COURSE NAME: 12TH **Marks : 100** **Topic : FULL SYLLABUS** **DATE : 20-01-2024**

PART – A

Instructions:

*(1) There are 50 objective type **(M.C.Q)** questions in **part-A** and all questions are compulsory.*

(2) The questions are serially numbered from 1 to 50 and each carries 1 mark.

(3) Read each question carefully, select proper alternative and answer in the O.M.R. sheet.

(4) The OMR sheet is given for answering the questions. The answer of each question is represented by (1) O, (2) O, (3) O, (4)O. Darken the circle of the correct answer with ball-pen.

(5) Rough work is to be done in the space provided for this purpose in the test booklet only.

(6) Set No. of question paper printed on the upper-most right side of the Question paper is to be written in the column provided in the OMR sheet.

(7) Students may use a calculator and log-table, if necessary.

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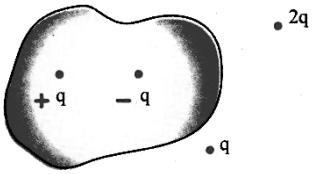
1. A charge Q is placed at the centre of a cube. The electric flux emerging from any one surface of the cube is ……..

(1) $\frac{Q}{\varepsilon_0}$ (2) $\frac{Q}{2\varepsilon_0}$ (3) $\frac{Q}{4\varepsilon_0}$ (4) $\frac{Q}{6\varepsilon_0}$

2. The liquid drop of mass m has a charge q. What should be the magnitude of electric field E to balance this drop?

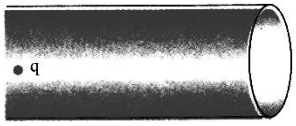
(1) $\frac{mg}{q}$ (2) $\frac{E}{q}$ (3) mgq (4) $\frac{mc}{g}$

3. As shown in figure the electric flux associated with close surface is.....



(1) $\frac{3q}{\varepsilon_0}$ (2) $\frac{2q}{\varepsilon_0}$ (3) $\frac{q}{\varepsilon_0}$ (4) Zero

4. As shown in the figure, q charge is placed at the open end of the cylinder with one end open. The total flux emerging from the surface of cylinder is.....



(1) $\frac{q}{\varepsilon_0}$ (2) $\frac{2q}{\varepsilon_0}$ (3) $\frac{q}{2\varepsilon_0}$ (4) Zero

5. Inside a bar magnet, the magnetic field line

(1) Are parallel to the cross-sectional area of the magnet

(2) Are not present

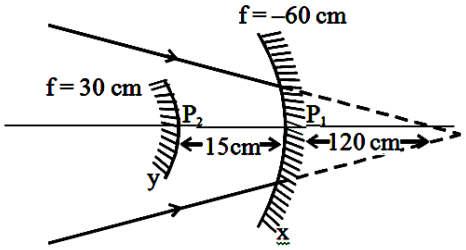
(3) Are in the direction from N-pole to S-pole

(4) Are in the direction from S-pole to N-pole

6. Thedistance between electric charge Q C and 9Q C is 4 m. What is the electric potential at a point on the line joining them are the electric field is zero

(1) $10\,\mathrm{kQ\,V}$ (2) $2\,\mathrm{kQ\,V}$ (3) $4\,\mathrm{kQ\,V}$ (4) $2.5\,\mathrm{kQ\,V}$

7. The image formed after two reflection (first at x then at y) will be:-



(1) Erect and enlarged 2 times

(2) Inverted and enlarged 2 times

(3) Erect and diminished 2 times

(4) Inverted and diminished 4 times

8. What is the r.m.s. value of the current for A.C. current $I = 100\cos(200t + 45^o)$ A?

(1) $100A$ (2) $50\sqrt{2}A$ (3) $100\sqrt{2}A$ (4) Zero

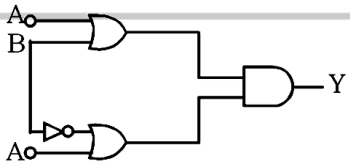
9. When charged particle moves in a magnetic field its kinetic energy …….

