ELECTRICAL MEASUREMENTS
UNIT-I
MEASUREMENT OF VOLTAGE AND CURRENT

1. **What is meant by galvanometer?**
An instrument for detecting and measuring small electric current it is also called as galvanometer.

2. **What is the Use of galvanometer in measurement system**?
Galvanometer is used as null detector (or) zero-current detector in bridge circuit and potentiometer measurement.

3. What are the different types of galvanometer?
- ❖ D'Arsonval galvanometer
- ❖ Vibration galvanometer
- ❖ Ballistic galvanometer
- ❖ Flux meter

4. What are the following methods are adopted calibrating the galvanometer?
- ❖ Use of charged capacitor
- ❖ Use of a standard solenoid
- ❖ Use of a mutual inductor

5. What is meant by vibration galvanometer?
Vibration galvanometer is a tuned detector and as such, it is very sensitive to Changes of frequency.

6. Differentiate between ammeter and voltmeter.

S. No	Ammeter	Voltmeter
1	It is a current measuring device which measures current through circuit.	It is a Voltage measuring device which measures potential difference between the two points of a circuit.
2	Always connected in series with circuit.	Always connected in Parallel with the circuit.
3	The resistance is very very small	The resistance is very very high
4	Deflecting torque is produced by current to be measured directly	Deflecting torque is produced by current which is proportional to the voltage to be measured

7. What is meant by measurement?
Measurement is an act or the result of comparison between the quantity and a predefined standard.

8. Mention the basic requirements of measurement.
The standard used for comparison purpose must be accurately defined and should be commonly accepted.The apparatus used and the method adopted must be provable.

9. What are the two methods for measurement?
- ❖ Direct method
- ❖ Indirect method.

10. Define the function of measurement system.

The measurement system consists of a transducing element which converts the quantity to be measured in an analogous form. the analogous signal is then processed by some intermediate means and is then fed to the end device which presents the results of the measurement.

11. Define Instrument.

Instrument is defined as a device for determining the value or magnitude of a quantity or variable.

12. List the types of instruments.

- Mechanical Instruments
- Electrical Instruments
- Electronic Instruments.

13. Classify instruments based on their functions.

- Indicating instruments
- Integrating instruments
- Recording instruments.

14. Give the applications of measurement systems.

- Monitoring of processes and operations.
- Control of processes and operations.
- Experimental engineering analysis.

15. Why calibration of instrument is important?

The calibration of all instruments is important since it affords the opportunity to check the instrument against a known standard and subsequently to errors in accuracy.

16. Define the calibration procedure.

Calibration procedure involves a comparison of the particular instrument with either a primary standard a secondary standard with a higher accuracy than the instrument to be calibrated or an instrument of known accuracy.

17. Define Calibration.

It is the process by which comparing the instrument with a standard to correct the accuracy.

18. Name the different essential torques in indicating instruments.

- Deflecting torque
- Controlling torque
- Damping torque

19. State the advantages of PMMC instruments

- Uniform scale No
- hysteresis loss
- Very accurate
- High efficiency

20. What are the types of moving coil instrument?

- Permanent magnet type
- Dynamometer type

21. What are the types of moving coil instrument?

- ❖ Attraction type
- ❖ Repulsion type

22. What are the meters used in a.c and d.c circuits?

Permanent magnet meters can be used only in d.c circuits.and induction meter can be used only in a.c. circuit. all other meters find application in both d.c.and a.c. circuits.

23. State the disadvantages of moving iron instruments.

- ❖ The meter readings are affected by hysteresis error, changes of frequency and wave forms
- ❖ The accuracy of the readings is affected by stray magnetic fields.
- ❖ The calibration is different for d.c. and a.c. usage

24. State the advantages of moving iron instruments.

- ❖ They are quite robust in construction.
- ❖ They are comparatively cheaper.
- ❖ Errors introduced by friction are negligible.
- ❖ They give sufficiently accurate readings, especially when used in a.c. circuits

25. What is the use of swamping resistor?

Swamping resistor is connected in series with meter resistance to reduce the error caused by temperature rise (i.e. temperature error). Swamping resistance to meter resistance ratio should be high.

