AMRITA VIDYALAYAM

AMRITA PRE BOARD EXAMINATION 2017 -'18

Class : XII **Marks : 70**

Time : 3 hrs

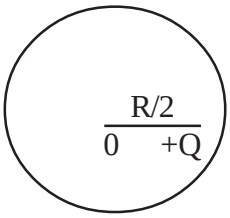
PHYSICS (042)

GENERAL INSTRUCTIONS:

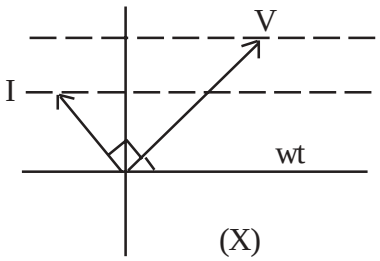
1. ***All questions are compulsory. There are 26 questions in all.***
2. ***Section A contains 5 questions of 1 mark each.***
   Section B contains 5 questions of 2 marks each.
   Section C contains 12 questions of 3 marks each.
   Section D contains 1 value based question of 4 marks.
   Section E contains 3 questions of 5 marks each.
3. ***There is no overall choice. However an internal choice has been provided in 1 question of 3 marks and all 3 questions of 5 marks each. You have to attempt only 1 of the choices in each questions.***
4. ***You may use the following values of physical constants.***
   $C = 3 \times 10^8 M / S$ $h = 6.63 \times 10^{-34} JS$
   $e = 1.6 \times 10^{-19} C$ $\mu_o = 4\pi \times 10^{-7} TmA^{-1}$

SECTION - A

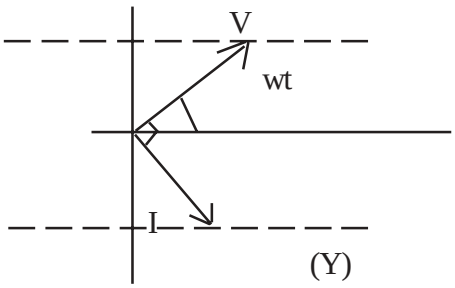
1. Figure shows a point +Q located at a distance $\frac{R}{2}$ from the centre of a spherical metal shell. Draw the electric lines for the given system.



2. Define mobility of a charge carrier. What is it's relation with relaxation time?
3. Two devices X and Y connected to an ac source V = V0 Sinwt simultaneously. The phasor diagrams for the X and Y devices are shown in the figure. Identify X and Y.



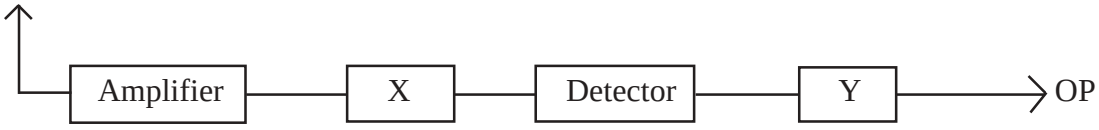
(X)



(Y)

4. In the given block diagram of receiver, identify the boxes labeled as X and Y.

Receiving antenna

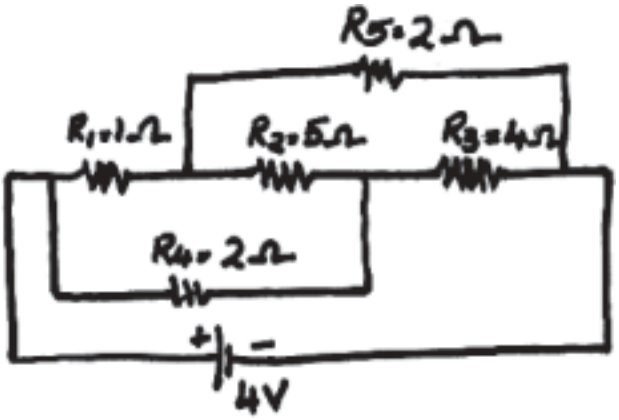


Receiving signal

5. The following graph shows the variation of object distance (u) with image distance (v) of a spherical lens.
a) Identify the lens.
b) What is the nature of the image formed?