(1) Increases (2) Remains constant (3) Can decrease (4) Becomes zero

10. For the first orbit of hydrogen atom the minimum excitation potential is ……. V.

(1) 3.4 (2) 10.2 (3) 13.6 (4) 3.6

11. For given combination Y equal to:



(1) A (2) B (3) 0 (4) 1

12. The capacitance of a variable capacitor joined with the battery of 100 V is changed from 2 μF to 10 μF. What is the change in the energy stored in it?

(1) $2.5\times10^{-2}\,J$ (2) $2\times10^{-2}\,J$ (3) $6.5\times10^{-2}\,J$ (4) $4\times10^{-2}\,J$

13. A long magnetic needle of length 2*L*, magnetic moment *M* and pole strength *m* units is broken into two pieces at the middle. The magnetic moment and pole strength of each piece will be

(1) $\frac{M}{2}, \frac{m}{2}$ (2) $M, \frac{m}{2}$ (3) $\frac{M}{2}, m$ (4) M, m

14. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90° about its perpendicular axis, the electric field at the same point will be

(1) E (2) E / 4 (3) E / 2 (4) 2E

15. The wavelength of the first line of Lyman series is d. The wave length of first line in Balmer series is ……

(1) $\frac{5}{27}\lambda$ (2) $\frac{9}{2}\lambda$ (3) $\frac{27}{5}\lambda$ (4) $\frac{2}{5}\lambda$

16. In R – C circuit when charge on the plates of the capacitor is increasing, the energy obtained from the source is stored in ……

(1) Magnetic field (2) Electric field

(3) Gravitational field (4) Both magnetic field and gravitational field

17. In Hertz's' experiment the ……. of the electromagnetic wave is equal to the kinetic energy of the charges oscillating between two spheres.

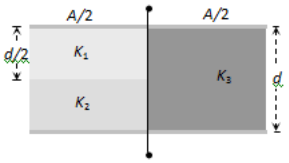
(1) Energy (2) Frequency (3) Wavelength (4) Velocity

18. The Output power in a step-up transformer is

(1) Equal to the input power. (2) Greater than the input power.

(3) Maintained even during the power cut. (4) Less than the input power.

19. In the figure a capacitor is filled with dielectrics. The resultant capacitance is



(1) $\frac{2\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$ (2) $\frac{\varepsilon_0 A}{d}\left[\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}\right]$

(3) $\frac{2\varepsilon_0 A}{d}[k_1+k_2+k_3]$ (4) None of these

20. Energy levels A, B, C of a certain atom corresponding to increasing values of energy i.e. $E_A < E_B < E_C$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiations corresponding to the transitions C to B, B to A and C to A respectively, which of the following statements is correct

(1) $\lambda_3 = \lambda_1 + \lambda_2$ (2) $\lambda_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}$ (3) $\lambda_1+\lambda_2+\lambda_3 = 0$ (4) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

21. For detecting the light,

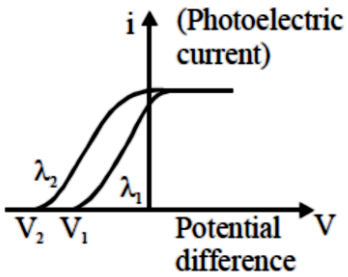
(1) The photodiode has to be reversed biased.

(2) The photodiode has to be forward biased.

(3) The LED has to connected in forward bias mode.

(4) The LED has to connected in reverse bias mode.

22. In the following diagram if $V_2 > V_1$ then



(1) $\lambda_1 = \sqrt{\lambda_2}$ (2) $\lambda_1 < \lambda_2$ (3) $\lambda_1 = \lambda_2$ (4) $\lambda_1 > \lambda_2$

23. An electron with energy 12.09 ev strikes hydrogen atom in ground state and gives its all energy to the hydrogen atom. Therefore hydrogen atom is excited to …….. state.