26. What is the use of thermal instruments?

It's used for measurement of radio frequency a.c. signals. They are very useful when used as transfer instruments to calibrate d.c instruments by potentiometer and standard cell. These instruments are suitable for both a.c and d.c.

27. What are the limitations of rectifier type instruments?

- Effects of waveform
- Effect of rectifier resistance
- Effect of temperature changes
- Effect of rectifier capacitance
- Decrease in sensitivity

28. What are the requirements of materials used in making shunts for extending range of instruments?

- The temperature co-efficient of shunt and instrument should be low and should be as nearly as possibly the same.
- The resistance of shunts should not vary with time.
- They should carry the current without excessive temperature rise.
- They should have a low thermal electromotive force with copper.

29. A PMMC instrument has a 0.12T magnetic flux density in its air gaps. The coil dimensions are D = 1.5 cm and l =2.25 cm. Determine the number of coil turns required to give a torque of 4.5 μN-m when the coil current is 100μA.

$T_d = NBldI$

$N = T_d / BldI = 4.5 \times 10^{-6} / (0.12 \times 2.25 \times 10^{-2} \times 1.5 \times 10^{-2} \times 100 \times 10^{-6})$

$N = 1111$

UNIT-II
MEASUREMENT OF POWER AND ENERGY

1. **What are the advantages of Electro dynamic Instruments?**
   - Free from hysteretic errors
   - Low power consumption
   - Light in weight
   - They have a precision grade accuracy
   - Electrodynamometer voltmeters are very useful where accurate r.m.s value of voltage, irrespective of waveforms are required.

2. **What are the disadvantages of Electro dynamic Instruments?**
   - These instruments have a low sensitivity due to a low torque to weight ratio. Also it introduces increased frictional losses. To get accurate results, these errors must be minimized.
   - They are more expensive than other type of instruments.
   - These instruments are sensitive to overloads and mechanical impacts. Therefore care must be taken while handling them.
   - They have a non-uniform scale.
   - The operating current of these instruments is large due to the fact that they have weak magnetic field.

3. **State the Advantages of Calibration Energy Meter.**
   - Its construction is simple and strong
   - It is cheap in cost
   - It has high torque to weight ratio, so frictional errors are less and we can get accurate reading
   - It has more accuracy
   - It requires less maintenance
   - Its range cane be extended with the help of instrument transformers.

4. **State the disadvantages of Calibration Energy Meter.**
   - It can be used only for a.c circuits
   - The creeping can cause errors.
   - Lack of symmetry in magnetic circuit may cause errors.

5. **What are the methods of measuring iron losses?**
   - Wattmeter method
   - Bridge Method
   - Potentiometer Method
   - Oscillographic Method

6. **List out the various types of errors occurring in electrodynamometer instruments.**
   - Errors due to potential coil connection
   - Errors due to inductance of potential coil
   - Errors caused by potential coil capacitance
   - Errors due to mutual inductance effect
   - Errors caused by stray magnetic fields
   - Errors due to eddy currents
   - Errors caused by changes of temperature.

7. What are the constructional parts of dynamometer type wattmeter?

- Fixed coil
- Moving Coil
- Current limiting resister
- Helical spring
- Spindle attached with pointer
- Graduated scale

8. Name the errors caused in Dynamometer type wattmeter.

- 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. .

9. What are the types of energy meters?

- Electrolytic meters
- Motor meters.
- Clock meters

10. How current coil is connected in induction type energy meter.

It is connected in series to the load.

- Why Al disc is used in induction type energy meter. Aluminum is a nonmagnetic metal.
- What is the purpose of registering mechanism.

