

## Viva Voce on Galvanometer to Ammeter or Voltmeter

### Q. 1. What is galvanometer?

**Ans.** It is a device which measures the presence of current in circuit. It consists of a coil placed in magnetic field. When a current flows through it then torque acts on it. As a result, it rotates and produces deflection through pointer - scale arrangement or lamp - scale arrangement.

### Q. 2. What is galvanometer current ( $I_g$ ) and current sensitivity?

**Ans.** The current required for full scale deflection is called as galvanometer current and current required for one division deflection is termed as current sensitivity.

### Q. 3. . What are the instruments for measuring current and voltage?

**Ans.** Ammeter and voltmeter

### Q. 4. What are the resistances of ideal voltmeter and ammeter?

**Ans.** The ideal voltmeter has infinite resistance while ideal ammeter posses zero resistance.

### Q. 5. How can a galvanometer be converted to a voltmeter?

**Ans.** A galvanometer meter has resistance of order 60 or 70  $\Omega$  while voltmeter has very high resistance. Thus connecting a high resistance in series of galvanometer, it can be converted to voltmeter.

### Q. 6. How can you determine the value of series resistance?

**Ans.** By formula  $R = \frac{V}{I_g} - G$

Here,  $V$  = maximum value of voltage range,  $G$  = galvanometer resistance  
 $I_g$  = current for full scale deflection in galvanometer =  $C_s N$   
 $N$  = total number of divisions in galvanometer  
 $C_s$  = Current sensitivity of galvanometer or figure of merit

### Q. 7. How can a galvanometer be converted to an ammeter?

**Ans.** A galvanometer meter has resistance of order 60 or 70  $\Omega$  while ammeter has very low resistance. When two resistances are connected in parallel combination then their resultant has value lower than the both. Thus low resistance (shunt wire) is connected in parallel combination with galvanometer to convert in ammeter.

### Q. 8. How can you determine the value of shunt wire resistance for given range?

**Ans.** By formula  $S = \frac{I_g}{I - I_g} G$

Here,  $I$  = maximum value of current range  
 $G$  = galvanometer resistance  
 $I_g$  = current for full scale deflection in galvanometer

### Q. 9 What should be the length of wire?

**Ans.** It is determined by the expression-  $l = \frac{\pi r^2}{\rho} S$

Where  $r$  is radius of wire and  $\rho$  is electrical resistivity of wire material.

**Q. 10. What are the types of galvanometer?**

**Ans.** The major classification are- Moving Magnet Type Galvanometer or Moving Coil type Galvanometer. It may be of two types suspended or pivoted type. Further the moving coil galvanometer can be sub-classified in Dead beat, Critically damped and Ballistic type Galvanometer.

**Q. 11. Which one is your galvanometer?**

**Ans.** It is pivoted type moving coil dead beat galvanometer.

**Q. 12. How have you recognize it?**

**Ans.** Since there is deflection in galvanometer on flowing current through it and deflection comes to zero slowly on switch off the current. Thus it is of dead beat type. Since pointer is connected to coil and it is moving on rotation of coil thus it is of moving coil. Since coil is not suspended but it is pivoted, hence it is pivoted type.

**Q. 13. How can you recognize the ballistic galvanometer?**

**Ans.** If a small current flow causes the multiple deflection in galvanometer on the both sides of its zero then it will be a ballistic galvanometer.

**Q. 14. What are the values of  $I_g$  and  $G$  for your galvanometer?**

**Ans.** For the present galvanometer,  $I_g=600\mu A$  and  $G=60\Omega$ .

**Q. 15. Can you experimentally determine the value of  $I_g$ ?**

**Ans.** Yes I can. The following circuit and expression is used for determination of  $I_g$ .

$$I_g = C_s N$$

$N$ = total number of divisions in galvanometer

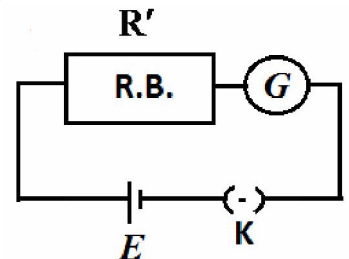
$C_s$  =Current sensitivity of galvanometer or figure of merit

$$C_s = \frac{E}{n(R' + G)}$$

$E$ = e.m.f. battery or cell

$R'$ = resistance involved in galvanometer circuit (in determination of determination  $C_s / I_g$ )

$n$ = deflection (number of division) in galvanometer on introducing the resistance  $R'$  in galvanometer circuit.



