Choose the correct answer

1. An electric dipole is placed at an alignment angle of 30° with an electric field of $2 \times 10^5 \text{ N C}^{-1}$. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is
   
   (a) 4 mC (b) 8 mC (c) 5 mC (d) 7 mC

2. Which charge configuration produces a uniform electric field?
   (a) point Charge (b) infinite uniform line charge (c) uniformly charged infinite plane (d) uniformly charged spherical shell

3. Two identical conducting balls having positive charges $q_1$ and $q_2$ are separated by a center to center distance $r$. If they are made to touch each other and then separated to the same distance, the force between them will be (NSEP 04-05)
   (a) less than before (b) same as before (c) more than before (d) zero

4. If voltage applied on a capacitor is increased from $V$ to $2V$, choose the correct conclusion.
   (a) $Q$ remains the same, $C$ is doubled  (b) $Q$ is doubled, $C$ doubled
   (c) $C$ remains same, $Q$ doubled  (d) Both $Q$ and $C$ remain same

5. A parallel plate capacitor stores a charge $Q$ at a voltage $V$. Suppose the area of the parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change?
   (a) Capacitance (b) Charge (c) Voltage    (d) Energy density

6. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of
   a) each of them increases   b) each of them decreases
   c) copper increases and germanium decreases
   d) copper decreases and germanium increases

7. In Joule’s heating law, when $I$ and $t$ are constant, if the $H$ is taken along the y axis and $I_2$ along the x axis, the graph is
   a) straight line b) parabola   c) circle d) ellipse
8. In a large building, there are 15 bulbs of 40W, 5 bulbs of 100W, 5 fans of 80W and 1 heater of 1kW are connected. The voltage of electric mains is 220V. The minimum capacity of the main fuse of the building will be
   (a) 14 A (b) 8 A (c) 10 A (d) 12 A

9. A carbon resistor of \((47 \pm 4.7)\ \text{k}\ \Omega\) to be marked with rings of different colours for its identification. The colour code sequence will be
   a) Yellow – Green – Violet – Gold
   b) Yellow – Violet – Orange – Silver
   c) Violet – Yellow – Orange – Silver
   d) Green – Orange – Violet – Gold

10. A toaster operating at 240 V has a resistance of 120 \(\Omega\). The power is
   a) 400 W b) 2 W c) 480 W d) 240 W

**TWO MARK write any 7 Q.NO 4 IS COMPULSORY**

1. No two electric lines of force can intersect each other? Why?
2. Explain the meaning of the statement 'electric charge of a body is quantised'.
3. Draw one equipotential surfaces (1) Due to uniform electric field (2) For a point charge \((q < o)\)?
4. A sample of HCl gas is placed in a uniform electric field of magnitude \(3 \times 104\ \text{N C}^{-1}\). The dipole moment of each HCl molecule is \(3.4 \times 10^{-30}\ \text{Cm}\). Calculate the maximum torque experienced by each HCl molecule
5. Why the charged balloon after rubbing sticks onto a wall
6. What are the differences between Coulomb force and gravitational force?
7. Define ‘electric flux’
8. What is corona discharge?
9. Write down Coulomb’s law in vector form and mention what each term represents
10. What is dielectric strength?

**THREE MARK WRITE ANY 7**

1. Write a short note on superposition principle.
2. Write a short note on ‘electrostatic shielding’.
3. Electric charge is uniformly distributed on the surface of a spherical balloon. Show how electric field vary (a) on the surface (b) inside and (c) outside
4. Prove that the energy stored in a parallel plate capacitor is given by \(\frac{1}{2} CV^2\) ?
5. Three capacitors each of capacitance \(9\ \text{pF}\) are connected in series. 1. What is the total capacitance of the combination? 2. What is the potential difference across each capacitor if the combination is connected to a 120 V supply?
6. Write any three difference between polar and non polar molecule
7. Why? During lightning accompanied by a thunderstorm, it is always safer to sit inside a bus than in open ground or under a tree
8. State kirchoff law
9. Is it possible to charge a conductor without any contact? Explain
10. Write any three properties of electric lines

FIVE MARK ANY 5

1. A parallel plate capacitor filled with mica having $\varepsilon_r = 5$ is connected to a 10 V battery. The area of the parallel plate is 6 m$^2$ and separation distance is 6 mm.
(a) Find the capacitance and stored charge.
(b) After the capacitor is fully charged, the battery is disconnected and the dielectric is removed carefully.
   OR
   Calculate the new values of capacitance, stored energy and charge

2. Calculate the electric field due to a dipole on its axial line and equatorial plane
   OR
   Derive an expression for electrostatic potential due to an electric dipole

3. State gauss law. Obtain the expression for electric field due to an infinitely long charged wire
   OR
   Derive an expression for the torque experienced by a dipole due to a uniform electric field.

4. Derive the expression for resultant capacitance, when capacitors are connected in series and in parallel
   OR
   Explain in detail the construction and working of a Van de Graaff generator

5. Explain in detail how charges are distributed in a conductor, and the principle behind the lightning conductor
   OR
   Explain wheatstone bridge