11. What is the purpose of braking mechanism.

It provides necessary braking torque.

- Define creeping.Slow but continuous rotation of disc when pc is energized and cc is not energized.
- State the reason why holes are provided in Al disc.

12. Define wattmeter

The wattmeter is an instrument for measuring the electric power or (the supply rate of electrical energy) in watts of any given circuit

13. What are the uses of wattmeter?

Wattmeter is an instrument which is used to measure the power consumption of an Electric circuit or an appliance which is connected to the supply in terms of Watts.

14. How would you connect a wattmeter into a circuit?

There are two coils in watt meter namely current coil & potential coil. the two ends of current coil are 'M' & 'L' and they should connect in series with instrument. and the two ends of p.c. is 'c' which is connected to 'L' and another is at the other end of instrument.

15 .An energy meter is designed to make 100 revolutions of disc for one unit of energy. Calculate the number of revolutions made by it when connected to load carrying 40 A at 230V and 0.4 power factor for an hour.

Actual energy consumed = V I cos φ t = 230 x 40 x 0.4 x 1 = 3.680 kWh No of revolutions per kWh = 100 No of revolutions for 3.680 kWh = 368.

16.What are the special features incorporated in low power factor wattmeter?

- Pressure coil current
- The pressure coil circuit is designed to have low value of resistance to increase the current and operating torque.
- Compensation for pressure coil current
- Compensation for inductance of pressure coil
- Small control torque

17.What is phantom loading?

When the current rating of a meter under test is high a test with actual loading arrangements will cause considerable waste of power. To avoid this phantom loading or fictitious loading is done. In phantom loading pressure coil is supplied with normal voltage and current coil circuit with separate low voltage supply to circulate rated current because the current circuit has low impedance. The total power consumed in this method is small.

18.How to prevent creeping in energy meters?

To prevent creeping two diametrically opposite holes are drilled in the disc. The disc will come to rest with one hole under the edge of a pole of the shunt magnet, the rotation being thus eliminated to a maximum of half a revolution.

19.A load draws 10A current from 230V AC mains at 0.75 power factor for half an hour what is the energy consumed?

Energy consumed = power×time = $VI\cos\varphi \times t = 230 \times 10 \times 0.75 \times 0.5 = 0.863$ Kwh

20. What is the need for lag adjustment devices is single phase energy meter?

The energy meter will read true value of energy only when the phase angle between supply voltage and pressure coil flux is 90 deg. This requires that the pressure coil winding should be highly inductive and has a low resistance, but even with this phase of flux and voltage few degrees less than 90. So lag adjustments are necessary to bring this shunt magnet flux in exact quadrature with supply voltage.

21. How to make adjustments in energy meters to reduce the error?

- ❖ Preliminary light load adjustment
- ❖ Full load unity factor adjustment
- ❖ Lag adjustment (low power factor adjustment)
- ❖ Light load adjustment
- ❖ Creep adjustment

22. How is creep effect energy meters avoided?

Two diametrically opposite holes are drilled in the disc of the energy meter. When one of the holes comes under the edge of a pole of the shunt magnet the rotation being limited to a maximum of half a resolution. In some cases a small piece of iron is attached to the edge of the disc.

23. What are the causes of creeping in an energy meter?

- Over compensation for friction
- Excessive voltage across the potential coil
- Vibrations
- Stray magnetic fields

24. List the different types of wattmeter.

- Ferro dynamic wattmeter
- Low power factor wattmeters (Electrodynamometer wattmeters)
- Thermocouple wattmeter (Thermal watt converter)

25. A 3φ 500 V motor load has a pf of 0.4. Two watt meters connected to measure the input. They show the input to be 30 kW. Find the reading of each instrument.

