CLASS XII SCIENCE

PHYSICS

HOME ASSIGNMENTS – 02 (DEC'2017)

FM – 33

Answer ALL questions IN ORDER.

1. Explain the principle of a capacitor.   (1)
2. An air capacitor is given a charge of 2 µC raising its potential to 200 V. If on inserting a dielectric medium, its potential falls to 50 V, what is the dielectric constant of the medium?   (1)
3. A uniformly charged conducting sphere of 2.4 m diameter has a surface charge density of 80.0 µC/m^2.
   (a) Find the charge on the sphere (b) What is the total electric flux leaving the surface of the sphere?   (2)
4. Using Gauss' theorem, derive an expression for electric field intensity at a point due to a uniformly charged thin spherical shell.   (3)
5. Derive an expression for the energy stored in a charged capacitor.   (3)
6. On a clear day, the electric field near the earth surface is 100 N/C, directed vertically downward.
   (a) If we adopt the convention that the potential at the earth surface is zero, then what is the potential 100 m above the earth surface.
   (b) What is the potential of the top of a peak 400 m above sea level.
   (c) What is the potential of the top of a man's head, if the man is 1.8 m tall.   (3)
7. Derive an expression for the electrostatic potential at a point due to an electric dipole.   (3)
8. Define torque, giving its SI unit; derive an expression for the torque acting on this dipole.   (3)
9. Two parallel plate capacitors X and Y, have same area of plates and same separation between them. X has air between the plates and Y has a dielectric medium of $\varepsilon_r = 4$.   (3)
   (i)   Calculate capacitance of each capacitor if capacitance of the combination is 4 µF.
   (ii) Calculate p.d between the plates of X and Y.
   (iii) What is the ratio of electrostatic energy stored in X and Y ?   (3)
10. Find the expression for the capacitance of a parallel plate capacitor when (i) a thin dielectric slab of thickness t is inserted in between the plates. (ii) a dielectric slab fills the entire space between the plates.   (3)
11. Find the expression for the energy stored in the capacitor. Also find the energy lost when the charged capacitor is disconnected from the source and connected in parallel with the uncharged capacitor. Where does this loss of energy appear?   (5)

HOME ASSIGNMENTS – 03 (DEC'2017)

FM – 33

Answer all questions in order.

1. In Young's double slit experiment while using a source of light of wavelength 5000 X 10^{-10} m, the fringe width obtained is 0.6 cm. If the distance between the screen and slit is reduced to half what should be the wave length of the source to get fringes 0.003m wide.   (3)
2. What happens when one of the slit in double slit experiment is covered with the opaque material?   (2)

3. Why a slight shaking of the picture on the TV screen is observed when a low flying aircraft passes overhead ? (2)

4. What will be the ratio of slit widths, if the amplitude ratio of light waves from them is $\sqrt{3} : 1$? (2)

5. What will be the effect on the fringes formed in Young's double slit experiment if –
   (a) the apparatus is immersed in water,
   (b) white light is used instead of monochromatic light ? (3)

6. What two main changes in diffraction pattern of a single silt will you observe when the monochromatic source of light is replaced by a source of white light ? (2)

7. State and prove Brewster's law. (3)

8. The refracted light is found to be completely plane polarised when sun light is incident on water surface at glancing angle 30^0 . Determine angle of refraction and refractive index of water . (3)

9. Derive an expression for the width of the central maximum for diffraction of light at a single slit. (5)

10. What is interference of light? Prove that the fringe width of both bright and dark fringes in interference is same in Young's double slit experiment. (5)

HOME ASSIGNMENTS – 04 (DEC'2017)

FM – 70   **TIME - 3 hrs.**

General Instructions :
(i) All questions are compulsory.
(ii) There are 26questions in total. Questions No. 1 to 5are very short answer type questions and carry one mark each.
(iii) Questions No. 6to 10 carry two marks each, questions 11 to 22 carry three marks each and questions 24 to 26carry five marks each.
(iv) One of the questions No. 23 carrying four marks weightage is value based question.
(v) There is no overall choice. However, an internal choice has been provided
in one question of two marks, one question of three marks and all three questions of five marks each weightage. You have to attempt only one of the choices in such questions.
(vi) Use of calculators is not permitted. However, you may use log tables if necessary.

1. You are asked to measure e.m.f of a cell. Which instrument will you use -a high resistance voltmeter or Potentiometer and why ?

2. An electron and a proton, having equal moment a, enter a uniform magnetic field at right angles to the field lines. What will be the ratio of their trajectories ?

3. Why is short wave band used for long distance Radio Broadcast ?

4. If a wire is stretched to double its original length without loss of mass, how will the resistivity of the wire be influenced ?

5. When light travel from a rarer to denser medium, the speed decreases. Does this decrease in speed imply a decrease in the energy carried by the light wave ? Justify your answer.

6. Write Einstein's photoelectric equation. Explain the terms.
   (i) Threshold frequency and
   (ii) Stopping potential.

