HEM SHEELA MODEL SCHOOL

D U R G A P U R

PHYSICS ASSIGNMENT

CLASS XII

ELECTROSTATIC

1. Derive an expression for the electric field at a point on the axial position of an electric dipole.
2. Derive an expression for the electric field at a point on the equatorial position of an electric dipole.
3. Derive an expression for the energy stored in a capacitor. Show that whenever two conductors share charges by bringing them into electrical contact, there is a loss of energy.
4. Derive an expression for the effective capacitance when capacitors are connected in (a) series and (b) parallel
5. Explain the principle of a capacitor and derive an expression for the capacitance of a parallel plate capacitor.
6. State Gauss theorem and apply it to find the electric field at a point due to (a) a line of charge (b) A plane sheet of charge (c) A Charged spherical conducting shell
7. State Coulomb's law and express it in vector form. Derive it using Gauss theorem.
8. Derive an expression for the torque on an electric dipole in a uniform electric field.
9. Derive an expression for the work done in rotating an electric dipole in a uniform electric field
10. Derive an expression for the energy stored (Potential Energy) in a dipole in a uniform electric field.
11. Derive an expression for the electrostatic potential energy of a system of point charges
12. Derive an expression for the capacitance of a parallel plate capacitor with (a) a dielectric slab (b) a metallic plate in between the plates of the capacitor.
13. Define electric potential at a point. Derive an expression for the electric potential at a point due to (a) a point charge (b) a system of point charges (c) a dipole (at an axial, equatorial and any point).
14. Show that the work done in an electric field is independent of path.
15. What are dielectrics? Distinguish polar and non-polar dielectrics. Define the term Polarization vector.
16. Show that the potential difference between the points is the line integral of the electric field.
17. Explain the principle of generator. Hence prove that the charge always flow from inner shell to the outer shell irrespective of their sign and magnitude of the charge. (Charge remains flow still their potential are not same).

ELECTRICITY

1. Define drift velocity and derive an expression for it.
2. Derive the expression I=nAevd.(where the symbols have their usual meanings).
3. Deduce Ohm's law from elementary ideas and hence write an expression for resistance and resistivity.
4. Derive an expression for conductivity in terms of mobility.
5. Explain the color coding of carbon resistors.
6. Derive an expression for the current in a circuit with external resistance R when (a) n identical cells of emf E and internal resistance r are connected in series (b) m identical cells are connected in parallel
7. State and explain Kirchhoff’s laws.
8. State and explain the principle of Wheat Stone's principle. Deduce it using Kirchhoff’s laws.
9. Describe how you will determine the resistance of a given wire using Meter Bridge.
10. Explain the principle of a potentiometer. Describe how will you determine (a) the ratio of emfs of two primary cells using potentiometer. (b) The internal resistance of a primary cell using potentiometer.

11. Explain the variation of resistance and resistivity with temperature and hence define temperature coefficient of resistance and resistivity.

Magnetic Effect of Current

1. State Biot- Savart law and apply it to find the magnetic field due to a circular loop carrying current at a point (a) at its centre (b) on the axis
2. State Ampere's circuital law and apply it to find the magnetic field (a) inside a current carrying solenoid (b) inside a current carrying toroid
3. Apply Ampere's circuital law to determine the magnetic field at a point due to a long straight current carrying conductor.
4. Derive an expression for the force on a current carrying conductor in a uniform magnetic field
5. Derive an expression for the force between long straight conductors carrying current and hence define 1 ampere.
6. Derive an expression for the torque on a current carrying loop in a uniform magnetic field.
7. Describe the principle construction and working of a Moving coil galvanometer.
8. Describe the conversion of a moving coil galvanometer into (a) Ammeter (b) Voltmeter
9. What is radial magnetic field? What is its importance in a moving coil galvanometer? How is a radial magnetic field realized in moving coil galvanometers?
10. Describe the principle construction and working of a cyclotron. Explain why an electron cannot be accelerated using a cyclotron.
11. Describe the motion of a charged particle in a magnetic field when it enters the field (a) perpendicular to the field lines (b) obliquely making and angle Θ with the field lines
12. Derive an expression for the magnetic dipole moment of a revolving electron and hence define Bohr magneton.