(1) Third (2) Fourth (3) Second (4) First

24. If the radii of $^{27}_{13}Al$ and $^{64}_{30}Zn$ nucleus are R_1 & R_2 respective, then $\frac{R_1}{R_2} =$ …….

(1) $\frac{3}{4}$ (2) $\frac{9}{16}$ (3) $\frac{27}{64}$ (4) $\frac{13}{30}$

25. Which of the following is responsible for glittering of diamond?

(1) Diffraction (2) Interference

(3) Total internal reflection (4) Refraction

26. A Square conducting coil of area 100 cm^2 is placed normally inside a uniform magnetic field of 10^3 wbm^{-2}. The magnetic Flux linked with the coil is ……. Wb.

(1) 10^{-5} (2) 10^5 (3) 10 (4) 0

27. For a thin convex lens when the height of the object is double then its image, its object distance is equal to …… Focal length of lens is f .

(1) $2f$ (2) $3f$ (3) f (4) $4f$

28. A ray of light is travelling from a denser medium to rarer medium. For these media critical angle is C. The maxima possible deviation of the ray is …….

(1) $\pi - 2C$ (2) $\pi - 2$ (3) $2C$ (4) $\frac{\pi}{2} + C$

29. The magnetic flux linked with a coil is changing with time t (second) according to $\phi = 6t^2 - 5t + 1$. Where ϕ is in Wb. At t = 0.5 S, the induced current in the coil is ……. The resistance of the circuit is 10 Ω.

(1) 0.1 A (2) 1 A (3) 0.1 mA (4) 10 A

30. Energy of a charged capacitor is U. Now it is removed from a battery and then is connected to another identical uncharged capacitor in parallel. What will be the energy of each capacitor now?

(1) U (2) $\frac{U}{4}$ (3) $\frac{3U}{2}$ (4) $\frac{U}{2}$

31. Three photo diodes D_1, D_2 and D_3 are made of semiconductors having band gap of 2.5 eV, 2 eV and 3 eV, respectively. Which one will be able to detect light of wavelength 6000Å?

(1) D_1 (2) D_2 (3) D_3 (4) D_1 and D_2 both

32. Two cells of equal e.m.f. and of internal resistances r_1 and $r_2 (r_1 > r_2)$ are connected in series. On connecting this combination to an external resistance R, it is observed that the potential difference across the first cell becomes zero. The value of R will be

(1) $r_1 + r_2$ (2) $r_1 - r_2$ (3) $\frac{r_1 + r_2}{2}$ (4) $\frac{r_1 - r_2}{2}$

33. Vm is the maximum Voltage between trends of the secondary terminal of a transformer used in a half wave rectifier. When the PN Junction diode is reverse biased, what will be the potential difference between two ends of the diode?

(1) Vm/2 (2) zero (3) Vm (4) 2 Vm

34. When an electron and proton are placed in an electric field ……..

(1) Only the magnitudes of forces are same.

(2) The electric forces acting on them are equal in magnitude as well as direction.

(3) Acceleration produced in them are same.

(4) Magnitudes of acceleration produced in them are same.

35. The radius of Second orbit in an atom of hydrogen is R. What is the radius in third orbit?

(1) 2.25 R (2) 3 R (3) 9 R (4) R/3

36. A plate of refractive index 1.5 is placed in the passage of one ray in young's experiment. If the central fringe remains bright, the minimum thickness of the plate is ……

(1) λ (2) 2λ (3) $\frac{\lambda}{3}$ (4) $\frac{2}{3\lambda}$

37. An electromagnetic wave passing through the space is given by equation $E = E_0 \sin(\omega t - kx)$, $B = B_0 \sin(\omega t - kx)$. Which of the following is true?