$P1 + P2 = 30kW$ ——— 1

$\cos \varphi = 0.4$; $\varphi = 66°24'$; $\tan \varphi = 2.289$;

$\tan \varphi = \sqrt{3} (P1 - P2) / (P1 + P2) = 2.289$

$\sqrt{3} (P1 - P2) / 30 = 2.289$

$(P1 - P2) = 39.7$ kW. ——— 2

From eqns 1 & 2

$P1 = 34.85kW$ & $P2 = -4.85kW$

UNIT-III
POTENTIOMETERS &INSTRUMENT TRANSFORMERS

1. **What is potentiometer?**
   Potentiometer is an instrument designed to measure an unknown voltage by comparing it with known voltage.

2. **A simple slide wire is used for measurement of current in a circuit. The voltage drop across a standard resistor of 0.1 Ω is balanced at 75 cm. Find the magnitude of the current if the standard cell emf of 1.45 V is balanced at 50 cm.**
   Voltage drop per unit length = 1.45 / 50 = 0.029 V/cm
   Voltage drop across 75 cm length = 75 x 0.029 = 2.175 V
   Current through the resistor = I = 2.175 / 0.1 = 21.75 A

3. **Mention some applications of potentiometer?**
   - ❖ Measurement of small emfs (upto 2V)
   - ❖ Comparison of emfs of two cells
   - ❖ Measurement of high emfs (upto 250V)
   - ❖ Measurement of resistance
   - ❖ Measurement of current
   - ❖ Calibration of ammeter
   - ❖ Calibration of voltmeter

4. **What are the types of potentiometer?**
   - ❖ DC Potentiometer
   - ❖ AC Potentiometer
   - ❖

5. **What are the types of DC potentiometer?**
   - ❖ Simple Dc Potentiometer
   - ❖ Direct reading Potentiometer
   - ❖ Crompton Potentiometer
   - ❖ Modern form of slide wire potentiometer

6. What are the classifications of AC potentiometers?

- Polar potentiometer
  i. Eg: Drysdale Instruments
- Co-ordinate potentiometer
  ii. Eg: Gall-Tinsley

7. What is the main difference in operation between DC Potentiometer and AC potentiometer?

Whereas in the DC potentiometer only the magnitude of the unknown emf and slide wire voltage drop must be made equal to Obtain balance in the AC potentiometer the phases of the two voltages as well as their magnitude must be equal for balance to be obtained.

8. Mention some practical applications of DC potentiometers.

- Measurement of resistance
- Measurement of current
- Measurement of high emf (upto 250V)
- Measurement of power
- Calibration of voltmeter
- Calibration of ammeter
- Calibration of wattmeter

9. What are the advantages of AC potentiometer?

- Very versatile instrument by using shunts and volt-ratio boxes its use may be extended to cover current voltage and resistance.
- The fact that phase as well as magnitude, is measured leads to such applications as measurement of power, inductance and phase angle of the coil etc.
- The basic principle of AC Potentiometer is also included in certain special measurement circuits.

10. Mention some applications of AC Potentiometers.

- Measurement of self inductance
- Calibration of ammeter
- Calibration of voltmeter
- Calibration of wattmeter

11. What are the advantages of instrument transformers over shunts and multipliers?

- Instruments of moderate size are used for metering
- Instruments and meters can be standardized so that there is a saving in overall cost.
- Single range instruments can be used to cover large current or voltage range.
- The metering circuit is isolated from the high voltage power circuits.
- There is low power consumption in metering circuit.
- Several instruments can be operated from a single instrument transformer.

12. What is the Name of potentiometer material used.

- German silver
- Manganin wire

13. What is standardization?

In case of a d.c potentiometer, the process of adjusting the working current so that the voltage across a portion of sliding wire against a std reference is known as standardization. But in case of an a.c potentiometer, the standardization is done with the help of std d.c source i.e a std cell or a zener source and a transfer instrument. This instrument is usually an electrodynamometer milliammeter, so constructed that its response to alternating currents is the same as its d.c response.