**Q. 16. Let 0.5volt is divided into 10 divisions in a voltmeter. What will be the least count?**

**Ans.** Least count of voltmeter will be  $0.5/10=0.05$ volts

**Q. 17. Let you have converted your galvanometer for an ammeter of range 0 to 1.5amp. What will be its least count?**

**Ans.** Least count of converted ammeter will be  $1.5/30=0.05$ amp

**Q. 18. Which source you are using in your experiment?**

**Ans.** It is DC source. It may be a cell or battery or dc power supply.

**Q. 19. What is rheostat?**

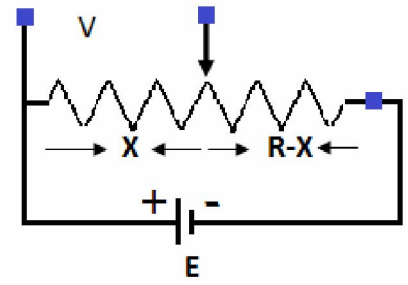
**Ans.** It is three terminal variable resistance which has application in voltage and current controlling.

**Q. 20. How does a rheostat used in controlling of voltage or as potential divider?**

**Ans.** For this, the two fixed ends of rheostat are connected to the terminals of battery and out put are taken at one fixed and one variable terminal as shown in figure. If X is resistance between fixed and variable terminal while R is total resistance of rheostat then potential V can written as-

$$V = \frac{X}{X + (R - X)} E = \frac{X}{R} E$$

When variable is moved then X changes. As a result V changes.

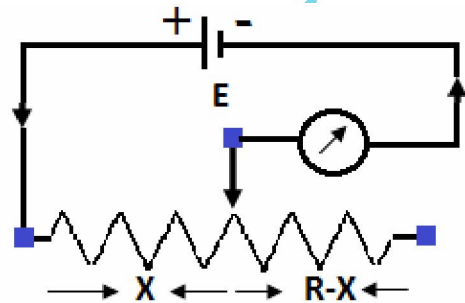


**Q. 20. How does a rheostat used in controlling of current?**

**Ans.** For this, it is connected in series between the fixed and variable terminals as shown in figure. If X is resistance between fixed and variable terminal then current ammeter can written as-

$$i = \frac{E}{X}$$

When variable is moved then resistance 'X' changes. As a result, current changes.



**Q. 21. What is voltmeter?**

**Ans.** It is an instrument used to measure the potential difference between two points directly in volts, when connected across those points.

**Q. 22. Why resistance of voltmeter should be high?**

**Ans.** A voltmeter is connected in parallel combination to measure the potential difference. In order to read actual potential difference between two points in a circuit, it is essential that no or negligible current should be drawn through it. For this, the resistance of voltmeter should be high.

**Q. 23. How can you change the range of voltmeter?**

**Ans.** We can increase the range of voltmeter by increasing the series resistance.

**Q. 24. What is millivoltmeter? How can a voltmeter be changed to millivoltmeter?**

**Ans.** It is a low range voltmeter. A voltmeter can be changed to millivoltmeter by decreasing its series resistance because millivoltmeter has comparatively low resistance with voltmeter.

**Q. 25. Can you change a voltmeter in to an ammeter?**

**Ans.** Yes, by shunting the voltmeter with a suitable low resistance.

**Q. 26. What is ammeter?**

**Ans.** It is an instrument used to measure the current in circuit when connected in series.

**Q. 27. What will happen if it is connected in parallel to the circuit?**

**Ans.** It will measure only the part of current flowing through it and will not measure the total current.

**Q. 28. Why is the resistance of ammeter kept low?**

**Ans.** If the resistance of ammeter is kept high, it will decrease the current through the circuit thus its resistance is kept low.

**Q. 29. What is milli-ammeter? How can ammeter be changed to milli-ammeter?**

**Ans.** Milli-ammeter is low range ammeter and has comparatively more resistance with an ammeter. Therefore, to convert an ammeter into a milli-ammeter, the resistance of shunt is increased.

