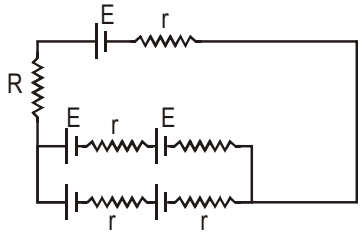
SAMPLE PAPER – I

Time Allowed : 3 hours
Maximum Marks : 70

Note : Attempt All questions. Marks allotted to each question are indicated against it.

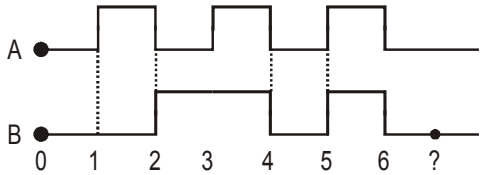
1. The magnetic field lines form closed curves. Why? 1
2. What is band pass filter. 1
3. How does magnifying power of a microscope change on decreasing the aperture of its objective? 1
4. Name the part of Electimagnetic spectrum which is suitable for (i) Physical therapy (ii) TV communication. 1
5. Why is energy distribution of β ray continuous? 1
6. A point source of light is at the focus of a convex lens. What is the type of refracted wavefront? 1
7. Drawn a graph showing variation of de Broglie wavelength of an electron with the variation of its momentum 1
8. All the cells are identical each of emf E and internal resistance 'r'. What is the current passing through R. 2



9. What is a repeater? Explain with the help of a diagram. How does it increase the communication range. 2

10. In a wire connected across a source, drift speed and electric field are *v* and *E* respectively. The wire is stretched uniformly of double the length, what will be new (i) drift speed (ii) electric field. 2

11. Sketch the output wave form from an OR gate. The input A and B are shown in the figure. If the output of above OR gate is fed to a Not gate, name the gate so formed. 2

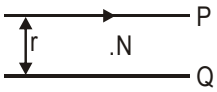


12. A charged particle of charge q and mass m is accelerated through potential different V befor entering a magnetic field B, perpendicular to the direction of motion. What will be the radius of circular path 2

OR

A circular coil of radius r is carrying current I. at what distance from the centre of loop on the axis magnetic field is one eight the magnetic field at the centre.

13. P and Q are long straight conductors r distance apart. N is a point in the plane of wires $\frac{r}{4}$ distance away from P carrying current I. What is the magnitude and direction of current in the wire Q, so that net magnetic field at N is zero.



14. In an electiomagnetic wave propagating along + x-axis electric field vector is Ey = 4 x 10^3 Cos (3 x 10^8 t – 1.5 x) V/m. What is (i) the frequency of emwave (ii) amplitude of magnetic field.

15. A and B are two concentric metallic spherical shell of radii a and b having charge q and Q respectively. How much work will be done in moving a test charge q_0 from A to B (a < b). 2

16. What is the SI unit of radioactivity. Express curie in SI unit. The mean life of radio active substance is 2400 yrs. What is its half life 2

17. What is meant by term modulation? Draw a block diagram of a simple modulator for obtaining an AM signal 2

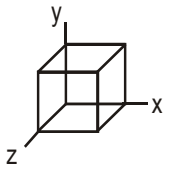
18. In interference pattern obtained in young's double slit experiment, explain how will the angular width of fringe be affected if

    (i) Slits seperation is increased

    (ii) Screen is moved away

    (iii) Experiment is performed in a denser medium 1+½+½+1

19. State Gauss's law in electrostatics. Find (i) net electric flux and (ii) charge enclosed by the cube of side 'a'. Given $E = E_0 x\vec{i}$



20. In an atom energy of electron in n^{th} orbit is $E_n = \frac{-13.6Z^2}{n^2}$ ev, where Z is atomic number.

    What is the shortest and longest wave length of emitted radiation in singly ionized He^+. 3

21. With the helps of a schematic diagram explain the principle and working of a cyclotron. 3

    A bar magnet of magnetic moment Mv held in magnetic field of strength B. What is

    (i) maximum torque on the magnet

    (ii) work done in turning it from stable equilibrium to unstable equilibrium.

22. A parallel plate capacitor of capacitance 4.8 μF has been charged by a battery of 6 V. After disconnecting the battery dielectric medium of dielectric contant 5 in introduced between its plates

    (i) Find new capacitance.

    (ii) What is the ratio of electrostatic energy stored before and after.

    (iii) Calculate new potential difference across the plates. 3

23. Define mutual inductance. Write its SI Unit. Derive an expression for mutual inductance of a system of two concentric and coplaner circular loop P and Q of radii a and b and number of turn N_1 or N_2 respectively (a << b).