14. State the advantages of crompton potentiometer.

- More accurate
- Easy to adjust

What are the practical difficulties in ac potentiometers? More complicated Accuracy is seriously affected Difficulty is experienced in standardization.

15. How the phase angle is measured in polar type potentiometers.

It is measured from the position of phase shifter.

16. State the advantages of instrument transformers.

Used for extension of range, Power loss is minimum, high voltage and currents can be measured.

17. What are the constructional parts of current transformer?

- Primary winding
- Secondary winding
- Magnetic core.

18. Name of the errors caused in current transformer.

- Ratio error
- Phase angle error

19. Define ratio error.

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

20. State two applications of CT and of PT.

The extension of instrument range, so that current, voltage, power and energy can be measured with instruments of moderate size. The high voltage and current of power systems are stepped down by C.T and P.T and measured by instruments of moderate size.

21. What is the need for phase shifters in a polar type A.C potentiometers?

Phase shifter has two windings separated by 90deg. A variable resistance and a variable capacitance are connected between the two windings. By adjusting these two variables the currents flowing through the two windings are adjusted so that the magnitudes are same and phase difference between them is 90 deg.

22. Name the errors caused in potential transformer.

- Ratio error
- Phase angle error.

23. What is called a volt-ratio box?

A volt-ratio box is a precision potential divider network, It provides multiple voltage ranges. The voltage to be measured is connected to the appropriate binding post

24.What is the use of C.Ts & P.Ts?

C.T and P.T are used for the extension of instrument range. In power systems, currents and voltages handled are very large so the solution is with use of instrument transformers they could be metered with moderate sizes.

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UNIT-IV
RESISTANCE MEASUREMENT

1. **What are the classifications of resistance?**
   - Low resistance
   - Medium Resistance
   - High Resistance
2. **State the difficulties in measuring high resistance.**
   - Due to high resistance, very small current flows through measuring circuit which is difficult to sense
   - Presence of leakage currents
   - The stray charge appearing due to electrostatic effects
   - The delay time is required in the measurement so that charging and absorbing currents get stabilize. This time may be very long in some cases.
   - The very high voltage is required to raise the magnitude of current. This may damage the galvanometer if proper care is not taken.
3. **What is the range of medium resistance?**

   Resistance of about 1 ohm to 100 kilo ohms are called medium resistance.
4. **Name the methods used for low resistance measurement.**
   - Ammeter – voltmeter method
   - Potentiometer method
   - Kelvin double bridge method
   - Ohm meter method.

5. **Name the methods used for medium resistance measurement**
   - Ammeter – voltmeter method
   - Substitution method
   - Wheatstone bridge method
   - Carey foster bridge method.

6. **Where high resistance m/s is required?**

   Insulation resistance of cables High resistance circuit elements Volume resistivity of a material Surface resistivity.

7. **State the advantages of Kelvin double bridge method.**

   Errors owing to contact resistance, resistance of leads can be eliminated by using this Kelvin double bridge.

8. **What are the constructional features of doctor ohmmeter?**

   Permanent magnet Current coil Pressure coil Battery Pointer with graduated scale.

9. **Define megger.**

   The megger is an instrument used for the measurement of high resistance and insulation resistance.

10. **Classify the resistances according to the values.**
    - Low resistance, 0.1 MΩ
    - Medium resistance,1Ω to 0.1 MΩ
    - High resistance, > 0.1 MΩ

11. What ranges of resistance can be measured by using doctor ohmmeter.

- 0 to 500 micro ohms
- 0 to 5 milli ohms
- 0 to 50 milli ohms
- 0 to 500 milli ohms
- 0 to 5 ohms.

12. How resistance is measured in direct deflection method.

The deflection of galvanometer connected in series with the resistance to be measured gives a measure of the insulation resistance.

13. Classify the cables according to their sheathing

- Armoured cables
- Unarmoured Cables

14. Name the leads present in megger.

- Earth lead
- Line Lead
- Guard lead.

