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:

$$
15 \times 1=15
$$

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) 4 F
d) 16 F
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 $\qquad$ 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 $90^{\circ}$
c) current lags current by $90^{\circ}$
d) current lags voltage by $45^{\circ}$
9. The dimensions of $E / B$ is same as that of
a) charge
b) current
c) velocity
d) acceleration
10. The linear magnification produced by a concave mirror is -1 , the object is placed at
a) center of curvature of the mirror
b) principal focus of the mirror
c) infinity
d) between principal focus and center of curvature
11. In Huygen's wave theory, a surface of constant phase is called
a) ray
b) beam
c) wavelength
d) wavefront
12. In an experiment on photoelectric emission, the magnitude of saturation current depends upon
a) frequency
b) intensity
c) work function
d) stopping potential
13. The negative sign in the expression for total energy of an electron signifies that
a) atom is in the excited state
b) the atom is unstable
c) the electron is bound with the nucleus
d) the electron is at infinite distance from the nucleus
14. The source of energy in the interior of stars is
a) nuclear fission
b) nuclear fusion
c) radioactivity
d) chain reaction
15. In $p-n$ junction is reverse biased, the resistance offered is
a) infinity
b) zero
c) low
d) high

## II.Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions:

## (Decreases, uniform, zero, directly, helium)

16. The magnetic field inside the solenoid is $\qquad$ proportional to the length of wire.
17. A transformers when connected to a DC voltage source records secondary voltage as $\qquad$ .
18. In the case of interference of light, the fringe width obtained is $\qquad$ throughout.
19. During a-decay, the nucleus emitted is $\qquad$ .
20. When $p-n$ junction is forward biased, the width of depletion region $\qquad$ .

## PART -B

## III. AnsweranyFIVEofthefollowingquestions:

$5 \times 2=10$
21. State and explain Gauss law in electrostatics.
22. Differentiate between polar and non-polar dielectrics.
23. Define magnetic dipole moment. Mention its SI unit.
24. Mention the expression for magnetic potential energy and the meaning of their symbols.
25. A pair of adjacent coils have a mutual inductance of 0.25 H . If the current in the primary changes from zero to 2 A in 0.05 s , what is the average induced emf in the secondary?
26. Mention the energy losses in the transformers.
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:

$5 \times 3=15$
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:

$3 \times 5=15$
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:

$2 \times 5=10$
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 2 V and 4 V 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 $220 \mathrm{~V}-50 \mathrm{~Hz}$ is connected in series with a resistance of $200 \Omega$, an inductor of inductance 100 mH and a capacitor of capacitance $30 \mu \mathrm{~F}$. 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.