**Q. 30. Can you change an ammeter in to a voltmeter?**

**Ans.** Yes, by putting a suitable high resistance in series with ammeter.

## Viva Voce on Z of LCR circuit

### Q. 1. What is Z?

**Ans.** It is impedance of circuit provides net resistance offered in an ac circuit and  $Z=R+j X$ .

### Q. 2. What is reactance?

**Ans.** The resistance offered in L or C ac circuit is termed as reactance. It is denoted by  $X_L$  or  $X_C$ .

### Q. 3. On what factor it depend?

**Ans.** It on frequency of AC source and value of L or C because  $X_L = j\omega L = 2\pi fL$

$$X_C = -j X_C = -j \frac{1}{\omega C} = \frac{1}{2\pi fC}.$$

### Q. 4. What are the Units of Z, $X_L$ and $X_C$ ?

**Ans.** All the three quantities have same unit ohm ( $\Omega$ ).

### Q. 5. What are differences among Z, R and X?

**Ans.** The quantities Z, R and X are complex, real and imaginary quantities.

### Q. 6. What is the formula of Z?

**Ans.** The formula of Z is  $Z = \sqrt{R^2 + (X_L - X_C)^2}$ .

### Q. 7. What is the resonance condition in series LCR circuit?

**Ans.** When  $X_L=X_C$ , then impedance of circuit becomes equal to R and current through circuit ( $I=V/Z=V/R$ ) becomes maximum.

### Q. 8. What is the resonance frequency?

**Ans.** The resonance frequency is the frequency at which the current becomes maximum through series LCR

circuit. It is equal to  $f_c = \frac{1}{2\pi\sqrt{LC}}$ .

### Q. 9. What is the nature of circuit before and after resonance?

**Ans.** The nature of circuit before resonance ( $f < f_c$ ) is capacitive because  $X_L$  becomes less than  $X_C$  while after resonance ( $f > f_c$ ), it is inductive as  $X_L > X_C$ .

### Q. 10. Explain phase changes among I, $V_R$ , $V_L$ , $V_C$ and V?

**Ans.** (i) Voltage across resistance  $V_R$  exists in phase of current.

(ii) Voltage across inductor  $V_L$  leads  $V_R$  by phase  $90^\circ$ .

(iii) Voltage across capacitance  $V_C$  lags  $V_R$  by phase  $90^\circ$ .

(iv) When  $V_L > V_C$ , resultant voltage V leads  $V_R$  by phase  $\phi = \tan^{-1} \frac{V_L - V_C}{V_R} = \tan^{-1} \frac{X_L - X_C}{R}$

(iv) When  $V_L < V_C$ , resultant voltage V lags  $V_R$  by phase  $\phi = \tan^{-1} \frac{V_C - V_L}{V_R} = \tan^{-1} \frac{X_C - X_L}{R}$

**Q. 11. If  $V_R$ ,  $V_L$  and  $V_C$  are 4volt, 20volts and 17volts respectively then what will be ac source voltage?**

**Ans.** It will be 5 volts as ,  $V = \sqrt{V_R^2 + (V_L - V_C)^2} = \sqrt{4^2 + (20 - 17)^2} = \sqrt{16 + 9} = \sqrt{25} = 5\text{volts}$

**Q. 12. What is ac voltage equation?**

**Ans.** It is  $V = V_0 \sin \omega t$  ; where  $V_0$  is peak voltage and  $\omega t$  is phase.

**Q. 13. What is rms voltage?**

**Ans.** It is the voltage equivalent to dc voltage that produces same heat or power loss in one cycle.

i.e      dc power loss =  $\frac{V_{rms}^2}{R}$

$$\text{ac power loss} = \frac{(\text{average ac voltage in one cycle})^2}{R} = \frac{(V_0 / \sqrt{2})^2}{R}$$

Since ac power loss = dc power loss, Then,  $V_{rms} = V_0 / \sqrt{2}$

**Q. 14. Which instrument is used for the measurement of AC voltage and current?**

**Ans.** AC voltmeter and AC ammeter.

**Q. 15. Is they measure rms value or peak value of AC voltage and current?**

**Ans.** They measure root mean square value of ac voltage and current.

**Q. 16. How are the voltmeter and ammeter connected in circuit?**

**Ans.** In a circuit, voltmeter is connected in parallel combination while ammeter in series.

**Q. 17. What are the types of AC voltmeter?**

**Ans.** They are-

**(a) Rectifier type instruments:-** In this, the ac voltage is converted into dc voltage using metal rectifier or diode rectifier and then measured with dc voltmeter.

**(b) Thermo-couple type instruments:-** Here, the heating effect of ac current is used to convert it into thermo-emf (dc voltage), and then it is measured with dc voltmeter.

**(c) Hot-wire instruments:-** When an ac current passes through a platinum wire then it becomes heated and expands. If a pointer with spring is connected with this wire through phosphor bronze wire then there is deflection. This technique is used in this type instrument.