24. State the principle of a potentiometer. In the following figure find the length PJ where J si null deflection position. Given PQ = 400cm, Resistance of PQ is 20Ω, Driver cell emf E = 4V and E^1 = 40 mV.

25. What is photo electric efect. Two monochromatic radiations, blue and violet, of the same intensity, are incident on a photo sensitive surface and cause photo electric emission. Would (i) the number of electrons emitted per second and (ii) the maximum kinetic energy of the electrons, be equal in the two cases? Justify your answer. 3

26. Aditya participated in a group discussion in his school on "Human eye and its defects" in the evening he noticed that his father is reading a book by placing it at a distance of 50 cm or more from his eye. He adviced him for his eye check-up.

    (i) Suggest the focal length/power of the reading spectacle for him, so that he may easily read the book placed at 25 cm from eye.

    (ii) Name the value displayed by Aditya.

27. Derive lens makers formula for a double convex lens of radii R_1 and R_2 and refraction index n_2 of the material of lens kept in a medium of refractive index n_1. How will this lens behave if $n_1 > n_2$, trace the required ray diagram.

OR

Draw a labelled diagram of compound microscope for the formation of image. Derive an expression for the magnifying power of a compound microscope.

28. Derive an expression for impedence of a series LCR circuit connected to an ac source. When does its value become minimum.

Sketch graph (i) X_L Vs *v* (ii) X_C Vs *v* (iii) Z Vs *v*.

OR

Derive the relationship between the peak and rms value of current in an ac circuit. For circuits used for transmission of electric power a low power factor implies large power loss in the transmission explain. 5

29. With the help of circuit diagram of an npn transister in common emitter mode, explain its use as an amplifier.

Drawn the output versus input voltage curve and mark region in which the transister is used a (i) switch, and (ii) amplifier.

OR

Draw forward and reverse characterestic curves of a pn junction diode. Explain briefly with the help of a circuit diagram, how a pn junction diode works as a full wave rectifier. If frequency of input ac signal is 'f' what is the frequency of output.

SAMPLE PAPER – I

1. Because magnetic monopole does not exist.
2. A device that allows the passage of a number of frequencies ($W_c \pm W_m$) along with carrier frequency W_c
3. Magnifying power is independent of aperture.
4. (i) IR radiation (ii) Radiowaves
5. Because β emission is followed by antiparticles α and $\bar{\alpha}$.
6. Plane Wavefront.
9. A device consisting of a transmitter and a receiver. This is used to increase communication Range as

   1,2,3 and 4 etc are the repeaters arranged between source of information and the use of information.

10. Drift speed $V_d = a\tau = \frac{eV}{m\rho}\tau$

    $\tau \rightarrow$ Relaxation time

    $V \rightarrow$ potential diff. across the conductor

    $V_d \times \frac{1}{\rho}$

    (i) Drift speed is halved.

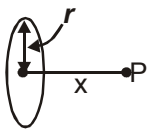
    (ii) $E' = \frac{V'}{l'} = \frac{V}{2\rho} = \frac{E}{2}$ $\therefore$ Electric field is halved.

11.

B	B	Y
0	0	0
1	0	1
0	1	1
1	1	1

OR + NOT $\rightarrow$ NOR

12. $\text{Baxial} = \frac{B_{centre}}{8}$



$$\frac{\mu_0 I r^2}{2(r^2 + x^2)^{3/2}} = \frac{r_0 I}{8(2r)}$$

$\Rightarrow \quad x = \sqrt{3}r.$

13. $B_N = B_P - B_Q$

$\Rightarrow \quad B_P = B_Q$

$$\frac{\mu_o I_p}{2\pi(r/4)} = \frac{\mu_o I_Q}{2\pi(3r/4)}$$

$\Rightarrow \quad I_Q = 3I_P$

14. $E_y = E_{oy} \cos (wt - kx)$

$$\omega = 2\pi\gamma \Rightarrow \gamma = \frac{\omega}{2\pi}$$

$$\gamma = \frac{3 \times 10^8}{2\pi} Hz$$

(i) Speed of *em* waves $V = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 m/s$

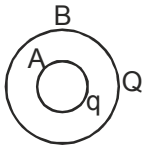
(ii) $B_o = \frac{E_o}{V} = \frac{4 \times 10^3}{2 \times 10^8} = 2 \times 10^{-2} T.$

15. $W_{AB} = q_o \Delta V = q_o (V_B - V_A)$

$$V_A = \frac{kq}{a} + \frac{kQ}{b}$$

$$V_B = \frac{kq}{b} + \frac{kQ}{b}$$

$$\therefore \quad W_{AB} = q_o kq\left(\frac{1}{b} - \frac{1}{a}\right).$$



16. In S.I. system the unit of radioactivity is becquerel.

1 becquerel = 1 disintegration/second.

