Series–B

Roll No.....

Total No. of Questions–27] [Total No. of Printed Pages–16

A–854–B–XII–2325

PHYSICS

(Theory)

Time Allowed—3 Hours Maximum Marks—60

Candidates are required to give their answers in their own words as far as practicable.

Marks allotted to each question are indicated against it.

Special Instructions :

(i) You must write Question Paper Series in the circle at top left side of title page of your Answer-book.

(ii) While answering your Questions, you must indicate on your Answer-book the same Question No. as appears in your Question Paper.

(iii) Do not leave blank page/pages in your Answer-book.

(iv) All questions are compulsory.

(v) The question paper has 27 questions. All the questions are compulsory. The Internal choice is given where applicable.

(vi) Answers should be brief and to the point.

(vii) Question Nos. 1 to 12 are MCQ (Multiple Choice Questions) carrying 1 mark each. Question Nos. 13 to 16 are very short answer type questions carrying 2 marks each. Question Nos. 17 to 23 are short answer type questions carrying 3 marks each and Question Nos. 24 carries 4 marks and Question Nos. 25 to 27 carry 5 marks each.

(viii) There is no negative marking.

(ix) All questions given in Section–A (Multiple Choice Questions) are to be attempt on OMR sheet provided with Answer book.

(x) You may use the following values of physical constants where ever necessary :

i) $c = 3 \times 10^{8} ms^{-1}$.

ii) $m_e = 9.1 \times 10^{-31} kg$.

iii) $e = 1.6 \times 10^{-19} c$.

iv) $\mu_0 = 4\pi \times 10^{-7} Tm\ A^{-1}$.

v) $h = 6.63 \times 10^{-34} JS$.

vi) $\epsilon_0 = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$.

vii) Avogadro number = 6.023×10^{23} per gram mole.

SECTION–A

(Multiple Choice Questions)

1. Dimensions of absolute permittivity of free space (ϵ_0) is : 1

   (a) $M^{-1} L^{-3} T^4 A^2$

   (b) $M^1 L^3 T^{-4} A^{-2}$

   (c) $M L^{-3} T^{-4} A^2$

   (d) $M^{-1} L^3 T^{-4} A^2$.

2. Three Copper wires of lengths and cross-sectional areas are (l, A), $(2l, A/2)$ and $(l/2, 2A)$. The resistance is minimum in : 1

   (a) wire of cross-sectional area $A/2$.

   (b) wire of cross-sectional area A.

   (c) wire of cross-sectional area 2A.

   (d) same in all the three cases.

3. Antiparallel currents in two long parallel conductors are : 1

   (a) attract each other

(b) repel each other

(c) neither attract nor repel each other

(d) attract and repel each other.

4. A 15.0 μF capacitor is connected to a 220 V, 50 Hz source. The capacitive reactance will be : 1

(a) 222 Ω

(b) 232 Ω

(c) 212 Ω

(d) 242 Ω.

5. Lenz's law is the consequence of the law of conservation of : 1

(a) charge

(b) momentum

(c) mass

(d) energy.

6. Unpolarised light of intensity (I_0) passes through a single polaroid, the intensity of polarised light approximately is : 1

(a) I_0

(b) $2\,I_0$

(c) $\frac{I_0}{4}$

(d) $\frac{I_0}{2}$.

7. An optician prescribes a corrective lens of power +2.5 D, then focal length of a convex lens is : 1

(a) +40 cm

(b) –40 cm

(c) +20 cm

(d) –20 cm. 1

8. In an experiment on photoelectric effect, the slope of cut-off voltage versus frequency of incident light is found to be 4.12×10^{-15} Vs. The value of Planck's constant is :

(a) 8.24×10^{-34} Js

(b) 13.18×10^{-34} Js

(c) 3.29×10^{-34} Js

(d) 6.59×10^{-34} Js. 1

9. Outside a nucleus : 1

(a) neutron is stable

(b) proton and neutron are stable

(c) neutron is unstable

(d) neither neutron nor proton is stable.

10. Trivalent acceptor atom doped in Tetravalent Lattice forms which type of semiconductor : 1

(a) p-type semiconductor

(b) n-type semiconductor

(c) Intrinsic semiconductor

(d) p-n semiconductor.

11. Assertion : A charge, whether stationary or in motion, produces a magnetic field.

Reason : Moving charges produce only electric field in the surrounding space.

(a) If both assertion and reason are true and reason is the correct explanation of assertion.

(b) If both assertion and reason are true but reason is not a correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false. 1

12. Assertion : Diodes can be used for rectifying an AC voltage.

Reason : A rectifier is used to convert alternating current into direct current.

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not a correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false. 1

SECTION–B

(Very Short Answer Type Questions)

13. Define the term mobility of charge carriers in a conductor. What is the relation with relaxation time? 2

14. What is meant by Magnetic intensity and intensity of Magnetisation? 2

15. What are Photoelectric effect? Derive Einstein's photoelectric equation. 2

16. A long straight wire carries a current of 35 A. What is the magnitude of the magnetic field at a point 20 cm from the wire?

