  - Surface resistivity.
7. **State the advantages of Wheatstone bridge method. (Remembering)**
  - Free from errors
  - The balance is quite independent of source emf
8. **State the advantages of Kelvin double bridge method. (Remembering)**  
Errors owing to contact resistance, resistance of leads can be eliminated by using this Kelvin double bridge.
9. **What are the constructional features of doctor ohmmeter? (Remembering)**
  - Permanent magnet
  - Current coil
  - Pressure coil
  - Battery
  - Pointer with graduated scale.
10. **Define megger. (Remembering)**  
The megger is an instrument used for the measurement of high resistance and insulation resistance.
11. **Name the parts of megger. (Remembering)**  
It consists of a hand driven dc generator and a direct reading true ohm meter.
12. **What is the range of low resistance? (Remembering)**  
Resistance of about 1 ohm and under are included in this class.
13. **What is the range of medium resistance? (Remembering)**  
Resistance of 100 kilohms and above are usually termed as high resistance.
14. **What ranges of resistance can be measured by using doctor ohmmeter. (Remembering)**



- 0 to 500 micro ohms
  - 0 to 5 milli ohms
  - 0 to 50 milli ohms
  - 0 to 500 milli ohms
  - 0 to 5 ohms.
- 15. How resistance is measured in indirect deflection method. (Understanding)**  
The deflection of galvanometer connected in series with the resistance to be measured gives a measure of the insulation resistance.
- 16. Classify the cables according to their sheathing. (Remembering)**
- Armoured cables
  - Unarmoured cables.
- 17. Name the leads present in megger. (Remembering)**
- Earth lead
  - Line lead
  - Guard lead.
- 18. How resistance is measured by using ohmmeter method. (Understanding)**
- Series ohmmeter method
  - Shunt ohm meter method.
- 19. How resistance is measured in loss of charge method. (Understanding)**  
In this method a capacitor is charged and discharged for a specific time period and from this resistance is measured.
- 20. State the balance equation used in bridge methods. (Remembering)**  
The product of opposite branch resistances are equal.
- 21. State the advantages of Price's guard wire method. (Remembering)**  
In this method leakage current does not flow through the meter and therefore it gives accurate reading.
- 22. How the earth resistance is measured. (Remembering)**  
By using earth megger the value of surface earth resistance can be measured.
- 23. State the balance equation used in AC bridges. (Remembering)**  
The product of opposite branch impedances are equal.
- 24. Name the bridge circuits used for the measurement of self inductance. (Remembering)**
- Maxwell's bridge
  - Maxwell-Wein Bridge
  - Anderson bridge
  - Hay's bridge.
- 25. Name the bridge circuits used for the measurement of capacitance. (Remembering)**
- DeSauty's bridge
  - Schering Bridge
  - Wein bridge

- 26. Name the bridge circuits used for the measurement of mutual inductance. (Remembering)**
- The Heaviside-Campbell bridge
  - The Campbell bridge.
- 27. Which type of detector is used in AC bridges? (Understanding)**  
Vibrational galvanometers are used.
- 28. Name the AC sources used in AC bridges. (Remembering)**
- AC supply with step-down transformer
  - Motor-driven alternator
  - Audio frequency and radio frequency oscillator.
- 29. In which cases are audio frequency oscillators used as AC sources. (Understanding)**  
For high frequency requirements audio frequency oscillators are used.
- 30. Name the sources of errors in AC bridges. (Remembering)**
- Errors due to stray magnetic fields
  - Leakage errors
  - Eddy current errors
  - Residual errors
  - Frequency and waveform errors.
- 31. State the advantages of Maxwell-Wien bridge. (Remembering)**  
The balance equation is independent of frequency and therefore more accurate.
- 32. State the disadvantages of Maxwell-Wien bridge. (Remembering)**  
This method needs a standard variable capacitor. Variable capacitor is costly.
- 33. State the disadvantages of Hay's bridge. (Remembering)**  
The balance equation is dependent of frequency and therefore any changes in frequency will affect the measurement.
- 34. State the use of Wien bridge. (Remembering)**  
It is used for the measurement of unknown capacitance and frequency.
- 35. What is the use of Campbell bridge? (Remembering)**  
This is used for the measurement of mutual inductance.
- 36. What is meant by inductometer? (Remembering)**  
The standard mutual inductance meter is called an inductometer.
- 37. Define Q-factor of the coil. (Remembering)**  
It is the ratio between power stored in the coil to the power dissipated in the coil.
- 38. Name the faults that occur in cables. (Remembering)**
- Breakdown of cable insulation
  - Short circuit fault
  - Open conductor fault.
- 39. Name the loop test methods used in location of fault. (Remembering)**
- Murray loop test
  - Varley loop test.

**40. How leakage errors are minimized in a bridge circuit. (Understanding)**

By using high grade insulation.

**41. State the use of a bridge. (Remembering)**

AC bridges are used for the measurement of self and mutual inductance and capacitance.

**UNIT-I**

1. Explain Classification of Instrument
2. Explain deflecting, controlling and damping torques
3. explain PMMC with expression for the deflecting torque and control torque  
Errors and compensations advantages and disadvantages
4. explain moving iron expression for the deflecting torque and control torque  
Errors and compensations advantages and disadvantages
5. explain Electrostatic expression for the deflecting torque and control torque  
Errors and compensations advantages and disadvantages
6. extension of range of instruments (ammeter, voltmeter)

**UNIT – II**

1. explain with neat diagram Principle and operation of D.C. Crompton's potentiometer standardization advantages and disadvantages with applications (unknown resistance, current, voltage)
2. explain with neat diagram Principle and operation of polar type advantages and disadvantages with applications
3. explain with neat diagram Principle and operation of gall tinselly standardization advantages and disadvantages with applications
4. explain with neat diagram Principle and operation of CT and PT

**UNIT-III**

1. explain Single phase dynamometer wattmeter with expression for the deflecting torque and control torque Errors and compensations advantages and disadvantages
2. Measurement of active and reactive power in balanced and unbalanced systems
3. explain power factor meters with expression for the deflecting torque and control torque Errors and compensations advantages and disadvantages
4. explain Single phase induction type energy meter with expression for the driving and braking torques Errors and compensations advantages and disadvantages

**UNIT-IV**

1. explain with neat diagram of wheat-stone's bridge
2. explain with neat diagram of high resistance (megger)
3. explain with neat diagram Kelvin's double bridge for measuring low resistance
4. explain with neat diagram Maxwell's bridge, Hay's bridge
5. explain with neat diagram Anderson's bridge
6. explain with neat diagram Desauty's Bridge – Wien's bridge – Schering Bridge

#### UNIT-V

1. Explain Definition of transducers, Classification of transducers
2. Explain Advantages of Electrical transducers,
3. Explain Characteristics and choice of transducers
4. explain with neat diagram Principle and operation of LVDT and LVDT Applications
5. explain with neat diagram Principle and operation of capacitor pressure transducers(strain gauge),