St. Xavier's Sr. Sec. School
Delhi-54

Pre Board Examination 2016
Std. 12
05-01-2016

Set 2

PHYSICS

Max. Marks : 70
Time : 3 hrs.

INSTRUCTIONS:

i) Q. Nos. 1 to 5 carries 1 mark each.
ii) Q. Nos. 6 to 10 carry 2 marks each.
iii) Q. Nos. 11 to 22 carry 3 marks each.
iv) Q. No. 23 carries 4 marks.
v) Q. Nos. 24 to 26 carry 5 marks each.
vi) Use pencil for the diagrams and graphs.
vii) Answers should be to the point.
viii) Use log tables if necessary.

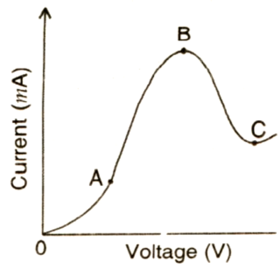
1. What happens to the converging ability of a convex lens as the refractive index of the surrounding medium increases? (1)

2. Define Q factor of an a.c. circuit (1)

3. A charge q is enclosed by a spherical surface of radius R. What is the electric flux thorough this spherical surface and how would this electric flux change if the radius is reduced to half of its original value? (1)

4. Define the modulation index. (1)

5. The graph shown represents a plot of current verses voltage for a given semiconductor. Identify the semiconductor and identify the region, if any, over which the semiconductor has a negative resistance. (1)



6. Find the ratio of de-Broglie wavelengths associated with two electrons 'a' and 'b' which are accelerated by 8V and 64V respectively. (2)

7. A battery of emf 2.0V and internal resistance 0.1Ω is being charged with a current of 5.0A. What is the potential difference between terminals of the battery? What will be the potential difference if the same amount of current is drawn from the battery? (2)

8. An object is placed 25 cm from a convex mirror. A plane mirror is now placed in such a way that both the mirrors produced image at the same place. Determine radius of curvature of the convex mirror. (2)

9. State Bohr's postulates. Using these postulates derive on expression for total energy of an electron. (2)

10. What do you mean by doping? How does the energy gap in a semiconductor vary,

when doped with a pentavalent impurity? (2)

11. Draw a neat ray diagram of an astronomical telescope in normal adjustment. Write one the defect of this telescope? Why this setting is preferred for astronomical telescope. (3)

12. State Kirchhoff's rules for an electric network. Using these rules, obtain the balance condition in terms of the resistances of four arms of Wheatstone bridge.

(OR)

What do you mean by potential gradient? Using neat circuit diagram, explain how the internal resistance of a primary cell is determined and hence derive the expression for internal resistance. (3)

13. What do you mean by break down voltage? What is its significance? With the help of circuit diagram, explain how Zener diode is used to regulate the voltage. (3)

14. (i) Show that the average power consumed in an inductor L connected to an a.c. source is zero.
(ii) In a series LR circuit, $X_L = R$ and the power factor of the circuit is P_1. When a capacitor with capacitance C such that $X_C = X_L$ is put in series, the power factor becomes P_2. Find out P_1 / P_2. (3)

15. (i) Which one of the following electromagnetic radiations has least frequency: UV radiations, x-rays and microwaves?
(ii) Write the expression for the energy density of an electromagnetic wave propagating in free space. (3)

16. In Young's double slit experiment two slits are 1.5 mm apart. The screen is at a distance of 15 m from the slits. If a light of wave length 500 nm is used; calculate;
(i) Angular separation between 10th bright fringe and 5th dark fringe on two sides of center bright.
(ii) At what minimum distance from the center will the intensity become half of the intensity at the center? (3)

17. (i) Why photoelectrons ejected from a metal surface have different kinetic energies although the frequencies of incident photons are same?
(ii) The work function of the following metal is given Na = 2.75 eV, K = 2.3 eV, Mo=4.14 eV, Ni=5.15 eV which of these metals will not give a photoelectric emission for radiation of wave length 3300 A^o. (3)

18. A 10 microfarad capacitor charged by a 30 V dc source. The capacitor is disconnected from the source and then connected across an uncharged 50 microfarad capacitor.
Calculate (i) the final potential difference across the combination.
(ii) the initial and final energies of the system.
What will you account for the difference in energy? (3)