Or

A Capacitor blocks d.c. but allows a.c. to pass through it. Explain, why? 2

SECTION–C

(Short Answer Type Questions)

17. Draw a labelled diagram of an a.c. generator. Explain principle and construction of an a.c. generator. 3

18. What is Interference? Obtain the conditions for constructive and destructive interference using Young's double slit experiment for interference of light. 3

19. (a) What are Nuclear forces? State the four properties of Nuclear force. 2

    (b) Convert one a.m.u into MeV. 1

20. An electric dipole with dipole moment 4×10^{-9} cm is aligned at 30° with the direction of a uniform electric field of magnitude $5 \times 10^{4} NC^{-1}$. Calculate the magnitude of the torque acting on the dipole. 3

21. What is displacement current? Write down four Maxwell's equations in electric and magnetic fields. 3

22. What is Internal resistance of a cell? Prove that the Internal resistance of a cell, 3

$$r = \left(\frac{E}{V} - 1\right)R$$

Where E is the e.m.f. of the cell, V is the terminal potential difference and R is the external resistance used in circuit.

23. (a) State the three postulates of Bohr's model in hydrogen atom. 2

(b) The ground state energy of Hydrogen atom is −13.6 eV. What are the Kinetic and potential energies of the electron in this state? 1

SECTION-D

(Case Study Based Question)

24. Study the following paragraph and answer question number (A) to (D) based on it.

An equipotential surface is a surface over which potential has a constant value. For a point charge, concentric spheres centred at a location of the charge on equipotential surfaces. The electric field E at a point is perpendicular to equipotential surface through the point. E is in the direction of the steepest decrease of the potential.

Potential energy of two charges q_1, q_2 at r_1, r_2 is given by :

$$U = \frac{1}{4\pi \epsilon_0} \cdot \frac{q_1 q_2}{r_{12}}$$

where r_{12} is the distance between q_1 and q_2. The potential energy of a charge q in an external potential V(r) is qV(r). The potential energy of a dipole moment p in a uniform electric field (E) is – P.E. Just outside the surface of a charged conductor, E is normal to the surface given by $E = \frac{\sigma}{\epsilon_0}\hat{n}$, where $\hat{n}$ is the unit vector along the outward normal to the surface and σ is

the surface charge density. In a cavity within a condutor, the electric field is zero.

(A) The angle between the electric lines of force and equipotential surface is : 1

(a) 0°

(b) 45°

(c) 90°

(d) 180°

(B) Electric potential (V) and electric flux (ϕ) are : 1

(a) both vectors

(b) V is scalar, ϕ is vector

(c) V is vector, ϕ is scalar

(d) Both scalars

(C) Equipotential surfaces at a great distance from a collection of charges whose total sum is not zero are approximately : 1

(a) Cocentric spheres

(b) Parallel planes

(c) Concentric circles

(d) Parallel linear lines.

(D) A charge of 5 C moves between two plates maintained at a potential difference of 0.5 Volt. The energy acquired by the charge is :

(a) 2 J

(b) 2.5 J

(c) 3 J

(d) 3.5 J. 1

SECTION–E

25. What is a compund microscope? With the help of ray digram, explain the working of compund microscope. Find an expression for its magnifying power. How can magnifying power be increased?

Or

(a) Double-Convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the Radius of curvature required if the focal length is to be 20 cm ? 3

(b) A converging and a diverging lens of equal focal lengths are placed co-axially in contact. Find the focal length and power of the combination. 2

26. (a) What is Rectifier? With the help of a circuit diagram, explain the use of a p-n junction diode as a full wave rectifier, giving its input and output waveforms. 4

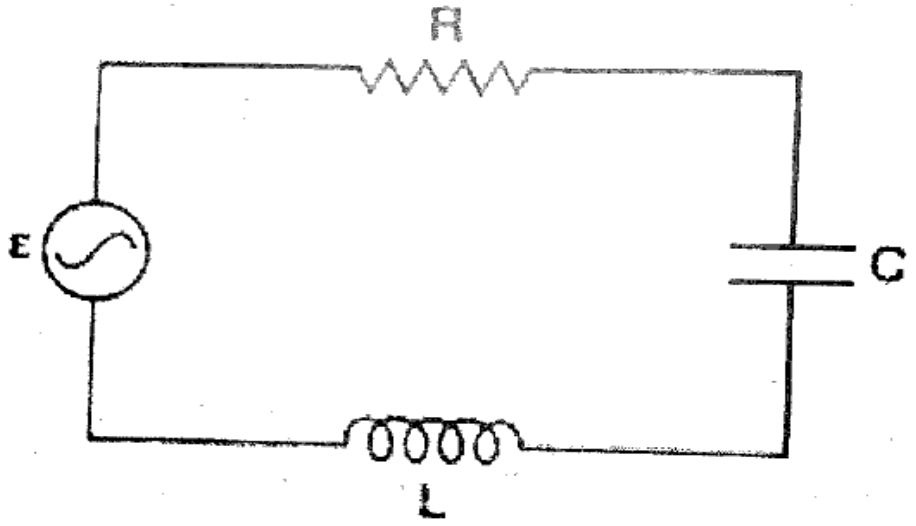
(b) In half wave rectification, what is the output frequency, if the input frequency is 50 Hz? What is the output frequency of a full wave rectifier for the same input frequency? 1

27. An a.c. voltage $E = E_0 \sin\omega t$ is applied across a series combination of an inductor (L), a capacitor

(C) and a resistor (R). Using the phasor diagram, derive an expression for impedanec of LCR-circuit. Calculate the resonant frequency.

Or

Figure shows a series LCR-circuit connected to a variable frequency 230 V source. $L = 5.0H$, $C = 80\ \mu F$, $R = 40\Omega$. 5



(i) Determine the source of frequency which drives the circuit in resonance.

(ii) Obtain the impedance of the circuit and the amplitude of the current at resonating frequency.

(iii) Determine the r.m.s potential drop across the three elements of the circuit.