SECTION - B

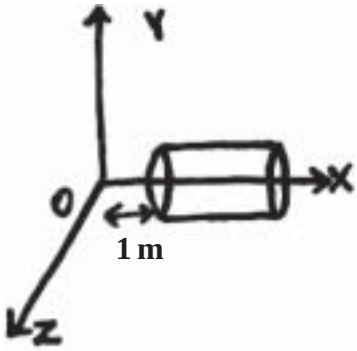
6. Calculate the current drawn from the battery in the given network.



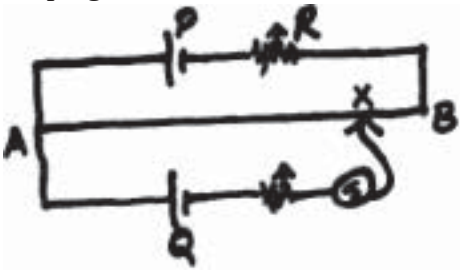
7. What does a polaroid consist of ? Using a simple polaroid, show that light waves are transverse in nature.
8. A monochromatic light source of power 5m W emits 8×10^{15} photons per second. This light ejects photoelectrons from a metal surface. The stopping potential for this set up is 2V. Calculate the work function of the metal.
9. A nucleus $^{23}Ne_{10}$ undergoes β decay and becomes $^{23}Na_{11}$. Calculate the maximum kinetic energy of electrons emitted assuming that the daughter nucleus and anti-neutrino carry negligible kinetic energy.
mass of $^{23}Ne_{10}$ = 22.994466 u Iu = 9301.5 Mev/c^2
mass of $^{23}Na_{11}$ = 22.989770 u
10. Which mode of wave propagation is suitable for television broadcast and satellite communication? Why?

SECTION - C

11. A hollow cylindrical box of length 1 m and area of cross section 25 cm^2 is placed in a three dimensional co-ordiante system as shown in the figure. The electric field in the region is given by E = 50 xi where E is in N/C and x is in metres. Find
a) net flux through the cylinder.
b) charge enclosed by the cylinder.

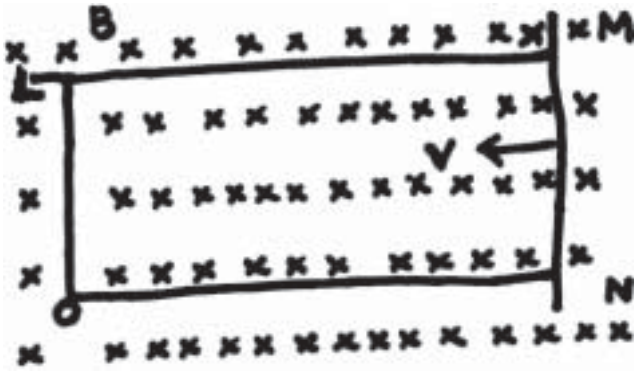


12. State the underlying principle of a potentiometer. Write two factors on which the sensitivity of a potentiometer depends. In the potentiometer circuit, shown in the figure, the balance point is at X. State, giving reason how the balance point is shifted, when
a) resistance R is increased.
b) resistance S is increased, keeping R constant.



13. a) Name the machine which uses crossed electric and magnetic fields to accelerate the ions to high energies. With the help of a diagram explain the resonance condition.
b) What will happen to the motion of charged particle if the frequency of the alternating voltage is doubled?

14. A rectangular conductor LMNO is placed in a uniform magnetic field of 0.5T. 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 m/s calculate the emf induced in the arm. Given the resistance of the arm to be 5 Ω (other arms are of negligible resistance) find the value of the current in the arm.



15. Identify the following electromagnetic radiations as per the wavelength given below. Write application of each.
a) 10^{-3} nm b) 10^{-3} m c) 1 nm

16. How is a wave front refracting defined? Using Hygen's construction, draw a figure showing the propagation of a plane wave front refracting at a plane surface separating two media. Hence verify Snell's low of refracton.