7. Two substances A and B have relative permeabilities slightly greater and less than unity respectively. To class of magnetic substances do they belong ?   **OR**

8. Find the resistivity of a conductor in which the current density of 2.5 Am^{-2} is found to exist when an electric field of 15 Vm^{-1} is applied on it.

9. An electron and a proton having equal momenta, enter a uniform magnetic field at right angles to the field lines. What will be the ratio of their trajectories ?

10. Suggest a suitable method to invert an image (i) Without change in size. (ii) Without change in size and without deviation from its original direction of view. Explain how the same is achieved ?

11. Define Self-inductance of a coil. Show that magnetic energy required building up the current I in a coil of self-inductance L is given by ½ LI^2.

12. 'n' identical capacitors when joined in series give an effective capacitance of C Units. What will be the capacitance if the capacitors are now placed in parallel combination ?

13. Show that the power due to the force exerted by the magnetic field on a moving charge is zero.

14. Two identical cells of emf 1.5V each joined in parallel, provide supply to an external circuit consisting of two resistors of 17Ω. Each joined in parallel. A very high resistance voltmeter reads the terminal voltage of the cells to be 1.4V. What is the internal resistance of each cell ?

15. Draw a plot showing the variation of (i) Electric field (E) and (ii) Electric potential (V) with distance r due to a point charge Q.

16. A change of 0.2 mA in the base current causes a change of 5mA in the collector current for a common emitter amplifier. (i) Find the a.c. current gain of the transistor. (ii) If the input resistance is 2k Ω, and its voltage gain is 75, calculate the load resistor used in the circuit.

17. The binding energy per nucleon of deuteron ($^2H_1$) and helium nucleus ($^4He_2$) is known to be 1.1 MeV and 7 MeV respectively. If two deuteron nuclei react to form a single helium nucleus; calculate the energy released ?

18. A person with a normal near point (25cm) using a compound microscope with an objective of focal length 8 mm and an eye piece of focal length 2.5cm can bring a object placed 9 mm from the objective in sharp focus. What is the separation between the two lenses? How much is the magnifying power of the Microscope ?

19. Define the term "modulation index" for an AM wave. What would be the modulation index for an AM wave for which the maximum amplitude is "a" while the minimum amplitude is 'b'?

Or

What is space wave propagation? Which two communication methods make use of this mode of propagation ? If the sum of the heights of transmitting and receiving antenna in line of sight of communication is fixed at h, how that the range is maximum when the two antenna have a height h/2 each.

20. Three light rays red (R), green (G), and blue (B) are incident on a right angled prism abc at face 'ab'. The refractive indices of the material of the prim for red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. Out of the three which colour ray will emerge out of face "ac"? Trace the path of these rays after passing through face 'ab' ?

21. An electromagnetic wave is travelling in a medium with a velocity V = Vî. The electric field oscillations of the electromagnetic wave are along the Y-axis.
    (a) Identify the direction in which the magnetic field oscillations of the electromagnetic wave are taking place.
    (b) How are the magnitudes of the electric field and magnetic field in the electromagnetic wave related to each other?

22. Using Biot-Savarts law, derive the expression for the magnetic field in the vector form at a point on the axis of a circular current loop.

23. (a) On what principle electromagnetic crane works?
    (b) One day Mrs. Rita mother of Master Rahul kept her charged mobile phone over a refrigerator in the evening and she took it next day morning, she found that the charge was totally very low, and she was discussing this to Master Rahul. Immediately Master Rahul said that mobile phone has a battery so due to excessive heat from refrigerator; battery will loose its magnetic property so that mobile phone shows lesser charge?
    (c) What character was highlighted by Master Rahul ?

24. Derive an expression for the impedance of a series LCR circuit connected to an AC supply of variable frequency. Plot a graph showing variations of current with the frequency of the applied voltage. Explain briefly how the phenomenon of resonance in the circuit c an be used in the tuning mechanism of a radio or a TV set ?

Or

Explain with the help of a labeled diagram, the principle, construction and working of an a.c generator.

25. State the assumptions and sign conventions in deriving the lens makers formula and also derive an expression for it.

Or

(a) How is a wave front different from a ray?

(b) Draw the geometrical shape of the wave fronts when (i) Light diverges from a point source. (ii) Light emerges out of a convex lens, when a point source is placed at its focus

(c) State Huygens principle. With the suitable diagram, prove law of reflection using Huygens principle.

26. (a) Draw a circuit diagram of a common emitter amplifier using p-n-p transistor. Show input and output voltages graphically. The current gain for common emitter amplifier is 59. If the emitter current is 6mA find (i) base current and (ii) collector current.

Or

a) Distinguish between metals, insulators and semiconductors on the basis of their energy bands.

b) Why are photodiodes used preferably in reverse basis condition ? A Photodiode is fabricated from a semiconductor with band gap of 2.8 ev. Can it detect a wavelength using 6000nm ? Justify.