AMRITA VIDYALAYAM

AMRITA PRE BOARD EXAMINATION 2 - 2018 - '19

Class : XII **Marks : 70**

Time : 3 hrs

PHYSICS (042)

GENERAL INSTRUCTIONS:

1. *All questions are compulsory. There are 27 questions in total.*
2. *This question paper has four sections.*
3. *Section A contains 5 questions of 1 mark each, Section B contains 7 questions of 2 marks each, Section C contains 12 questions of 3 marks each, Section D contains 3 questions of 5 marks each.*
4. *There is no overall choice. However an internal choice has been provided in 2 questions of 1 mark, 2 questions of 2 marks, 4 questions of 3 marks and 3 questions of 5 marks each. You have to attempt only 1 of the choices in such questions.*
5. *You may use the following values of physical constants wherever necessary.*

$C = 3 \times 10^8$ m/s $\quad h = 6.63 \times 10^{-34}$ JS

$e = 1.6 \times 10^{-19}$C $\quad \mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ C^{2}N^{-1}m^{-2} $\quad m_e = 9.1 \times 10^{-31}$ kg

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ Nm^{2}C^{-2}

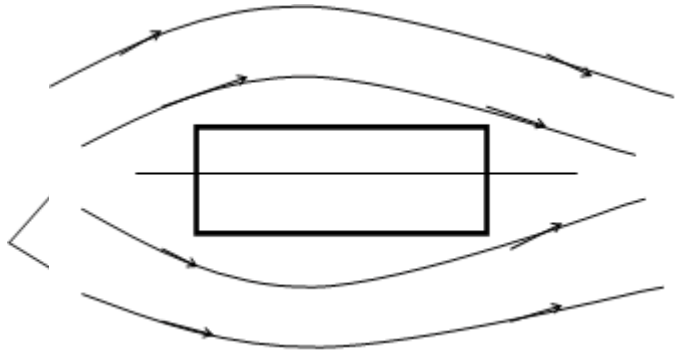
Mass of neutron = 1.675×10^{-27} kg $\quad$ Mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

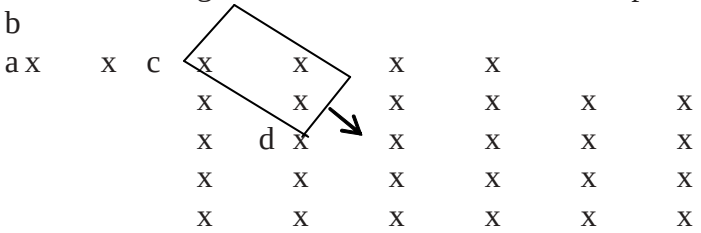
Boltzmann constant = 1.38×10^{-23} JK^{-1}

SECTION - A

1. Weber is the unit of which physical quantity? Define this quantity.
2. What is sky wave propagation?
3. Give the logic symbol of NOR gate.
4. Identify the type of material from the given figure? Give one example also.



5. Predict the direction of induced current in the rectangular loop abcd as it is moved into the region of a uniform magnetic field $\vec{B}$ directed normal to the plane of the loop?



OR

The instantaneous current and voltage of an a.c circuit are given by i = 10 sin 300t A and ν = 200 sin 300 t ν. What is the power dissipation in the circuit?