1 curie = 3.7×10^{10} bq.

$T_{½}$ = mean life × *ln* 2

$$= \frac{\text{mean life}}{1.44}$$

$$= \frac{2400}{1.44}$$

= 1667 years

17. Definition of modulation N.C.E.R.T. Pg. 517 Vol-II.

18. Linear fringe width $\beta = \frac{\lambda D}{d}$

Angular fringe width, $\theta = \frac{\beta}{D} = \frac{\lambda}{d}$

$$\theta = \frac{\lambda}{\mu d}(\text{in some medium})$$

(i) $\theta = \alpha\frac{1}{d} \Rightarrow \theta$ decreases

(ii) θ is undependent of D, $\Rightarrow$ no effect.

(iii) $\theta\alpha\lambda \Rightarrow$ angular width increases

(iv) $\theta\alpha$ 1/M $\Rightarrow$ angular width decreases.

19. Statement of Gauss's law

$$\phi_E = \phi\vec{E}\cdot d\vec{A}$$

$$= \phi_1 + \phi_2 + \phi_3 + \phi_4 + \phi_5 + \phi_6$$

$$= \int\vec{E}\cdot d\vec{A}_1 + 0 + 0 + 0 + 0 + 0$$

$$= E_0 a\hat{i}\, a^2\hat{i}$$

$$= E_0 a^3$$

(ii) $\phi_E = q/E0 \Rightarrow q = \phi_E E_0 = E_0 a^3 E_0$

20. $$\lambda = \frac{hc}{E_2 - E_1}$$

$$= \frac{hc}{13.6 z^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)}$$

For $\lambda_{shortest}$ $n_1 = 1$, $n_2 = \infty$

$$\lambda_{shortest} = \frac{6.624\times10^{-34}\times3\times10^8}{13.6\times4\left(\frac{1}{1} - \frac{1}{\infty}\right)} = 2.25\times10^{-8} m$$

For $\lambda_{longest}$ $n1 = 1, n_2 = 2$

For $\lambda_{longest}$ $\frac{4}{3}\lambda_{shortest}$

$$\frac{4}{3}\times2.25\times10^{-8} m$$

3×10^{-8}m

t $\rightarrow$ Re

21. Principle, working 1, 2

OR

(i) $\tau = MB \sin\theta$

$\tau_{max} = MB \sin 90° = MB$

(ii) $W = U_2 - U_1$ $U = MB\cos\theta$

$= MB - (-MB)$ $U = -MB$ (stable equilib)

$= 2MB$ $U = +MB$ (Unstable equilib)

22. (i) $C = k C_o = 5 \times 4.8 = 24.0\ \mu f$

(ii) $\frac{q^2/2C_o}{q^2/2C} = \frac{C}{C_o} = 5$

(iii) $V = \frac{V_0}{k_1} = \frac{6}{5} = 1.2 volt.$

23. NCERT (Part I) Solved Example

24. Principle of potentiometer when a steady current is passed through a potentiometer wire AB of length L, and V is the potential difference across wire AB, then

Potential gradient $k\frac{V}{L}$

$I = \frac{E}{R + R_{PQ}} = \frac{4}{480 + 20} = 8 \times 10^{-3} A$

$V_{PQ} = I R_{PQ} = 8 \times 10^{-3} \times 20 = 0.16$ Volt.

Potential gradient $k = \frac{V_{PQ}}{L_{PQ}} \frac{0.16}{400} = V/cm$

$AJ = \frac{40 \times 10^{-3}}{0.16} \times 400 \quad = 100 cm.$

25. Define photoelectric effect

(i) Since Intensity is same, ∴ number of electrons emitted per second remain same

(ii) K. Emax a ha

$\alpha_{violet} > \alpha_{blue}$

$\therefore (E.E_{max})_{violet} > (K. E_{max})_{blue}$

27. Refer NCERT

OR

28. Refer NCERT

$P = V_{rms}\ I_{rms}\ Cos\theta$

$$Cos\theta = \frac{P}{I_{rms}V_{rms}}$$

$P_{loss} = I^2_{rms}$ R. R Þ resistance of transmission line.

P_{loss} a I^2_{rms}

Low power factor ($cos\theta$) $\Rightarrow$ high

$\Rightarrow$ high power loss.

29. Refer NCERT