(1) $E_0\ \omega = B_0\ k$ (2) $E_0\ B_0 = \omega\ k$ (3) $E_0\ k = B_0\ \omega$ (4) $E_0\ \omega k = B_0$

38. The frequency of electromagnetic wave in free space is 2 MHz. When it passes through a region of relative permittivity $\varepsilon_r = 4.0$, the its wave length …… & frequency ……

(1) Becomes double, remains constant
(2) Become double, becomes half
(3) Becomes half, becomes double
(4) Becomes half, remains constant

39. The self-inductance of two solenoids A and B having equal length are same, if the number of turns in two solenoids A and B are 100 and 200 respectively. The ratio of radii of their cross section will be ……

(1) 1 : 2 (2) 2 : 1 (3) 1 : 4 (4) 4 : 1

40. The de-broglie wavelength associated with a particle with rest mass m_o and moving with speed of light in vacuum is

(1) 0 (2) $\frac{h}{moC}$ (3) ∞ (4) $\frac{m_o c}{h}$

41. Photons of energy 1 ev and 2.5 ev successively illuminate a metal whose work function is 0.5 ev. The ratio of maximum speed of emitted electrons ……..

(1) 2 :1 (2) 1 : 2 (3) 3 : 1 (4) 1 : 3

42. A magnetic needle kept non parallel to the magnetic field in a non-uniform magnetic field experiences. ……

(1) A torque but not a force.
(2) A force but not a torque.
(3) Both a force & a torque.
(4) Neither a force nor a torque.

43. Cathode rays …….

(1) Are electromagnetic waves.
(2) Are the atoms moving towards the cathode.
(3) Are negative ions travelling from cathode to anode.
(4) Are electrons emitted by cathode & travelling towards anode.

44. A cell supplies a current of 0.9 A through 2Ω resistor and current of 0.3 A through 7Ω resistor. What is the internal resistance of cell?

(1) 1Ω (2) 0.5 Ω (3) 1.2 Ω (4) 2 Ω

45. Magnetic intensity is define by

(1) $H = \frac{B}{\mu_0} - I$ (2) $H = \frac{B}{\mu_0} + I$ (3) $H = \mu_0(I - B)$ (4) $H = \frac{2B}{\mu_0} - I$

46. A long solenoid is formed by winding 20 turns/cm. The current necessary to produce a magnetic field of 20 millitesla inside the solenoid will be approximately

$(\frac{\mu_0}{4\pi} = 10^{-7}\ tesla - metre/ampere)$

(1) 8.0 A (2) 4.0 A (3) 2.0 A (4) 1.0 A

47. The electron performs circular motion of radius r perpendicular to a uniform magnetic field B. The kinetic energy gained by this electron in half the revolution is ……..

(1) $\frac{1}{2}mv^2$ (2) $\frac{1}{2}mv^{27}$ (3) zero (4) $\pi r\ Be\ V$

48. At a place on electric field and a magnetic field are in downward direction. There an electron moves in downward direction. Hence this electron.

(1) Will bend towards right (2) Will bend towards left.

(3) Will gain velocity. (4) Will lose velocity

49. A charged particle is moving will velocity $\vec{v}$ in a uniform magnetic field $\vec{B}$. The magnetic force acting on it will be maximum when ……

(1) $\vec{v}$ & $\vec{B}$ are in opposite direction. (2) $\vec{v}$ & $\vec{B}$ are in same direction

(3) $\vec{v}$ & $\vec{B}$ are mutually perpendicular. (4) $\vec{v}$ & $\vec{B}$ make an angle of 45° with each other.

50. The spheres carrying charge q are hanging from a same point of suspension with the help of threads of length 2m, in space free from gravity. The distance between them will be ……

(1) 1 (2) 0 (3) 4 (4) 2

PART- B

Instructions:

(1) Write in a clear legible handwriting.

(2) There are three sections in part- B of the question paper and total 1 to 27 questions are there.

(3) All the questions are compulsory. Internal options are given.

(4) The numbers at section side represent the marks of the question.

(5) Start new section on new page.

(6) Maintain sequence.

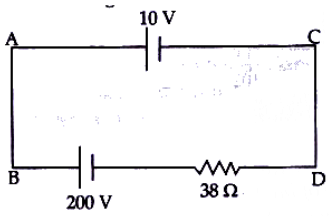
(7) Students may use a calculator and log-table, if necessary.

SECTION – A [2 M]

- **Answer question No. 1 to 12 as directed. Each question carry 2 marks. (Attempt any 8 out of 12)** **[16]**

1. State the underlying principle of a transformer. How is the large scale transmission of electric energy over long distances done with the use of transformers?