19. (i) With the help of circuit diagram, show how a moving coil galvanometer can be converted into a voltmeter of given range. Derive the necessary mathematical formula for the resistance needed to convert it into voltmeter.
(ii) A galvanometer coil has resistance of 12 ohm and the meter shows full scale deflection for a current of 3mA.Calculate the value of resistance needed to convert it into voltmeter

of range 0-18V. (2+1)

20. What does 'LOS communication' mean? Name the type of waves that are used for this communication. Give typical examples. Explain space mode propagation with the help of a diagram. (3)

21. Calculate the binding energy per nucleon for a ${}^{12}_{6}C$ nucleus and mass of ${}^{12}_{6}C$ =12amu, mass of a proton = 1.007825 amu and mass of a neutron = 1.00866 amu. 1 a.m.u. $\equiv$ 931 MeV. (3)

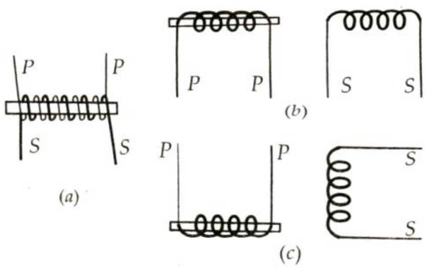
22. Explain the working of npn transistor as an amplifier and find an expression for its voltage gain. (3)

23. A group of students while coming from the school noticed a box marked "Danger H.T. 22000V" at a substation in the main street. They did not understand the utility of such a high voltage, while they argued; the supply was only 220 V. They asked their teacher this question the next day. The teacher thought it to be an important question and therefore explained to the whole class. Answer the following questions:
(i) What device is used to bring the high voltage down to low voltage of a.c. current and what is the principle of its working?
(ii) Is it possible to use this device for bringing down the high dc voltage to the low voltage? Explain.
(iii) Write the values displayed by the students and the teacher. (4)

24. (i) State Ampere's circuital law. A straight thick wire of uniform cross section of radius 'a' is carrying steady current I. Using Ampere's circuital law, obtain the relation showing the variation of magnetic field inside and outside the wire.
(ii) A long straight conductor of radius 4cm carries a current of 2A, which is uniformly distributed over its circular cross section. Find the magnetic field at a distance of 3cm from the axis of the conductor. (3+2)

(OR)

a) Define mutual induction. On what factors does the mutual inductance of a pair of coils depend.
b) In which of the following cases will the mutual inductance of two coils be
(i) minimum
(ii) maximum.



c) A solenoid of length 50cm with 20 turns per cm and area of cross section 40cm^2 completely surrounds another co-axial solenoid of the same length, area of cross section 25cm^2 with 25 turns per cm. Calculate the mutual inductance of the system. (2+1+2)

25. (i) Give reason why diffraction dark fringes are never completely dark; whereas interference dark could be completely dark.
    (ii) What is Fresnel's distance? Establish an expression for it.
    (iii) In a single slit diffraction experiment light of wave length 600 nm is used. If first minima fall at an angle of 30° from the centre of the slit determine the width of the slit. If two such slits are now used in double slit experiment; what should be the separation between them so that the 10 bright interference fringes are formed between the centre maxima of the diffraction pattern. (1+1+3)

(OR)

Draw a ray diagram to show path of light through a convex refracting curved surface placed in a rarer surrounding. Hence derive the surface formula. By obtaining the expression for 1^{st} and 2^{nd} principal focal length distinguish clearly between them. (1+2+2)

26. Give the relation between the magnitudes of electric fields of a short dipole at axial and equatorial points.
    (i) How does an electric dipole, which is free to move, behave when it is placed in
        (a) a uniform electric field.
        (b) a non-uniform electric field?
    (ii) Three point charges +q, +2q and Q are placed at the three vertices of an equilateral triangle. Find the value of Q (in terms of q), so that electric potential energy of the system is zero. (1+2+2)

(OR)

    (i) State Gauss's theorem, write its mathematical equation.
    (ii) Derive the expression for electric field intensity due to charged sphere at a point
        (a) Inside the sphere.
        (b) Out side the sphere.
    (iii) Show the variation of electric field intensity with the distance as measured from the center of the sphere. (1+3+1)

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