I.   Answer ALL the questions   **1 × 10 = 10**

1. Draw the electric field lines for a system of two positive point charges
2. Give the SI unit of current density
3. How does the susceptibility of paramagnetic substance vary with absolute temperature?
4. What is the phase relation between electric and magnetic fields in an electromagnetic wave?
5. Write the expression for displacement current.
6. What are coherent sources?
7. Define impact parameter.
8. How does the mass number change when a nucleus undergoes α decay?
9. Give an example for nuclear fusion reaction.
10. The output of OR gate is connected to the input of NOT gate. Name the equivalent logic gate.

II.   Answer any FIVE of the questions   **2 × 5 = 10**

11. Draw a labeled diagram of Van – de Graff generator.
12. A resistor has the colour of different bands in the order yellow, violet and blue. What is its resistance and tolerance?
13. Give an expression for the torque experienced by a rectangular current loop placed in a uniform magnetic field? When is it maximum?
14. Explain the principle of conservation of energy in Lenz' law.
15. Define resolving power of a microscope. How does the resolving power vary along with the increase in wavelength of light used?
16. Give any two types of electron emission.
17. Write the circuit symbol and truth table of AND gate.
18. What is photo diode? Mention the principle of photo diode

III.   Answer any FIVE of the following   **3 × 5 = 15**

19. Mention the properties of electric field lines.
20. What is hysteresis? Draw a hysteresis loop showing coercivity and retentivity.
21. Derive the expression for potential energy of a bar magnet when placed in the external magnetic field.
22. What is a transformer? Give any two sources of energy loss in the transformer.
23. Draw a ray diagram for the image formed at near point in case of a compound microscope. Give the expression for the magnifying power of the same.
24. What are matter waves? Derive the expression for de-Broglie wavelength.
25. Mention any three characteristics of nuclear forces.
26. What is amplitude modulation? Draw a block diagram of AM receiver.

IV.   Answer any TWO of the following   **5 × 2 = 10**

27. Using Gauss' law, derive an expression for the electric field at a point on the axis of electric dipole.
28. State Ohm's law. Deduce the relation **j = σ E**
29. What is a cyclotron? With a neat and labelled diagram, explain the construction and working of a cyclotron.

V.   Answer any TWO of the following   **5 × 2 = 10**

30. Derive an expression for the impedance in an LCR circuit using phasor diagram.
31. Obtain an expression for the refractive index of the material of the prism in terms of angle of prism and angle of minimum deviation.
32. What is a transistor? Explain the basic action of n-p-n transistor.

33. Two capacitors of capacitances 600pF and 900pF are connected in series across a 200V supply. Calculate i) the effective capacitance of the combination (ii) the p.d across each capacitor and (iii) the total energy stored in the system.

34. Two cells of emf $3V$ and $2V$ and internal resistances 1.5 Ωand 1Ω are connected in parallel across 3Ω resistor such that they tend to send current through the resistor in the same direction. Calculate the potential difference across 3Ω resistor.

35. A square coil of 10 cm side and with 60 turns is rotated at a uniform speed of 500 rpm about an axis at right angles to a uniform field of 0.5 T. calculate the maximum emf developed in the coil. What is the instantaneous value of emf , when the plane of the coil makes an angle of 30^0 with the magnetic field.

36. In YDSE, fringes of certain width are produced on the screen kept at certain distance from the slits. When the screen is moved away from the slits by 0.1 m, fringe width increase by 6×10^{-5} m. The separation between the slits is 1 mm. calculate the wavelength of the light used.

Time: 3 Hours 15 Minutes   Max. Marks :70

I.   Answer all the questions: 1 × 10 = 10

1. What is meant by electric flux through a surface?
2. What is a solenoid?
3. Give the principle of AC generator.
4. What is the net magnetic moment of atom of diamagnetic material.
5. Name the electromagnetic radiation which is having high penetrating power.
6. What is a Polaroid?
7. How does the de-Broglie wavelength of a proton change if its velocity is increased?
8. What is mass defect?
9. Give the SI unit of radioactivity.
10. What is repeater in the communication system?

II.   Answer any five question: 2 × 5 = 10

11. State and explain Coulomb's law in electrostatics.
12. How is a galvanometer converted to ammeter? What is the effective resistance of an ideal ammeter?
13. What are soft ferromagnetic substances? Give an example.
14. Write an expression for the torque experienced by a short bar magnet placed in a uniform magnetic field. When is it maximum?
15. Name the electromagnetic wave used in (a) remote control of TV and (b) mobile communication.
16. Define resolving power of telescope. Mention its expression.
17. Give the circuit symbol and truth table of NOR gate.
18. Define the terms (a) transducer and (b) attenuation in communication.

III.   Answer any five questions: 3 × 5 = 15

19. Obtain an expression for torque acting on an electric dipole placed in an uniform electric field.
20. Mention the factors on which the resistance of a conductor depends.
21. Distinguish between diamagnetic and paramagnetic substances.
22. Describe coil and coil experiment to demonstrate electromagnetic induction.
23. Show that current leads emf in an AC circuit containing capacitor only.
24. What is total internal reflection? Write its conditions.
25. Derive the expression for velocity of electron in n^{th} orbit of hydrogen atom using Bohr's postulate.
26. Explain the working of p-n junction in the reverse bias.

IV.   Answer any two questions: 2 x 5 = 10

27. Derive an expression for the equivalent capacitance of two capacitors are connected in parallel.
28. Derive the expression for equivalent EMF and hence obtain the expression for current, when cells are connected in series.
29. State and explain Biot-Savat's law. Express it in vector form.

V.   Answer any two questions: 2 × 5 = 10

30. Give the theory of interference and arrive at the condition for constructive interference.
31. Write Einstein's photoelectric equation. Explain the experimental observations of photoelectric effect based on Einstein's photoelectric equation.
32. With a neat circuit diagram, describe the working of full wave rectifier. Draw the input and output waveforms.

VI. **Answer any three questions:** **3 × 5 = 15**

33. ABCD is a square of side 1m. Charges $+2 \times 10^{-10}$C, -4×10^{-10}C and $+8 \times 10^{-10}$C are placed at the corners A,B and C respectively. Calculate the amount of work done in transferring a charge of 10μC from D to the point of intersection of diagonals.

34. When two resistors are connected in series with a cell of emf 1V and negligible internal resistance a current of 2/5A flows in the circuit. When the resistors are connected in parallel, the main current is 5/3 A. calculate the resistances.

35. An alternating emf of 220V, 50 Hz is applied to a circuit having resistance of 200Ω, inductance 4H and capacitance 2μF in series. Calculate the impedance of the circuit and the maximum current in the circuit.

36. At what angle should a ray of light be incident on the face of a prism of refracting angle 60^{0},so that it just suffer total internal reflection at other face? The refractive index of prism is 1.524.

37. The half life of $_{38}Sr^{90}$ is 28 years. What is the disintegration rate of 15 mg of this isotope?