15. How resistance is measured by using ohm meter method.

- Series ohm meter method
- Shunt ohm meter method.

16. How resistance is measured in loss of charge method.

In this method a capacitor is charged and discharged for a specific time period and from this resistance is measured.

17. What are the precautions to be taken while measuring the insulation resistance of a cable?

- Critical points of the measuring circuit must be screened.
- In order to obtain definite ratios in the potential distribution with respect to surroundings, one point of the circuit should be connected to earth for accurate measurement.
- The testing conditions, time between the application of voltage and observation of the current must be specified.
- Adequate steps have to be taken to prevent damage of delicate instruments.

18. Give the example for high resistance measurement.

Insulation resistance of components and built up electrical equipment like machines and cables, resistance of high resistance circuit elements like in vacuum tube circuits, leakage resistance of capacitors, volume resistivity of a material, surface resistivity.

19. What is ground fault?

The insulation of the cable may breakdown causing a flow of current from the core of the cable to the lead sheath or to the earth. This is called "Ground Fault".

20. List the applications of megger.

Megger is a type of ratio meter ohmmeter; it is used for measuring the insulation resistance in portable instruments.

It is also used in insulation testing instruments.

21. What are the difficulties in measurement of high resistance?

Leakage current, which varies with humidity conditions, causes unpredictable complications and errors.

Stray changes due to electrostatic effects cause's errors in the measuring circuits.

High resistance and capacitance in the specimen causes some time delay in conduction and absorption currents.

Delicate instruments are used like galvanometer and micro-ammeter etc. so prevention has to be made to avoid damage of those instruments.

UNIT-V
IMPEDANCE MEASUREMENT

1. What is the use of bridge circuits?

This circuits mainly used for measuring many quantities such as resistance inductance and capacitance.

2. What are the advantages of bridge circuits?

- ❖ High measurement accuracy
- ❖ The accuracy is independent of null detectors characteristics.
- ❖ The balance equation is independent of the magnitude of the input voltage or its source impedance the sensitivity and impedance of the null detector or any impedance shunting the detector.
- ❖ The interchange of source and detector does not affect the balance condition
- ❖ The bridge circuit can be used in control circuits.

3. What are the two main types of bridges?

- ❖ DC Bridge
- ❖ AC Bridges

4. What are the sources of errors in ac bridges?

Stray conductance effects due to imperfect insulation

Mutual inductance effects, due to magnetic coupling between various components

Stray capacitance effects due to electrostatic fields

Residues in components.

5. What are the types of DC bridges?

- ❖ Wheatstone bridge
- ❖ Kelvin's Bridge
- ❖ Kelvin's double bridge

6. What is a Wheatstone bridge?

Wheatstone bridge is used for measurement of medium resistance in the range of 1Ω to 100 kw.

7. What are the application of wheatstone bridge?

- ❖ To measure the DC resistance of various types of wire either for the purpose of quality control of the wire itself, or of some assembly in which its used.

Eg: Measurement of resistance of motor windings transformers, solenoids and relay coils.

- ❖ This bridge is also used extensively by telephone companies and others to locate cable faults.

8. What is Kelvin bridge?

Wheatstone bridge is not suitable for measurement of very low resistance. Kelvin's bridge is a modification of Wheatstone bridge and is used to measure values of resistance below 1 Ω.

9. What is Schering bridge?

The Schering bridge one of the most important AC bridges, is used extensively for measurement of capacitors with a low dissipation factor. Besides capacitance and dissipation factors it also measures the insulating properties of the electrical cables (for phase angle very close to 90˚) and equipment.

10. What are the conditions must be satisfied for the AC bridge?

Two conditions must be met for the AC bridge to be balanced. The first condition requires that the magnitude of the four impedances satisfy relationship.

$Z_1Z_x = Z_2Z_3$,

The second condition relates the impedance angles.