**(d) Moving iron type instruments (attracted or repulsion iron type)-** When the currents passes through a solenoid or circular coil, magnetic filed is generated. In this type of instruments, the magnetic effect of current is used for the deflection of pointer on scale.

In all above, the graduated scale can be used measurement of AC voltage and current.

**Q. 18. What is step down transformer?**

**Ans.** It is device which converts high ac voltage to low ac voltage. It works on the principle of electromagnetic induction. It consists of large number of turns in primary coil while small number of turns in secondary coil. Due to small number of turns at secondary coil, a low voltage is induced at its terminals. In this process, there is no change in frequency of ac voltage, while the current increases.

**Q. 19. Is the frequency of ac voltage change at the out put of step down transformer?**

**Ans.** No, it is independent of transformer parameter.

**Q. 20. How can an ac signal or voltage be generated?**

**Ans.** An ac signal can be generated through an oscillator or function generator.

## **Viva Voce on De-Sauty bridge**

**Q. 1. What is your object?**

**Ans.** To determine the capacitance of capacitor with help of de-sauty bridge.

**Q. 2. Which type of bridge is it?**

**Ans.** It is an ac bridge, which works on Wheatstone bridge balance condition principle.

**Q. 3. How many types of balance condition should be satisfied by ac bridges?**

**Ans.** Two types- (i) real part or dc balance condition (ii) ac or phase balance condition.

**Q. 4. For your bridge both balance conditions are dependent or independent?**

**Ans.** Dependent

**Q. 5. What are the other ac bridges used for measuring C?**

**Ans.** Weins series bridge and Schering bridge.

**Q. 6. Which one is better among the three?**

**Ans.** Schering bridge, because both the balance conditions are independent to each other. The accuracy and sensitivity of this bridge is better than other.

**Q. 7. For what purpose, weins bridge is better?**

**Ans.** It is good for comparing the capacitance of two capacitors.

**Q. 8. Which one instruments can be used as detector in ac bridges?**

**Ans.** Headphone, null-detector and CRO.

**Q. 9. When will you use headphone as detector?**

**Ans.** Headphone can be used, when the ac source has frequency in audio signal range.

**Q. 10. What is audio frequency range?**

**Ans.** It is 20Hz to 20kHz.

**Q. 11. What is the frequency of dc source?**

**Ans.** It is zero.

**Q. 12. Which detector will you use for the case of dc source?**

**Ans.** Galvanometer

**Q. 13. What is capacitor and what are its types?**

**Ans.** It is device that is used to store the charges on the principle of polarization. Types of capacitors- paper capacitor, mica capacitor, electrolytic capacitor and variable capacitor.

**Q. 14. What is the unit of capacitance?**

**Ans.** Coulomb/volt, farad,  $\mu\text{f}$  (micro-farad) and pf (pico-farad).

**Q. 15. On what factor the capacitance of capacitor depends?**

**Ans.** It depends on geometry of plates (area of plates, separation between plates, length and radius of cylinder, radius of sphere) and dielectric constant of material, concentration of electrolyte.

## Viva Voce on Galvanometer Resistance

### Q. 1. What is galvanometer?

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### Q. 2. What is galvanometer current ( $I_g$ ) and current sensitivity?

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### Q. 6. How can you recognize the ballistic galvanometer?

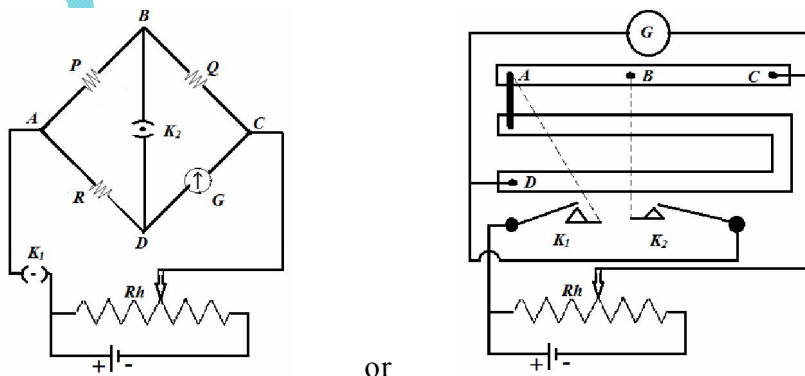
**Ans.** If a small current flow causes the multiple deflection in galvanometer on the both sides of its zero then it will be a ballistic galvanometer.

