

Time: 3 hours 15

min. Max Marks: 70

**General Instructions:**

1. All parts are compulsory.
  2. For Part – A questions, first written-answer will be considered for awarding marks.
  3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
  4. Direct answers to numerical problems without detailed solutions will not carry any marks.
- 

**PART-A**

**I. Pick the correct option among the four given options for ALL of the following questions:**

**15×1= 15**

1. The force of repulsion between two point charges is F. If the distance between them is increased four times, then the new force is  
a)  $\frac{F}{4}$                       b)  $\frac{F}{16}$                       c) 4F                      d) 16F
2. Constantan wire is used for manufacturing resistance coils because it has  
a) high specific resistance                      b) low specific resistance  
c) high melting point                      d) low temperature co-efficient of resistance
3. The relaxation time in conductor  
a) increases with increase in temperature                      b) decreases with increase in temperature  
c) it is independent of temperature  
d) increases linearly upto critical temperature and then decreases exponentially
4. A galvanometer can be converted into an ammeter by connecting  
a) a low resistance in series                      b) a high resistance in parallel  
c) a low resistance in parallel                      d) a high resistance in series
5. The dimensions of magnetic intensity is same as  
a) Magnetization    b) magnetic moment    c) magnetic field    d) magnetic susceptibility
6. When north pole of a magnet is moved towards a closed coil, the direction of induced current with respect magnet is  
a) clockwise                      b) anticlockwise  
c) clockwise only if the speed is very less                      d) clockwise only if the speed is high
7. Self inductance plays the role of \_\_\_\_\_ in mechanics  
a) linear momentum                      b) energy                      c) force                      d) inertia
8. In case of pure inductor  
a) current and voltage are in phase                      b) current leads the current by 90°



27. What is displacement current? Mention its expression.
28. What are coherent sources? Give one example.
29. What is doping? Which type of dopant is used in p-type semiconductor?

### **PART-C**

#### **IV. Answer any FIVE of the following questions:**

**5×3=15**

30. Derive an expression of torque experienced by an electric dipole placed in an external electric field.
31. What are equipotential surfaces? Draw the equipotential surfaces for  
a) positive point charge b) uniform electric field
32. Derive the relation  $j = \sigma E$ .
33. Derive the expression for radius and frequency of charged particle describing uniform circular motion in magnetic field.
34. Mention the properties of magnetic field lines.
35. Derive the expression for motional emf.
36. Explain the Cartesian sign conventions for an image formation in a spherical mirror.
37. Give the de-Broglie explanation of Bohr's II postulate.
38. Explain Binding energy curve.

### **PART-D**

#### **V. Answer any THREE of the following questions:**

**3×5=15**

39. Define capacitance. Derive an expression for capacitance of parallel plate capacitor.
40. Derive an condition for a balanced wheat stone network.
41. Derive an expression for force between two parallel current carrying conductors and hence define ampere.
42. A) Mention any two applications of polarizer.  
B) Give the Einstein's explanation of photoelectric effect.
43. Explain the working of half wave rectifier.

#### **VI. Answer any TWO of the following questions:**

**2×5=10**

44. Three point charges equal to +4 nC are placed at the three corners of a square of side 2 cm. Find the electric field at the fourth corner.
45. Two cells of emf 2V and 4V and internal resistance 1  $\Omega$  and 2  $\Omega$  are connected parallel so as to send the current in the same direction through an external resistance of 10  $\Omega$ . Find the potential difference across 10  $\Omega$  resistor.
46. A source of alternating emf of 220V-50 Hz is connected in series with a resistance of 200  $\Omega$ , an inductor of inductance 100 mH and a capacitor of capacitance 30  $\mu\text{F}$ . Does the current lead or lag the voltage and by what angle?

47. A convex lens of focal length 0.24 m and of RI 1.5 is completely immersed in water of RI 1.33. Find the change in focal length of the lens.