$<\theta_1 + <\theta_X = <\theta_2 + <\theta_3$

As a consequence, when the bridge is balanced the voltage across Z_x and Z_2 must be equal both in amplitude and phase.

11. What are the advantages of Schering bridge ?

- The balance equation is independent of frequency.
- It is for measuring the insulating properties of electrical cables and equipment.

12. What is Maxwell bridge?

The Maxwell bridge (or) Maxwell – Wien bridge is used to measure both a given inductance (with a Q between 1 and 10) and its series resistance by capacitance to a standard capacitance using a capacitance as a standard offers several advantages capacitors are easy to shield and they produce almost no external field of their own. In addition they are compact and fairly expensive.

13. What are the advantages of Maxwell Bridge?

- The frequency does not appear in any of the two equations.
- The two balance equations are independent, if the value of R1 and C1 as variable elements.
- This bridge yields simple expression for unknown Lx and Rx in terms of known bridge elements.
- This bridge is very useful for measurement of wide range of inductance at power and audio frequency.

14. What are the disadvantages of Maxwell Bridge?

- This bridge is limited to measurement of low Q coils ($1<Q<10$).
- It requires a variable standard capacitor which may be very expensive if calibrated to a high degree of accuracy.

15. What is Hay Bridge?

The hay bridge or opposite angle bridge is used for the measurement of high-Q inductor ($Q>10$). The bridge arm opposite to the unknown inductance contains a capacitive reactance.

16. What are the advantages of Owen bridge?

- The balance equations are quite simple and do not contain any frequency component.
- The bridge can be used over a wide range of measurement of inductances.

17. What are the disadvantages of Owen bridge?

- This bridge requires a variable capacitor which is an expensive item and also its accuracy is about one percent.
- The value of capacitance and tends to become rather large when measuring high Q coils.

18. What is Anderson bridge?

It is a modified version of the Maxwell's inductance capacitance bridge. In this method, the self-inductance is measured in terms of a standard capacitor. It is applicable for precise measurement of self-inductance over a very wide range of values.

19. What are the advantages and disadvantages of Anderson bridge?

- A fixed capacitor can be used instead of a variable capacitors in the case of Maxwell's bridge
- This bridge may be used for accurate determination of capacitance in terms of inductance
- It is much easier to obtain balance in case of Anderson's bridge than in Maxwell's bridge for low Q coils.

20. What is Wien Bridge?

The Wien bridge is not only used to measure frequency as an AC bridge but also for its application in various other useful Circuits For example a Wien bridge in the harmonics distortion Analyzer, where it is used as a notch filter discriminating against One specific frequency. The wien bridge also finds application in audio and HF oscillators as the frequency determining element.

21. Write four application of AC bridge?

- To measure unknown inductance
- To measure dissipation factor
- To measure quality factor
- To measure unknown capacitance

22. Which measurements are possible using Schering bridge?

- Measurement of unknown capacitor
- Measurement of dielectric loss of capacitor
- Measurement of power factor
- Measurement of loss angle and dissipation factor

23. How to get two balance equations in an AC bridge?

The products of the magnitudes of the opposite arms must be equal while sum of the phase angles of the opposite arms must be equal.

24. Name the bridge circuits used for the m/s of self inductance.

- Maxwell's bridge
- Maxwell-Wein Bridge
- Anderson bridge
- Hay's bridge.

25. Write the limitation of Maxwell Bridge?

- It cannot be used for the measurement of high Q values. Its use is limited to the measurement of low Q values from 1 to 10. This can be proved from phase angle balance condition which says that sum of the angles of one pair of opposite arms must be equal.

  $\theta_1 + \theta_4 = \theta_2 + \theta_3$
- There is an interaction between the resistance and reactance balances, Getting the balance adjustment is little Difficult.
- It is unsuited for the coils with low Q values, less than one, because of balance convergence problem.
- The bridge balance equations are independent of frequency. But practically, the properties of coil under test vary with frequency which can cause error.