### Q. 7. What is galvanometer resistance? Why is there resistance in galvanometer?

**Ans.** The resistance offered in the flow of current through galvanometer is called as galvanometer. It is resistance of galvanometer coil.

### Q. 8. Which method have you used for the determination of galvanometer resistance?

**Ans.** Here, Kelvin or Thomson has been used for the determination of  $G$ . In this method bridge, the galvanometer (whose resistance is to be measured) is connected in CD arm of Wheatstone bridge. Under the balance condition of bridge, there is no change in deflection of galvanometer. Under this condition,  $G = QR/P$ .



### Q. 9. What is the principle of your method?

**Ans.** When the bridge is balanced ( $P/Q = R/G$ ), no current flows through BD arm of bridge.

**Q. 10. What will happen, when you press key K1 (battery key) and then K2 (BD arm key)?**

**Ans.** The galvanometer produces deflection on pressing K1. But this deflection may increase or decrease or unaltered on pressing K2 after K1.

**Q. 11. What is the reason behind it?**

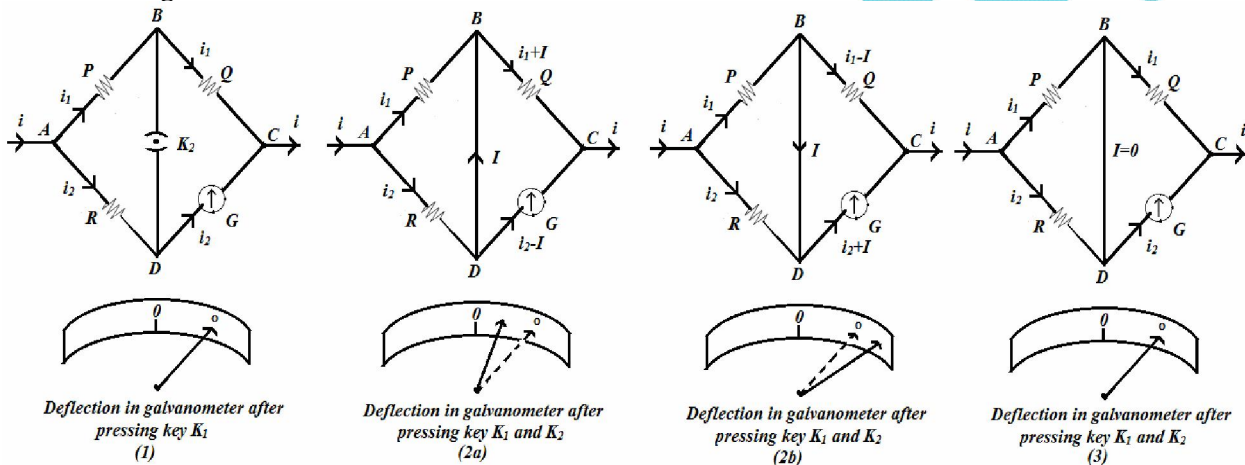
**Ans.** When only K1 is pressed, then  $i_1$  and  $i_2$  currents flows through ABC and ADC arms of bridge. As a results, galvanometer produced deflection corresponding to current  $i_2$ .

Now On pressing K2, the BD arm becomes connected. Depending upon the balance condition, current flows through it.

If P, Q and R is such that the potential at B is larger than D, then a current I flows from B to D. As a result, current through DC arm increases and becomes  $i_2+I$ . This results increase in deflection in galvanometer.

If P, Q and R is such that the potential at B is less than D, then a current I flows from D to B. As a result, current through DC arm decreases and becomes  $i_2-I$ . This results decrease in deflection in galvanometer.

If P, Q and R is such that the potential at B is equal to D, then a no current flows through BD arm (i.e. the bridge is balanced). As a result, current through DC arm remains unchanged. This results no change in deflection in galvanometer.



By knowing the value of P, Q and R under the balanced condition, we can calculate the value of G with the formula  $G=QR/P$ .

**Q. 12. Can we press K2 then K1 in your experiment?**

**Ans.** No, if we press key K2 at first then K1, the resultant current will flow directly through the galvanometer. In this situation, the prediction of no change in galvanometer deflection can not be determined

**Q. 13. What is the use of potential divider in your experiment?**

**Ans.** It controls the voltage across A and C terminals of bridge, which controls the current flowing through DC arm (galvanometer). That is, it directly controls the deflection through galvanometer.

