AMPLITUDE PHYSICS SAMPLE PAPER FOR BOARD EXAM FOR 100 % SUCCESS

SAMPLE PAPER -1

Time allowed: 3 hours **SET A** *Maximum Marks: 70*

General Instructions

1. *All questions are compulsory. There are 26 questions in all.*
2. *This question paper has five sections: Section A, Section B, Section C, Section D and Section E.*
3. *Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.*
4. *.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 the three questions of five marks weight age. You have to attempt only one of the choices in such questions.*
5. *You may use the following values of physical constants wherever necessary.*

$c=3x10^8$ m/s $h=6.6 \times 10^{-34}$ Js $e=1.6 \times 10^{-19}$ C $N_A = 6.023 \times 10^{23}$ /mole $m_n = 1.67 \times 10^{-27}$ kg

SECTION A

Q.1> Why do the I-V characteristics of conductors deviate from straight line for high value of current?

Q.2> A bulb is connected in series with an inductor to an a.c. supply. How would the brightness of the bulb change on inserting a diamagnetic core in the inductor.

Q.3> In a velocity selector, an electron moving with a velocity V, passes without any deviation in its path. What can be concluded about the direction of E and B?

Q.4> A capacitor of 5nF is given a charge 10mC. What is the amount of work done in moving an electron from the negative plate to the positive plate?

Q.5> Plot the variation of V versus $^1/_R$ for a negative point charge.

SECTION B

Q.6> An alpha particle and a proton are accelerated by the same potential difference. They both enter a uniform magnetic field perpendicular to their velocity. Find the ratio of their radius.

Q.7> Which EM wave has highest (a) Speed in vacuum (b) Wavelength in vacuum

Q.8> Keeping the voltage of the charging source constant, what would be the percentage change in the energy stored in a parallel plate capacitor if the separation between its plates were to be increased by 10%?

Q.9> Two identical charged particles moving with same speed enter a region of uniform magnetic field. If one of these enters normal to the field direction and the other enters along a direction at 30^0 with the field, what would be the ratio of their (a) angular frequencies (b) Radius?

Q.10> Show that the magnetic field at the center of a coil of radius R is $2^{3/2}$ times the magnetic field at an axial point which is at a distance R from the center.

SECTION C

Q.11> Derive an expression for the torque acting on a current carrying loop placed in a magnetic field. Mention two pairs of perpendicular vectors in this expression.

Q.12> What is mutual induction? Mention its SI unit and derive an expression for the mutual inductance for a pair of concentric coils of radius R_a and R_b with $R_a << R_b$

Q.13> Four charges +Q, -Q, +Q and –Q are placed on the corners of a square ABCD in that particular order. Will the E.F and potential be same if instead of the above order the charges were kept as +Q, +Q, -Q and –Q.

Q.14> Two resistors "A" and "B" of 10 ohm each are connected in series across a 100 volt cell. The potential difference across "A" is measured using (a) 1MΩ voltmeter (b) 1KΩ voltmeter (c) Potentiometer. The readings obtained

in the three cases are V_1, V_2 and V_3 respectively. Arrange the readings in ascending order. Explain which of them is most accurate and why

Q.15> An ideal cell when connected across a resistor "X", produces 2A current and when the cell is connected across "Y", the current in the circuit is 1A. Find the current in the circuit if the cell is connected across
(a) Series combination of "X" and "Y" (b) Parallel combination of X and Y

Q.16> An a.c. supply of 220 volts is connected across a series circuit of R=5ohm, L = 5mH and C = 5μF.
(a) Find the resonance frequency (b) Find the amplitude of current at resonance
(c) Find the power loss and power factor at resonance

Q.17> The variation of potential difference across the Terminals of a cell as a function of current is shown in the adjacent graph. Using this, find EMF of the cell (b) Internal resistance of the cell

Q.18> Name an EM wave having frequency (a) greater (b) lesser than visible light. Mention one use of each

Q.19> State kirchoff's laws and mention their basis. Derive condition for balanced Wheatstone bridge.

Q.20> State Coulomb's law in vector form. Define dielectric constant in terms of force b/w charges.

Q.21> What are superconductors? Plot the variation of R versus T for and mention one real life application.
(b) Draw diagram to depict the behavior of magnetic field lines near a bar of mercury cooled to 2K.

Q.22> What is electric flux? Is it a vector? Mention its SI unit.
(b) An electric charge of 8.85×10^{-13}C is placed at the center of a sphere of radius 1m. What is the total flux linked with the sphere? How will the flux change if another equal but opposite charge is kept at a distance of
(a) 0.5m from the center (b) 1.5m from the center.

SECTION D

Q.23> Ravi was performing the potentiometer experiment to determine the internal resistance of a Daniel cell using a shunt of 100ohm. He could not obtain the null point. As he moved the jockey from A to B, the galvanometer reading goes on increasing. He tried several times but at last gave up. Then his friend came and solved the problem and finally a null point was obtained at 75cm with the shunt key open and 50cm with the shunt key closed.
(a) What value was displayed by the friend
(b) What was the mistake that Ravi was doing?
(c) Mention one other mistake where a null point will not be obtained.

