D.A.V SR. SEC. PUBLIC SCHOOL,RIHAND NAGAR

PHYSICS XII
ASSIGNMENT-I

1. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current.

2. To which part of the electromagnetic spectrum does a wave of frequency 5×1019 Hz belong ?

3. Two equal balls having equal positive charge 'q' coulombs are suspended by two insulating strings of equal length. What would be the effect on the force when a plastic sheet is inserted between the two ?

4 Define intensity of radiation on the basis of photon picture of light. Write its S.I. unit.

5.The electric current flowing in a wire in the direction from B to A is decreasing. Find out the direction of the induced current in the metallic loop kept above the wire as shown.

6. Why is it found experimentally difficult to detect neutrinos in nuclear β-decay ?

7. Why is the use of a.c. voltage preferred over d.c. voltage ? Give two reasons.

8. A biconvex lens made of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens ? Give reason.

9.Using Rutherford model of the atom, derive the expression for the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron ?

OR

Using Bohr's postulates of the atomic model, derive the expression for radius of nth electron orbit. Hence obtain the expression for Bohr's radius.

10.A parallel plate capacitor of capacitance C is charged to a potential V. It is then connected to another uncharged capacitor having the same capacitance. Find out the ratio of the energy stored in the combined system to that stored initially in the single capacitor.

11.Considering the case of a parallel plate capacitor being charged, show how one is required to generalize Ampere's circuital law to include the term due to displacement current.

12.A cell of emf 'E' and internal resistance 'r' is connected across a variable resistor 'R'. Plot a graph showing variation of terminal voltage 'V' of the cell versus the current 'I'. Using the plot, show how the emf of the cell and its internal resistance can be determined.

13.Explain, with the help of a circuit diagram, the working of a p-n junction diode as a half-wave rectifier.

14.Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area $1.0 \times 10–7$ m2 carrying a current of 1.5 A. Assume the density of conduction electrons to be 9×1028 m–3.

15.Two monochromatic rays of light are incident normally on the face AB of an isosceles right-angled prism ABC. The refractive indices of the glass prism for the two rays '1' and '2' are respectively 1.35 and 1.45. Trace the path of these rays after entering through the prism.

16.Write the functions of the following in communication systems : (i) Transducer (ii) Repeater

17.Show diagrammatically the behaviour of magnetic field lines in the presence of (i) paramagnetic and (ii) diamagnetic substances. How does one explain this distinguishing feature ?

18.Draw a circuit diagram of n-p-n transistor amplifier in CE configuration. Under what condition does the transistor act as an amplifier ?

19.(a) Using the phenomenon of polarisation, show how transverse nature of light can be demonstrated.

(b) Two polaroids P1 and P2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity Io is incident on P1. A third polaroid P3 is kept in between P1 and P2 such that its pass axis makes an angle of $30°$ with that of P1. Determine the intensity of light transmitted through P1, P2 and P3.

20.Define the term 'mutual inductance' between the two coils.Obtain the expression for mutual inductance of a pair of long coaxial solenoids each of length *l* and radii r1 and r2 (r2 >> r1). Total number of turns in the two solenoids are N1 and N2 respectively.

21.Answer the following :

(a) Why are the connections between the resistors in a meter bridge made of thick copper strips ?

(b) Why is it generally preferred to obtain the balance point in the middle of the meter bridge wire ?

(c) Which material is used for the meter bridge wire and why ?

22.A resistance of R Ω draws current from a potentiometer as shown in the figure. The potentiometer has a total resistance Ro Ω. A voltage V is supplied to the potentiometer. Derive an expression for the voltage across R when the sliding contact is in the middle of the potentiometer.

23.A voltage V = Vo sin ωt is applied to a series LCR circuit. Derive the expression for the average power dissipated over a cycle. Under what condition is (i) no power dissipated even though the current flows through the circuit, (ii) maximum power dissipated in the circuit ?

24.Write any two distinguishing features between conductors,semiconductors and insulators on the basis of energy band diagrams.

25.For the past some time, Aarti had been observing some erratic body movement, unsteadiness and lack of coordination in the activities of her sister Radha, who also used to complain of severe headache occasionally. Aarti suggested to her parents to get a medical check-up of Radha. The doctor thoroughly examined Radha and diagnosed that she has a brain tumour.

(a) What, according to you, are the values displayed by Aarti ?

(b) How can radioisotopes help a doctor to diagnose brain tumour ?

26.Write two basic modes of communication. Explain the process of amplitude modulation. Draw a schematic sketch showing how amplitude modulated signal is obtained by superposing a modulating signal over a sinusoidal carrier wave.

27.An electron microscope uses electrons accelerated by a voltage of 50 kV. Determine the de-Broglie wavelength associated with the electrons. Taking other factors, such as numerical aperture etc. to be same, how does the resolving power of an electron microscope compare with that of an optical microscope which uses yellow light ?

28.(a) Deduce the expression for the torque acting on a dipole of dipole Moment p in the presence of auniform electric field E.