Electromagnetic Induction (EMI)-

1. State and Explain Faraday's laws of electromagnetic induction.
2. State Lenz' Law and show that it is in accordance with the law of conservation of energy.
3. Use Lenz' law to find the direction of induced emf in a coil when (a) a north pole is brought towards the coil (b) north pole taken away from the coil (c) A south pole is brought towards the coil and (d) a south pole is taken away from the coil, Draw illustrations in each case.
4. What is motional emf. Deduce an expression for it. State Fleming's right hand rule to find the direction of induced emf.
5. What are eddy currents? Describe the applications of eddy currents.
6. Explain the working of (a) Electromagnetic Brakes (b) Induction Furnace
7. Which physical quantity is called the INERTIA OF ELECTRICITY? Why is it called so?
8. Define self induction and self inductance. What is its unit? Write its dimensions.
9. Derive an expression for the self inductance of a long solenoid.
10. Explain the phenomenon of mutual induction and define mutual inductance. Write the unit and dimensions of mutual inductance.
11. What are the factors affecting mutual inductance of a pair of coils? Define coefficient of coupling.
12. Describe the various methods of producing induced emf. Derive an expression for the instantaneous emf induced in a coil rotated in a magnetic field.
13. What is displacement current? Explain its need.

Alternative Current-

1. Describe the principle construction and working of an AC generator. Draw neat labeled diagram
2. Define mean value of AC(over a half cycle) and derive an expression for it.
3. Define RMS value of AC and derive an expression for it.
4. Show that the average value of AC over a complete cycle is zero.
5. Show that the current and voltage are in phase in an ac circuit containing resistance only.
6. Deduce the phase relationship between current and voltage in an ac circuit containing inductor only.
7. Deduce the phase relationship between current and voltage in an ac circuit containing capacitor only.
8. Draw the phasor diagram showing voltage and current in LCR series circuit and derive an expression for the impedance.
9. What do you mean by resonance in Series LCR circuit? Derive an expression for the frequency of resonance in LCR circuit.
10. Distinguish between resistance, reactance and impedance.
11. Define quality factor (Q factor) of resonance and derive an expression for it. .
12. Derive an expression for the average power in an ac circuit.
13. Define power factor. Deduce expression for it and explain wattles current?
14. Describe the principle construction theory and working of a transformer.
15. Describe the various losses in a transformer and explain how the losses can be minimized.

Electromagnetic Waves-

1. Explain the inadequacy of Ampere's circuital law
2. Describe Hertz experiment to demonstrate the production of electromagnetic waves
3. Write the properties of electromagnetic waves.
4. Write any five electromagnetic waves in the order of decreasing frequency and write any two properties and uses of each
5. Deduce an expression for velocity of em waves in vacuum
6. Establish the transverse nature of electromagnetic waves.
7. Compare the properties of electromagnetic waves and mechanical waves.

Ray-Optics-

1. Derive mirror formula for a concave mirror and convex mirror.
2. Derive an expression for lateral shift and normal shift. On what factors these depend.
3. Define TIR and write the conditions for TIR. Derive a relation between critical angle and the refractive index of the medium. Also explain the working of isosceles prism and optical fiber.
4. Derive the following relation for a real image formed by a convex refracting surface when the object is placed in rarer medium. Also write the assumptions and sign convention used.

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$

5. Derive the lens maker's formula. Also write the assumptions and sign convention used.
6. Derive the lens formula for convex lend and concave lens.
7. Derive the relation for equivalent focal length or power when two thin lenses are placed in contact to each other. In which condition the lens combination will act as a plane glass sheet.
8. Derive the following relations for a prism-

(a) $i + e = A + \delta$ (b) $\delta = (\mu - 1)\, A$ (c) $\mu = \dfrac{\sin\frac{A+\delta_m}{2}}{\sin\frac{A}{2}}$ where the symbols have their usual meanings.

10. Draw a ray diagram to show the image formation in refracting type astronomical telescope in the near point adjustment (when image is formed at LDDV i.e. D=25cm). Derive an expression for its magnifying power. Why the diameter of objective of telescope should be large?

11. Draw a ray diagram to show the image formation in refracting type astronomical telescope in the normal adjustment (when image is formed at infinity). Derive an expression for its magnifying power. How does the magnifying power get affected on increasing the aperture of the objective lens and why?
12. Draw a ray diagram to show the image formation a compound microscope. Explain briefly the working. Derive an expression for its magnifying power. Why the diameter of objective of microscope should be small.
13. Draw a labeled diagram of a reflecting type telescope. State two advantages of this telescope over refracting type telescope.
14. Define resolving power of compound microscope. How does the resolving power of a compound microscope change when-(a) Refractive index of medium between the object and objective lens increases (b) Wavelength of the light used is increased (c) decreasing the diameter of objective (iv) increasing the focal length of its objective.
15. Define the resolving power of astronomical telescope. Write the expression for it and state, on what factors it depends