2. A 10 V cell of negligible internal resistance is connected in parallel across a battery of emf 200 V and internal resistance 38 W as shown in the figure.



Find the value of current in the circuit.

3. A light bulb and a solenoid are connected in series across an ac source of voltage.

Explain, how the glow of the light bulb will be affected when an iron rod is inserted in the solenoid.

4. The battery remains connected to a parallel plate capacitor and a dielectric slab is inserted between the plates.

What will be effect on its

(i) potential difference

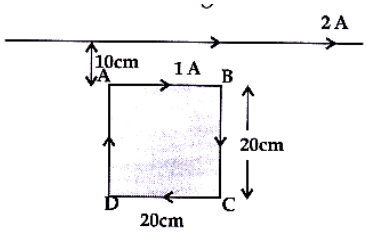
(ii) capacity

(iii) electric field and

(iv) energy stored?

5. A small bulb (assumed to be appoint source) is placed at the bottom of a tank containing water to a depth of 80 cm. Find out the area of the surface of water through which light from the bulb can emerge. Take the value of the refractive index of water to be 4/3.

6. A square loop of side 20 cm carrying current of 1 A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure.

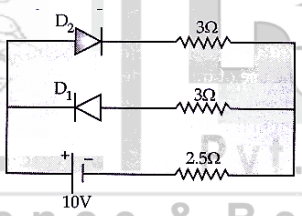


Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor.

7. Write two important limitation of Rutherford's nuclear model of the atom**.**

8. The refractive index of a material is $\sqrt{3}$. What is the angle of refraction if the unpolarised light is incident on it at the polarizing angle of the medium?

9. Assuming that the two diodes D_1 and D_2 used in the electric circuit shown in the figure are ideal, find out the value of the current flowing through 2.5 Ω resistor.



10. Does the step down transformer violate the principle of conservation of energy? Explain

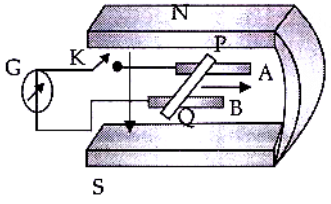
11. Professor C.V Raman surprised his students by suspending a tiny light ball freely in a transparent vacuum chamber by shining a laser beam on it. Which property of EM waves he exhibiting? Give one more example of this property?

12. Write the expression for speed of electromagnetic waves in a medium of electrical permittivity E and magnetic permeability **μ**.

SECTION – B [3 M]

▪ **Answer question No.13 to 21 as directed. Each question carry 3 marks.(Attempt any 6 out of 9) [18]**

13. Figure shows a metallic rod PQ of length l, resting on the smooth horizontal rails AB positioned between the poles of a permanent magnet. The rails, the rod, and the magnetic field are in three mutual perpendicular direction. A galvanometer G connects the rails through a switch K. Assume the magnetic field to be uniform. Given the resistance of the closed loop containing the rod is R.



(i) Suppose K is open and the rod is moved with a speed with a speed v in the direction shown. Find the polarity and magnitude of induced emf.

(ii) With K open and the rod moving uniformly, there is no net force on the electrons in the rod PQ even though they do experience magnetic force due to motion of the Explain.

(iii) What is the induced emf in the moving rod id the magnetic field is parallel to the rails instead of being perpendicular?

14. (i) Derive the expression for the electric potential due to an electric dipole at a point on its axial line.

(ii) Depict the equipotential surface due to electric dipole.

15. A bar magnet of magnetic moment 6 J/T is aligned at 60° with a uniform external magnetic field of 0.44 T. Calculate (1) the work done in turning the magnet to align its magnetic moment (i) normal to the magnetic field (ii) opposite to the magnetic field ,and (2) the torque on the magnet in the final orientation in case(ii).

16. What is relaxation time? Derive an expression for resistivity of a wire in terms of number density of free electrons and relaxation time.