26. Name the bridge circuits used for the m/s of capacitance.

- De Sauty's bridge
- Schering Bridge
- Wein bridge

27. Name the bridge circuits used for the m/s of mutual inductance.

- The Heaviside Campbell bridge
- The Campbell bridge.

28. Name the ac sources used in ac bridges.

AC supply with step-down transformer Motor driven alternator Audio frequency and radio frequency oscillator.

- In which cases audio frequency oscillators are used as ac source. For high frequency ac requirement audio frequency oscillators are used.
- Name the sources of errors in ac bridge m/s.

Errors due to stray magnetic fields Leakage errors, Eddy current errors, Residual errors Frequency and waveform errors.

29. Define Q-factor of the coil.

It is the ratio between power stored in the coil to the power dissipated in the coil.

30. Name the components of iron loss.

- Eddy current loss
- Hysterisis loss

31. What are the precautions for reducing the errors in bridge circuits?

Use of high-quality components, bridge lay out, sensitivity, stray conductance effects, eddy current errors, residual errors, Frequency and wave form errors.

16 Mark questions

UNIT-1

1. Describe the construction and working of permanent magnet moving coil instrument and derive the torque equation for the PMMC instrument.
2. Explain in detail about the D'Arsonval galvanometer and ballistic galvanometer.
3. Describe the construction and principle of moving coil meter. List their advantages and disadvantages
4. Explain the construction and principle of operation of the dynamometer type instrument.
5. With a neat circuit explain the process of extension of range and calibration of voltmeter and ammeter.
6. Describe the construction and principle of moving iron meter. List their advantages and Disadvantages.
7. Explain the construction and principle of operation of the rectifier type instrument.

UNIT-2

1. With a neat sketch describe the construction and working of a electrodynamometer type wattmeter.
2. Write short notes on LPF wattmeter.
3. What is Phantom loading? Explain with an example how it is more advantages than testing with direct loading.
4. Discuss the methods for calibration of wattmeters.
5. Explain the construction and operating principle of single phase induction type energy meter with neat sketches.
6. The Energy meter is designed to make 100 revolutions of disc for one unit of energy. Calculate the revolutions made by it when connected to load carrying 40A at 230V and 0.4 power factor for an hour. If it actually makes 360 revolutions. Find the percentage error.

UNIT-3

1. Describe the construction and working of laboratory type potentiometer.
2. Describe the construction and working of drysdale type potentiometer.
3. With a suitable diagram explain the construction and working of coordinate type potentiometer.
4. Explain the use of instrument transformer for the measurement of power with a neat diagram.
5. Draw the equivalent circuit and phasor diagram of a current transformer. Derive the expression for ratio and phase angle errors.
6. With a suitable diagram explain the construction and working of polar potentiometer.

UNIT-4

1.Explain the principle of working of a Kelvin's double bridge. Also obtain the balance conditions for this type of bridge.

2. Write short notes on

   i) ammeter-voltmeter method.

   ii) Wheatstone bridge method.

3. Explain the construction and working principle of a megger.
4. Explain the working principle of a high resistance measurement.
5. Explain the construction and working principle of price's guard-wire method.
6. Write short note on Earth resistance measurement.

UNIT-5

1.With neat electrical connection diagram Explain how schering bridge is used for the measurement of capacitance. List the advantages and disadvantages.

2. What are the sources of error in bridge circuits? List the techniques of reducing errors and explain.

3. Explain with the help of neat diagram anderson's bridge circuit for measurement for measurement of capacitance and derive the expression for capacitance in the above said method.

4. Describe the working principle of a galvanometer used in ac measurements.

5. Write short notes no

   i) wein's bridge.

   ii) Campbell bridge.

6. Describe with neat diagram the Maxwell bridge which is used to measure the self-inductance. Derive the balance equation for the same.