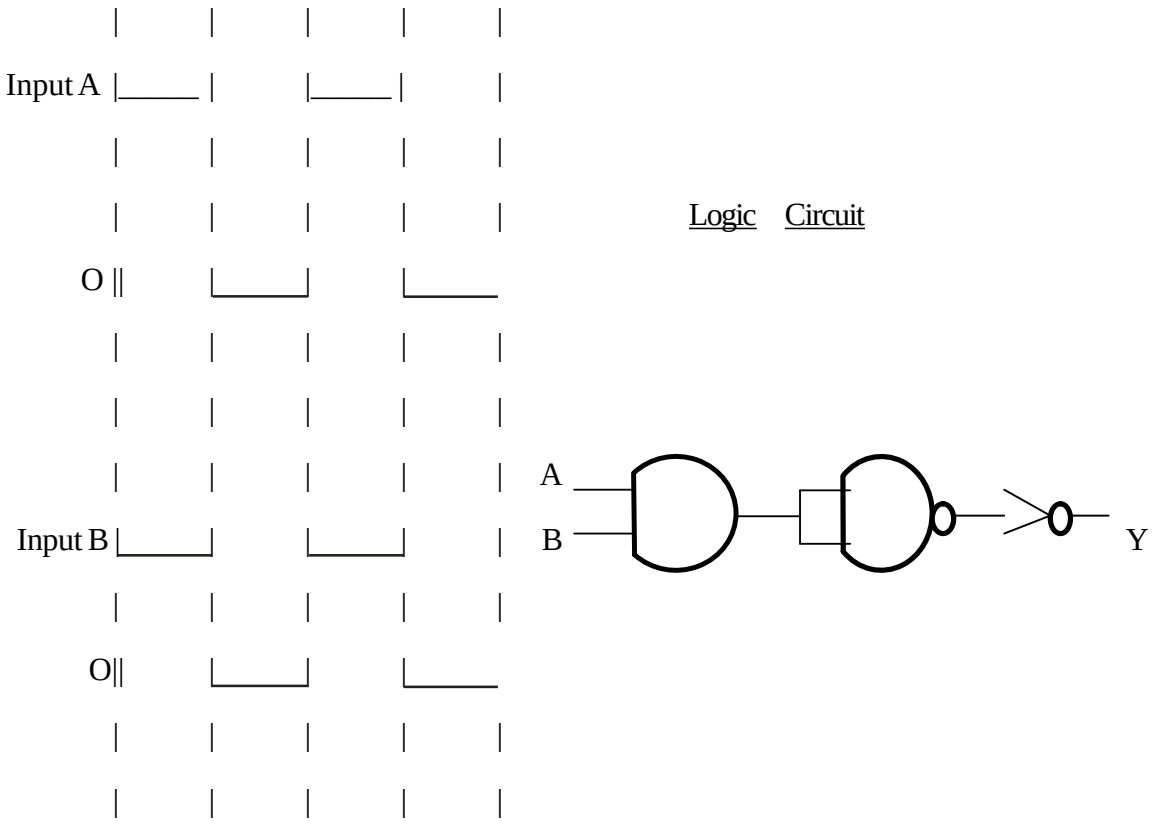
SECTION - B

6. A student connects a cell, of emf E_2 and internal resistance r_2 with a cell of emf E_1 and internal resistance r_1, such that their combination has a net internal resistance less than r_1. This combination is then connected across a resistance R. Draw a diagram of the set-up' and obtain an expression for the current flowing through the resistance R.

OR

A 9 V battery is connected in series with a resistor. The terminal voltage is found to be 8 V. Current through the circuit is measured as 5 A. What is the internal resistance of the battery?

7. What are eddy currents? How can it be reduced?
8. Draw graph showing variation of photo electric current with collector plate potential for 2 different metals and mark saturation current.
9. Using the wave forms of the input A and B, draw the output wave form of the given circuit. Identify the logic gate obtained.



10. An α particle and a proton are accelerated from rest by the same potential. Find the ratio of their de-Broglie wave lengths.
11. You are given the following 3 lenses. Which 2 lenses will you use as an eyepiece and as an objective to construct an astronomical telescope? Give reason.

Lenses	Power (D)	Aperture (cm)
L1	3	8
L2	6	1
L3	10	1

12. Name the opto electronic device used for detecting optical signals and mention the biasing in which it is operated. Draw it's I - V characteristics.

SECTION - C

13. Write the principle of working of potentiometer. Describe briefly with the help of circuit diagram, how a potentiometer is used to determine the internal resistance of a given cell.

14. a) Whether the following graph obeys Ohm's law. Justify your answer.

b) Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in terms of number density and relaxation time.

15. In young's double slit experiment, derive the condition for constructive interference and destructive interference.

OR

Draw a ray diagram to show the formation of the image of an object placed on the axis of a convex refracting surface, of radius of curvature 'R', separating the two media of refractive indices 'n_1' and 'n_2' ($n_1 > n_2$). Use this diagram to deduce the relation.

$\frac{n2}{v} - \frac{n1}{u} = \frac{n2-n1}{R}$, where *u* and v represent respectively the distance of the object and the image formed.

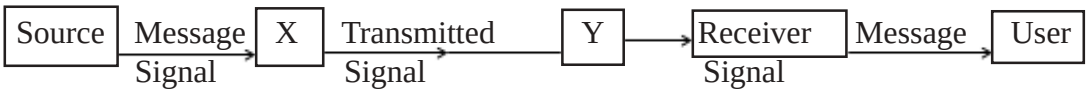
16. a) State Bohr's postulates to define stable orbits in hydrogen atom. How does de Broglie's hypothesis explain the stability of these orbits?

b) A radio active nucleus 'A' undergoes a series of decays according to the following scheme.

$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{r} A_4$

The mass no. and atomic no. of A are 180 and 72 respectively. What are these numbers for A_4?

17. a) Given a block diagram of a generalized communication system.



Identify the boxes 'X' and 'Y' and write their functions.

b) Distinguish between 'Point to Point' and Broad cast modes of communication.

18. A capacitor of unknown capacitance is connected across a battery of V volt. A charge of 360 μC is stored in it. When the potential across the capacitor is reduced by 120 V, the charge stored in the capacitor becomes 120 μC. Calculate V and the unknown capacitance. What would have been the charge on the capacitor if the voltage were increased by 120 V?