17. Draw a labeled 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.

18. Draw a graph showing the variation of stopping potential with frequency of incident radiation for two photo electric material having work functions W1 and W2 (W1 > W2). Write two important conclusions that can be drawn from the study of these plots.

19. Define the activity of a rationuclide. Write its S.I. unit. Give a plot of the activity of a radioactive species versus time. How long will a radioactive isotope, whose half life is T years, take for its activity to reduce to $1/8^{th}$ of its mitial value?

OR

Using Bohr's postulates, obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer service occur due to transition between energy levels.

20. Draw V-1 characteristics of a p-n junction diode. Answer the following questions giving reasons.
a) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage?
b) Why does the reverse current show a sudden increase at the critical voltage?
c) Name any semiconductor device which operates under the reverse bias in the breakdown region.

21. a) Write the functions of the three segments of a transistor.
b) The figure shoes the input wave forms A and B for 'AND' gate. Draw the output wave form and write the truth for this logic gate.

22. a) Write the factors that prevent a baseband signal of low frequency to be transmitted over long distances.
b) What is to be done to overcome these factors? Draw a block diagram to obtain the desired signal.

SECTION - D

23. Kamal's uncle was advised by his doctor to undergo an MRI Scan test of his chest and gave him an estimate of the cost. Not knowing much about the significance of this test and finding it to be too expensive, he first hesitated. When Kamal learnt about it, he decided to take help of his family, friends and neighbours, who arranged the money for the said test. He convinced his uncle to undergo this test so as to enable the doctor to diagnose the disease. He got the test done for his uncle and the resulting information greatly helped the doctor to give his uncle a proper treatment.
a) What according to you, are the values displayed by Kamal?
b) Assuming that MRI Scan test involved a mag.field of 0.1T, find the max and min values of force that field could exert on a portion moving with a speed of 10^{-4}m/s.

SECTION - E

24. An a.c. source generating a voltage V = Vm Sin ωt is connected to a capacitor of capacitance C. Find the expression for the current i following through it. Plot a graph of ν and I versus ωt to show that the current is π/2 ahead of the voltage.
A resistor of 200 Ω and and a capacitor of 15.0 μF are connected in series to a 220 V. 50Hz a.c. source. Calculate the current in the circuit and the rms voltage across the resistor and the capacitor. Is the algebraic sum of these voltages more than the source voltage? If yes resolve the paradox.

OR

Explain briefly, with the help of a labeled diagram, the basic principle of the working of an a.c. generator.
In an a.c. generator, coil of N turns area A is rotated at n revolutions per second in a uniform

magnetic field B. Write the expression for the emf produced.

A 100-turn coil of area $0.1 m^2$ rotates at half a revolution per second. It is placed in a magnetic field 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil.

25. a) Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation.

b) Explain briefly how the phenomenon of total internal reflection is used in fibre optics.

OR

a) Obtain lens makers formula using the expression.

$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R}$$

Here the ray of light propagating from a rarer medium of refractive index(n_1) to a denser medium of refrative index (n_2) is incident on the convex side of spherical refracting surface of radius of curvature R.

b) Draw a ray diagram to show the image formation by a concave mirror when the object is kept between its focus and the pole. Using this diagram, derive the magnification formula for the image formed.

26. a) Define electric flux. Write its S.I. unit.

'Gauss's law in electrostatics is true for any closed surface, no matter what its shape or size is'. Justify this statement with the help of a suitable example.

b) Use Gauss's law to prove that the electric field inside a uniformly charged spherical shell is zero.

OR

a) Derive the expression for the energy stored in a parallel plate capacitor. Hence obtain the expression for the energy density of the electric field.

b) A fully charged parallel plate capacitor is connected across an uncharged identical capacitor. Show that the energy stored in the combination is less than that stores initally in the single capacitor.