SECTION E

Q.24> When an AC source of 20 volts is connected across "X", the current is found to be 5 A and in phase with the applied voltage. When the same source is connected separately across "Y", the current is found to be 4A but leading the voltage by 90 degrees. The source is then connected across "Z" and the current is found to be 10A but lagging the voltage by 90 degrees. (a) Identify "X", "Y" and "Z" giving suitable reasons
(b) Find the current in the circuit of X,Y and Z are connected in series across the same source.

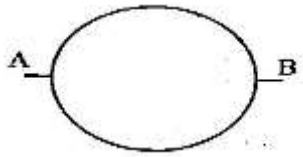
Q.25> Using a labeled diagram, explain the construction and working of a Moving coil Galvanometer
(b) A galvanometer of coil resistance 5ohm shows full scale deflection at 2mA. What should be done so that this galvanometer shows half scale deflection at 5mA current?

Q.26> A mobile adapter consists of a transformer in which the number of turns in the primary are ten times more than the number of turns in the secondary. The input power is 100W at 200 volts. If the efficiency is 75%, find the Primary current (b) Secondary voltage (c) Secondary current (d) Output Power

SAMPLE PAPER -2

SECTION A

1. A wire of resistance 16R is bent in the form of a circle. What is the effective resistance between the ends of a diameter AB?

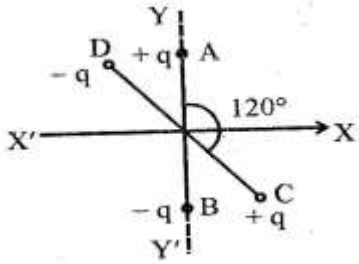


2. Draw the graph showing the distribution of kinetic energy of electrons emitted during beta decay.
3. What is the minimum number of satellites that enables a Global Positioning System (GPS) receiver to determine one's longitude/latitude position, i.e., to make a 2D position fix.
4. Why is choke coil needed in the use of fluorescent tubes with ac mains ?
5. A partially plane polarized beam of light is passed through Polaroid. Show graphically the variation of the transmitted light intensity and angle of rotation of the Polaroid.

SECTION B

6. Explain photodiode working. Draw its V – I characteristics for two different intensities of illumination.

7. Two small identical electrical dipoles AB and CB, each of dipole moment 'p' are kept at angle of 120^0 as shown in figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field E directed along +X direction, what will be the magnitude and direction of torque acting this?



8. Draw a plot of the binding energy per nucleon as a function of mass number for a large number of nuclei. Explain the constancy of binding energy per nucleon in the range $30 < A < 170$ using the property that nuclear force is short-ranged?

OR

How long can an electric lamp of 100W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reaction as

$$_1H^2 + {}_1H^2 \rightarrow {}_2He^4 + n + 3.27 \text{ MeV}$$

9. A small compass needle of magnetic moment 'M' and moment of inertia 'I' is free to oscillate in a magnetic field 'B'. It is slightly disturbed from is equilibrium position and then released. Show that it execute simple harmonic motion. Hence write the expression for its time period.
10. For a single slit of width 'a', the monochromatic light of wavelength λ first minimum of the interference pattern occurs at an angle of λ/a .At the same angle λ/a, get a maximum for two narrow slits separated by a distance 'a'. Explain.

SECTION C

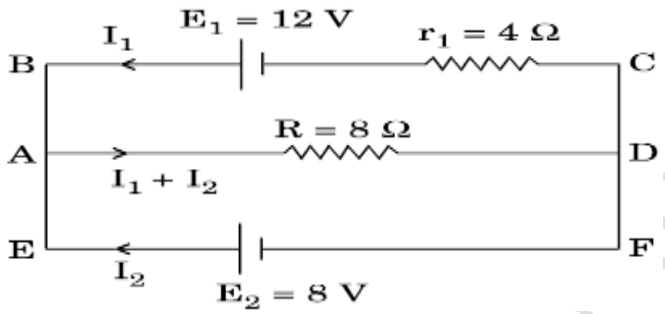
11. (a) How does oscillating charge produce electromagnetic waves ?
(b) Sketch a schematic diagram depicting oscillating electric and magnetic fields of an em wave propagating along + z-direction.

12. A charge Q is distributed over two concentric hollow spheres of radii a and b (b>a) such that the surface densities are the same .Calculate the potential at the common centre of the two spheres.

13. Draw a schematic sketch of a moving coil galvanometer and describe briefly its working.
Increasing the current sensitivity of a galvanometer does not necessarily increase the voltage sensitivity. Justify this statement.