19. An electron of mass m_e revolves around a nucleus of charge + Z_e. Show that it behaves like a tiny magnetic dipole. Hence prove that the magnetic moment associated with it is expressed as

$\vec{\mu} = \frac{e}{2m_e}\vec{L}$, where $\vec{L}$ is the orbital angular momentum of the electron. Give the significance of negative sign.

20. a) Identify the part of the electromagnetic spectrum which is

(i) suitable for radar system used in aircraft navigation.

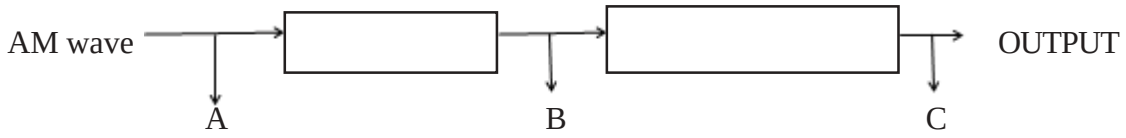
(ii) produced by bombarding a metal target by high speed electrons.

b) Why does a galvanometer show a momentary deflection at the time of charging or discharging a capacitor? Write the necessary expression to explain this observation.

21. A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. Upto which energy level the hydrogen atoms would be excited? Calculate the wavelengths of the first member of Lyman and first member of Balmer series.

22. Define the terms 'depletion layer' and 'barrier potential' for a p-n junction. How does
a) an increase in the doping concentration and
b) biasing across the junction, affect the width of the depletion layer?

23. a) Describe briefly the three factors which justify the need for translating a low frequency signal into high frequencies before transmission.
b) Figure shows a block diagram of a detector for AM signal.



Draw the waveforms for the a) input AM wave at A, b) output B at the rectifier, and c) output signal at C.

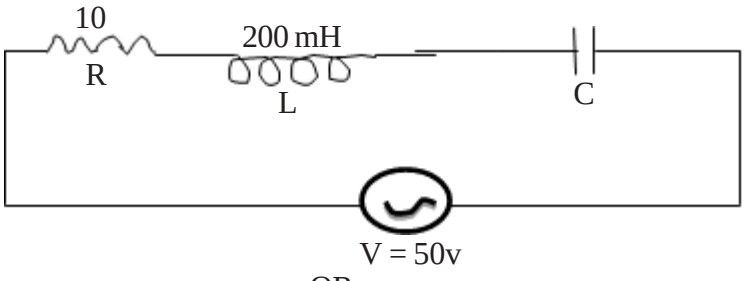
24. a) State Biot- Savart law and express it in the vector form.
b) Two identical circular coils, P and Q each of radius R, carrying currents I A and $\sqrt{3}$ A respectively, are placed concentrically and perpendicular to each other lying in the XY and YZ planes. Find the magnitude and direction of the net magnetic field at the centre of the coils.

25. a) State Gauss' law. Using this law, obtain the expression for the electric field due to an infinitely long straight conductor of linear charge density λ.
b) A wire AB of length L has linear charge density $\lambda = kx$, where x is measured from the end A of the wire. This wire is enclosed by a Gaussian hollow surface. Find the expression for the electric flux through this surface.

OR

a) Derive the expression for the electric potential at any point P, at distance r from the centre of an electric dipole, making angle α with its axes.
b) Two point charges 4 μC and + 1 μC are separated by a distance of 2 m in air. Find the point on the line-joining charges at which the net electric field of the system is zero.

26. In the given circuit, calculate
a) the capacitance of the capacitor, if the power factor of the circuit is unity.
b) the Q-factor of this circuit.
What is the significance of the Q-factor in a.c. circuit? Given the angular frequency of the a.c. source to be 100/s. Calculate the average power dissipated in the circuit.



OR

a) Prove that the current flowing through an ideal inductor connected across a.c. source, lags the voltage in phase by $\pi/2$.
b) An inductor of self-inductance 100 mH, and a bulb are connected across a.c source of rms voltage 10 V, 50 Hz. It is found that effective voltage of the circuit leads the current in phase by $\pi/4$. Calculate the inductance of the inductor used and average power dissipated in the circuit, if a current of 1 A flows in the circuit.

27. a) The relation, between the angle of incidence i) and the corresponding, angle of deviation (δ), for a certain optical device, is represented by the graph shown in the figure. Identify this device. Draw a ray diagram for this device and use it for obtaining an expression for the refractive index of the material of this device in terms of an angle characteristic of the device and the angle, marked an δ_{m1} in the graph.

b) Based on Huygen's construction, draw the shape of a plane wave front as it gets refracted on passing through a convex lens.

OR

a) Show, with the help of a diagram, how unpolarized sunlight gets polarized due to reflection.

b) Two polaroids P_1 and P_2 such that its pass axis makes an angle of 45^0 with that of P_1. Determine the intensity of light transmitted through P_1, P_2 and P_3.