(b) Consider two hollow concentric spheres, S1 and S2, enclosing charges 2Q and 4Q respectively as shown in the figure. (i) Find out the ratio of the electric flux through them. (ii) How will the electric flux through the sphere S1 change if a medium of dielectric constant 'εr' is introduced in the space inside S1 in place of air ?

29.Deduce the necessary expression.

(a) In Young's double slit experiment, describe briefly how bright and dark fringes are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width.

(b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9 : 25. Find the ratio of the widths of the two slits. **OR**

(a) Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence obtain the conditions for the angular width of secondary maxima and secondary minima.

(b) Two wavelengths of sodium light of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture $2 \times 10-6$ m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.

30.(a) Deduce an expression for the frequency of revolution of a charged particle in a magnetic field and show that it is independent of velocity or energy of the particle.

(b) Draw a schematic sketch of a cyclotron. Explain, giving theessential details of its construction, how it is used to accelerate the charged particles **OR**

(a) Draw a labelled diagram of a moving coil galvanometer. Describe briefly its principle and working. (b) Answer the following :

(i)Why is it necessary to introduce a cylindrical soft iron coreinside the coil of a galvanometer ?

(ii) Increasing the current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity. Explain, giving reason.

ASSIGNMENT II

1. Two charges of magnitudes – 2Q and + Q are located at points (a, 0) and (4a, 0) respectively. What is the electric flux due to these charges through a sphere of radius '3a' with its centre at the origin?
2. How does the mutual inductance of a pair of coils change when
(i) distance between the coils is increased and
(ii) number of turns in the coils is increased?
3. The graph shown in the figure represents a plot of current versus voltage for a given semiconductor. Identify the region, if any, over which the semiconductor has a negative resistance.
4. Two identical cells, each of emf E, having negligible internal resistance, are connected in parallel with each other across an external resistance R. What is the current through this resistance?
5. The motion of copper plate is damped when it is allowed to oscillate between the two poles of a magnet. What is the cause of this damping?
6. Define the activity of a given radioactive substance. Write its S.I. unit.
7. Welders wear special goggles or face masks with glass windows to protect their eyes from electromagnetic radiations. Name the radiations and write the range of their frequency.
8. Write the expression for the de Broglie wavelength associated with a charged particle having charge 'q' and mass 'm', when it is accelerated by a potential V.
9. Draw typical output characteristics of an n-p-n transistor in CE configuration. Show how these characteristics can be used to determine output resistance.
10. A parallel beam of light of 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen. Calculate the width of the slit.
11. A slab of material of dielectric constant K has the same area as that of the plates of a parallel plate capacitor but has the thickness d/2, where d is the separation between the plates. Find out the expression for its capacitance when the slab is inserted between the plates of the capacitor.
12. A capacitor, made of two parallel plates each of plate area A and separation d, is being charged by an external ac source. Show that the displacement current inside the capacitor is the same as the current charging the capacitor.
13. Explain the term 'drift velocity' of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of 'drift velocity'. **OR**
Describe briefly, with the help of a circuit diagram, how a potentiometer is used to determine the internal resistance of a cell.
14. A convex lens of focal length $f1$ is kept in contact with a concave lens of focal length $f2$. Find the focal length of the combination.
15. In the block diagram of a simple modulator for obtaining an AM signal, shown in the figure, identify the boxes A and B. Write their functions.
16. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.
17. (a) For a given a.c., $i = i_m \sin \omega t$, show that the average power dissipated in a resistor R over a complete cycle is $\frac{1}{2} i_m^2 R$.
(b) A light bulb is rated at 100 W for a 220 V a.c. supply. Calculate the resistance of the bulb.
18. A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5 T. The field is directed perpendicular to the plane of the conductor. When the arm MN of length of 20 cm is moved towards left with a velocity of 10 ms–1, calculate the emf induced in the arm. Given the resistance of the arm to be 5 Ω (assuming that other arms are of negligible resistance) find the value of the current in the arm
OR
A wheel with 8 metallic spokes each 50 cm long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of the Earth's magnetic field. The Earth's magnetic field at the plane is 0.4 G and the angle of dip is 60°. Calculate the emf induced between the axle and the rim of the wheel. How will the value of emf be affected if the number of spokes were increased?
19. Define the current sensitivity of a galvanometer. Write its S.I. unit.
Figure shows two circuits each having a galvanometer and a battery of 3 V.

When the galvanometers in each arrangement do not show any deflection, obtain the ratio R1 / R2 .

20. A wire AB is carrying a steady current of 12 A and is lying on the table. Another wire CD carrying 5A is held directly above AB at a height of 1 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of g = 10 ms–2]

21. Draw V- I characteristics of a p–n junction diode. Answer the following questions, giving reasons:

(i)Why is the current under reverse bias almost independent of the applied potential upto a critical voltage?

(ii) Why does the reverse current show a sudden increase at the critical voltage?

Name any semiconductor device which operates under the reverse bias in the breakdown region.

22. Draw a labelled ray diagram of a refracting telescope. Define its magnifying power and write the expression for it.

Write two important limitations of a refracting telescope over a reflecting type telescope.

