Q.1 Solve from the following (2 marks each)

1. Explain application of Ohm’s Law to a complete circuit.
2. Explain the terms.
   (i) EMF of cell
   (ii) P. D.
3. What is thermistor? Where it is used?
4. Derive an expression for temperature coefficient of resistance.
5. Explain effect of temperature on resistance.

Q.2 Solve from the following (3 marks each)

1. Explain super conductivity and define critical temperature.
2. Explain Heating effect of electric current.
3. State and explain limitations of Ohm’s Law.
4. Explain colour code system for resistors.
5. Define: (i) Drift velocity and (ii) thermal velocity of an electrons
Q.1  Answer any five of following  

a. Distinguish between Aliphatic and Aromatic compounds.

b. State and explain octet rule.

c. How will you prepare benzene from sodium benzoate and phenol.

d. Explain types of Hybridisation.

e. Distinguish between sigma and pi bond.

f. Explain steps Involved in Hybridisation.

Q.2  Answer any five of following  

a. What is action of following on Benzene.

   1) Hydrogen    2) conc. H₂SO₄    3) Nitrating mixture

b. Explain the formation of methane on the basis of sp³ Hybridisation.

c. Draw molecular orbital diagram of oxygen molecule.

d. Explain Friedel Craft Alkylation and write its mechanism.

e. Explain the formation of Acetylene on the basis of sp Hybridisation.

f. Explain the formation of BF₃ on the basis of SP² – Hybridisation.
1. In quadrilateral ABCD, prove that
   (i) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{AD} + \overrightarrow{DC} = 2\overrightarrow{AC}$
   (ii) $\overrightarrow{AD} + \overrightarrow{BC} = 2\overrightarrow{MN}$, where M and N are the mid points of sides AB and CD respectively.

2. The position vectors of points A, B and C are $\overrightarrow{A} = 2\mathbf{i} - \mathbf{j} + \mathbf{k}$, $\overrightarrow{B} = 3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and $\overrightarrow{C} = 6\mathbf{i} + 11\mathbf{j} - 7\mathbf{k}$ respectively. Show that A, B and C are collinear and $\overrightarrow{AB} : \overrightarrow{BC} = 1:3$.

3. Find the projection of $\overrightarrow{AB}$ on $\overrightarrow{CD}$, where $A = (3, -5, 2), B = (-1, 2, 1), C = (2, 0, 1), D = (-2, 3, 0)$.

4. If $\overrightarrow{a} + \overrightarrow{b} + \overrightarrow{c} = \overrightarrow{0}, |\overrightarrow{a}| = 3, |\overrightarrow{b}| = 4$ and $|\overrightarrow{c}| = 5$, show that $\overrightarrow{a} \cdot \overrightarrow{b} + \overrightarrow{b} \cdot \overrightarrow{c} + \overrightarrow{c} \cdot \overrightarrow{a} = -25$.

5. If $\theta$ is the angle between the unit vectors $\mathbf{e}_1$ and $\mathbf{e}_2$, prove that $\sin \frac{\theta}{2} = \frac{1}{2} |\mathbf{e}_1 - \mathbf{e}_2|$.  

6. Find vectors of magnitude 6 units and perpendicular to vectors $2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ and $\mathbf{i} - 2\mathbf{j} + \mathbf{k}$.

7. Without expanding, show that the value of the following determinants is zero.

\[
\begin{vmatrix}
1 & xy & xy(x+y) \\
1 & yz & yz(y+z) \\
1 & zx & zx(z+x)
\end{vmatrix}
\]

8. Without expanding the determinants, show that

\[
\begin{vmatrix}
a^2 + 2ab & a & 1 \\
3b^2 & b & 1 \\
c^2 + 2bc & c & 1
\end{vmatrix} = \begin{vmatrix}
a^2 & a & 1 \\
b^2 & b & 1 \\
c^2 & c & 1
\end{vmatrix}
\]

9. Find $k$, if following equations are consistent

\[(k+1)x + (k-1)y + (k-1) = 0,\]
\[(k-1)x + (k+1)y + (k-1) = 0,\]
\[(k-1)x + (k-1)y + (k+1) = 0\]