**Q. 14. What are the other methods for the measurement of resistances?**

**Ans.** They are-(a) very low resistances-Carey-Foster Bridge Method (b) low and medium resistances- P O Box method (Mance, Kelvin, Thomson method), equal deflection method (c) high and very high resistance-leakage of capacitor method, Kelvin's double bridge method, Mega-ohm resistance method.

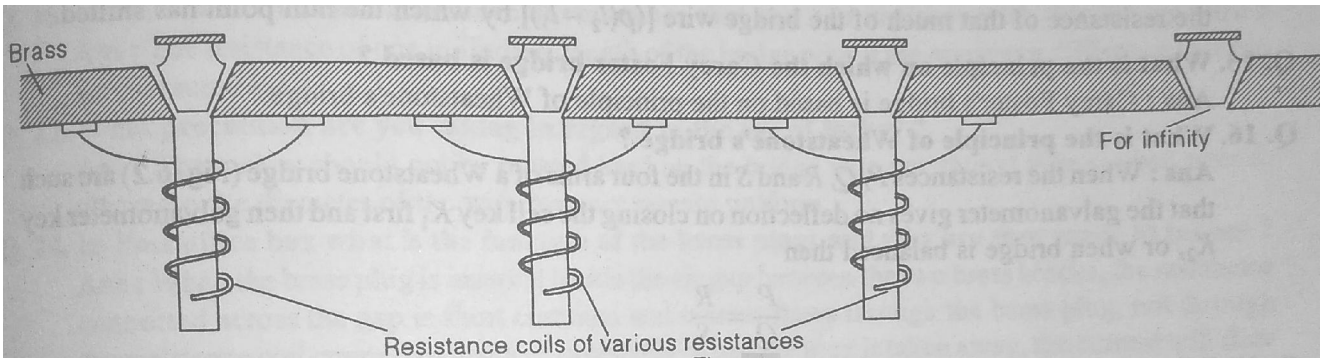
**Q. 15. Why is the material posses resistance?**

**Ans.** In a material, electrons moves making collision with positive ions. In each collision, the wave vector of electron changes by the transfer of momentum through positive ions (lattice). Thus, resistance in a material is caused by scattering of electron through phonon (energy quanta of mechanical wave) or due to electron-phonon interaction.



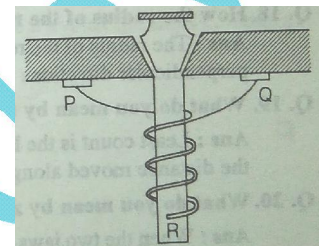
**Q. 16. What is resistance box?**

**Ans.** A resistance box has number of coils of different resistances, all are connected in series and mounted inside the box.



**Q. 17. How are the resistance coils placed inside the box?**

**Ans.** In resistance coil, the insulated wires of suitable lengths of magnin material are taken. Each wire say PRQ is doubled on itself and then it is wounded in the bobbin of non-conducting material. The free ends P and Q of the wire are soldered to the piece of brass at the top.



**Q. 18. Why is the wire doubled before winding over bobbin?**

**Ans.** This is done to avoid the inductive effects. When the current passes through the coil, its direction of flow in one wire is opposite to that in the other wire. So that the magnetic flux produced by one wire is equal and opposite to flux produced by the other wire. Hence the total flux is always zero.

**Q. 19. What is specific resistance?**

**Ans.** The specific resistance of material is the resistance of material wire having unit area of cross-section and unit length. Its value depends on temperature. Its unit is ohm-m.

**Q. 20. Let current flows for a long time through a metal wire. Is the resistance of wire remains same or not?**

**Ans.** No, the resistance will not remain same. It will increase.

**Q. 21. Which source have you used in this experiment?**

**Ans.** It is DC source.

**Q. 22. Is it DC power supply or cell?**

**Ans.** It is DC power supply.

**Q. 23. What are its component?**

- Ans.**
- (1) **Step down transformer:** It reduces the high ac voltage to low ac voltage.
  - (2) **Rectifier:** It converts ac voltage to dc voltage.
  - (3) **Filter circuit:** It reduces the ripples present in the output of rectifier.
  - (4) **Regulation circuit:** It makes constant output voltage with respect to load.

**Q. 24. If you have no power supply, then which cell you will prefer?**

**Ans.** Leclanche cell.

**Q. 25. What is difference between cell and battery?**

**Ans.** A battery is combination of number of cells.