23. Write Einstein's photoelectric equation and point out any two characteristic properties of photons on which this equation is based. Briefly explain the three observed features which can be explained by this equation.

24. Name the type of waves which are used for line of sight(LOS)communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a height of 20 m and the height of the receiving antenna is 45 m. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the Earth = 6.4 × 106 m)

25. (a) What is linearly polarized light? Describe briefly using a diagram how sunlight is polarised.

(b) Unpolarised light is incident on a polaroid. How would the intensity of transmitted light change when the polaroid is rotated?

26. One day Chetan's mother developed a severe stomach ache all of a sudden. She was rushed to the doctor who suggested for an immediate endoscopy test and gave an estimate of expenditure for the same. Chetan immediately contacted his class teacher and shared the information with her. The class teacher arranged for the money and rushed to the hospital. On realising that Chetan belonged to a below average income group family, even the doctor offered concession for the test fee. The test was conducted successfully.

Answer the following questions based on the above information:

(a) Which principle in optics is made use of in endoscopy?

(b) Briefly explain the values reflected in the action taken by the teacher.

(c) In what way do you appreciate the response of the doctor on the given situation?

27. (a) Using Biot-Savart's law, derive the expression for the magnetic field in the vector form at a point on the axis of a circular current loop.

(b) What does a toroid consist of ? Find out the expression for the magnetic field inside a toroid for N turns of the coil having the average radius r and carrying a current I. Show that the magnetic field in the open space inside and exterior to the toroid is zero. **OR**

(a) Draw a schematic sketch of a cyclotron. Explain clearly the role of crossed electric and magnetic field in accelerating the charge. Hence derive the expression for the kinetic energy acquired by the particles.

(b) An α–particle and a proton are released from the centre of the cyclotron and made to accelerate.

(i) Can both be accelerated at the same cyclotron frequency? Give reason to justify your answer.

(ii) When they are accelerated in turn, which of the two will have higher velocity at the exit slit of the dees?

28. (a) Define electric dipole moment. Is it a scalar or a vector? Derive the expression for the electric field of a dipole at a point on the equatorial plane of the dipole.

(b) Draw the equipotential surfaces due to an electric dipole. Locate the points where the potential due to the dipole is zero. **OR**

Using Gauss' law deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point (i) outside and (ii) inside the shell.

Plot a graph showing variation of electric field as a function of r > R and r < R. (r being the distance from the centre of the shell)

29. Using Bohr's postulates, derive the expression for the frequency of radiation emitted when electron in hydrogen atom undergoes transition from higher energy state (quantum number ni) to the lower state,(nf).

When electron in hydrogen atom jumps from energy state *ni* =4 to *nf* =3, 2,1, identify the spectral series to which the emission lines belong. **OR**

(a) Draw the plot of binding energy per nucleon (BE/A) as a function of mass number A. Write two important conclusions that can be drawn regarding the nature of nuclear force.

(b) Use this graph to explain the release of energy in both the processes of nuclear fusion and fission.

(c) Write the basic nuclear process of neutron undergoing β–decay. Why is the detection of neutrinos found very difficult?

1. Two charges of magnitudes – 3Q and + 2Q are located at points (a, 0) and (4a, 0) respectively. What is the electric flux due to these charges through a sphere of radius '5a' with its centre at the origin?

2. A light metal disc on the top of an electromagnet is thrown up as the current is switched on. Why? Give reason.

3. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.

4. A parallel beam of light of 600 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1.2 m away. It is observed that the first minimum is at a distance of 3 mm from the centre of the screen. Calculate the width of the slit.

5. A wire AB is carrying a steady current of 10 A and is lying on the table. Another wire CD carrying 6A is held directly above AB at a height of 2 mm. Find the mass per unit length of the wire CD so that it remains suspended at its position when left free. Give the direction of the current flowing in CD with respect to that in AB. [Take the value of g = 10 ms–2]

6. Name the type of waves which are used for line of sight (LOS) communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a height of 45 m and the height of the receiving antenna is 80 m. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the Earth =6.4×106 m).

7. Two charges of magnitudes + 4Q and – Q are located at points (a, 0) and (– 3a, 0) respectively. What is the electric flux due to these charges through a sphere of radius '2a' with its centre at the origin?

8. The motion of copper plate is damped when it is allowed to oscillate between the two poles of a magnet. If slots are cut in the plate, how will the damping be affected?

9. How does the mutual inductance of a pair of coils change when

(i) distance between the coils is decreased and

(ii) number of turns in the coils is decreased?

10. In the circuit shown in the figure, identify the equivalent gate of the circuit and make its truth table.

11. A slab of material of dielectric constant K has the same area as that of the plates of a parallel plate capacitor but has the thickness 2d/3, where d is the separation between the plates. Find out the expression for its capacitance when the slab is inserted between the plates of the capacitor.

12. Name the type of waves which are used for line of sight (LOS) communication. What is the range of their frequencies?

A transmitting antenna at the top of a tower has a height of 45 m and the receiving antenna is on the ground. Calculate the maximum distance between them for satisfactory communication in LOS mode. (Radius of the Earth =6.4×106M)

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