17. If a copper wire is stretched to make 1% longer, what is the percentage change in its resistance?

18. **(a)** In photoelectric effect, do all the electrons that absorb a photon come out as photoelectrons irrespective of their location? Explain

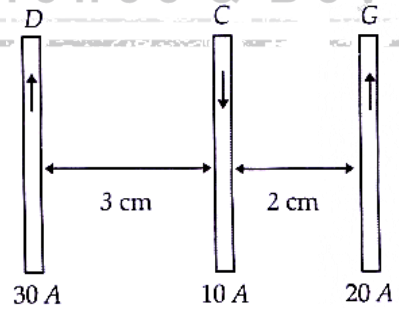
(b) A source of light, of frequency greater than the than he threshold frequency, is placed at a distance's' from the cathode of a photocell. The stopping potential is found to be V. if the distance of the light source is reduced to d/n (where n>1) ,explain the changes that are are likely to be observed in the (i) photoelectric current and (ii) stopping potential.

19. The number of silicon atoms per m^3 is 5×10^{28}. This is doped simultaneously with 5×10^{22} atoms per m^3 of Arsenic and 5×10^{20} per m^3 atoms of Indium. Calculate the number of electrons and holes. Given that $n_i = 1.5 \times 10^{16}$ per m^3. Is the material n-type or p-type?

20. (i) What type of resistance is to be added with a galvanometer in which combination for it to act as a voltmeter?

(ii) Why are microwaves considered suitable for radar systems used in aircraft navigation?

21. (i) Three long, straight parallel wires carrying current are arranged shown in the figure.



What will be the force experienced by a 25 cm length of wire C?

(ii) Four nuclei of an element undergo fusion to form a heavier nucleus, with release, with release of energy. Which of the two−the parent or the daughter nuclei−would have higher binding energy per nucleon?

SECTION – C [4 M]

▪ **Answer question No. 22 to 27 as directed. Each question carry 4 marks. (Attempt any 4 out of 6)** **[16]**

22. (i) Describe the working principle of a step-up transformer with the help of a suitable diagram. Obtain the relation between input and output voltage in terms of the number of turns of primary and secondary windings and the currents in the input and output circuits.

(ii) Given the input current 15 A and the input voltage 100 V for a step-up transformer having 90% efficiency, find the output power and the voltage in the secondary if the output current is 3 A.

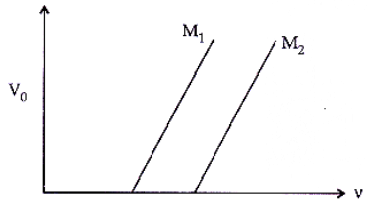
23. (1)

(i) Write three observed features of photoelectric effect which cannot be explain by wave theory of light. Explain how Einstein's photoelectric equation is used to describe these features satisfactorily.

(ii) Figure shows a plot of stopping potential (V_0) with frequency (v) of incident radiation for two photosensitive materials M_1 and M_2. Explain

(2) Why the slope of both the lines is same?

(3) For which material emitted electrons have greater Kinetic energy for the same frequency of incident radiation?



24. (i) Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law, (ii) A wire whose cross-sectional area increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remain constant in the wire?

(1) drift speed (2) Current density (3) electric current (4) electric field

Justify your answer.

25. (i) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.

(ii) A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $\frac{3}{4}$ th of the angle of prism. Calculate the speed of light in the prism.

26. (i) Use Gauss's law to derive the expression for the electric field $\left(\vec{E}\right)$ due to a straight uniformly charged infinite line of charge density $\lambda\, C/m$.

(ii) Draw a graph to show the variation of E with perpendicular distance r from line of charge. (iii) Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_2 > r_1$).

27. A capacitor of capacitance C_1 is charged to a potential V_1 another capacitor of capacitance C_2 is charged to a potential difference V_2. The capacitors are now disconnected from their respective charging batteries and connected in parallel to each other.

(i) Find the total energy stored in the capacitors before they are connected.

(ii) Find the total energy stored in the parallel combination of the two capacitors.

(iii) Explain the reason for the difference of energy in parallel combination in comparison to the total energy before they are connected.