14. Derive an expression for dipole intensity at any point on equatorial line of short electric dipole. Is there any force and torque in an electric dipole in a non uniform electric dipole

15. In the electric network shown in the figure use Kirchhoff's rules to calculate the power consumed by the resistance R = 8Ω



16. An observer, in a laboratory, starts with nuclei of a radioactive sampe and keeps on observing the number (N) of left over nuclei at regular intervals of 10 minutes each. She prepares the following table on the basis of her observation :Use this data to plot a graph for the given table and calculate the (i) decay constant and (ii) half-life of the given sample.

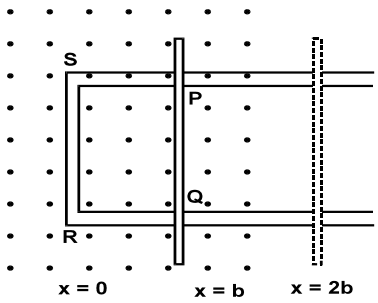
Time (t) in minutes →	0	10	20	30	40
$\log_e\left(\frac{N_0}{N}\right) \rightarrow$	0	3.465	6.930	10.395	13.860

17. Define internal resistance .A battery has an emf E and internal resistance r.A variable resistance R is connected across the terminals of the battery .Find the value of R such that (a) the current in the circuit is maximum (b) the potential difference across the terminals is maximum.

18. In Young's double slit experiment, the two slits 0.12 mm apart are illuminated by monochromatic light of wavelength 420 nm. The screen is 1.0 m away from the slits.(a) Find the distance of the second (i) bright fringe (ii) dark fringe from the central maximum. How will the fringe pattern change if screen moves away from the slits ?

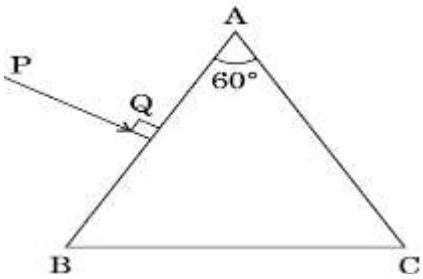
19. Figure shows a rectangular conductor PQRS in which the conductor PQ is free to move in a uniform magnetic field B perpendicular to the plane of the paper. The field extends from x = 0 to x = b and is zero for x > b. Assume that only the arm PQ=L posses resistance (r). When the arm PQ is pulled outward form

x = 0 with constant speed v, obtain the expressions for the flux and the induced emf. Sketch the variation of these quantities with distance



20. (i) Show that the time period of ions in a cyclotron is independent of both the speed and radius of circular path. (ii) What is resonance condition? How is it used to accelerate the charged particles?

21. A ray PQ is incident normally on the face AB of a triangular prism of refracting angle of 60^0, made of a transparent material of refractive index $2/\sqrt{3}$, as shown in the figure. Trace the path of the ray as it passesthrough the prism. Also calculate the angle of emergence and angle of deviation.



22. Mention the significance of Davission - Germer experiment. An α particle an a proton are accelerated from rest through the same potential difference V.Find the ratio of de broglie wavelengths associated them.

OR

Define threshold wavelength . A photon and electron have got same de-broglie wavelength .Prove that the energy of photon is 2mcλ/h of the kinetic energy of photon.

SECTION D

23. Anuj's mother was having constant headaches. After a medical check-up, she was diagnosed with tumour. Anuj realized there was a telecommunication tower very close to their house. He enquired from the doctor if the radiation from the tower could have caused the tumour. As the doctor supported his anxiety, he lodged a complaint with the police and ultimately succeeded in getting the tower removed to a distant place away from the residential colony. Answer the following :

(i) What values were displayed by Anuj ? (ii) Anuj made a rough estimate about the height of the antenna to be about 20 m from the ground. Calculate the maximum distance upto which radiations from the tower are likely to reach. Use the value of radius of the Earth = 6400Km.

SECTION E

24. Draw a labelled ray diagram of an astronomical telescope to show the image formation of a distant object at normal adjustment . Write the main considerations required in selecting the objective and eyepiece lenses in order to have large magnifying power and high resolution of the telescope.

(b) A compound microscope has an objective of focal length 1.25 cm and eyepiece of focal length 5 cm. A small object is kept at 2.5 cm from the objective. If the final image formed is at infinity, find the distance between the objective and the eyepiece.

OR

(a) Light waves each of amplitude "a" and frequency "w", emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by y_1=a coswt and y_2=a cos(wt + θ) where θ is the phase difference between the two, obtain the expression for the resultant intensity at the point.

(b) A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. Find the width of the slit.

25. (a) A series LCR circuit is connected to an a.c. source of variable frequency. Draw a suitable phasor diagram to deduce the expressions for the amplitude of the current and phase angle. (b) Obtain the condition at resonance. Draw a plot showing the variation of current with the frequency of a.c. source for two resistances R1 and R2 (R1 > R2). Hence define the quality factor, Q and write its role in the tuning of the circuit.

OR

(a)Draw a labelled diagram of a.c. generator and state its working principle.

(b)How is magnetic flux linked with the armature coil changed in a generator ?

(c) Derive the expression for maximum value of the induced emf and state the rule that gives the direction of the induced emf.

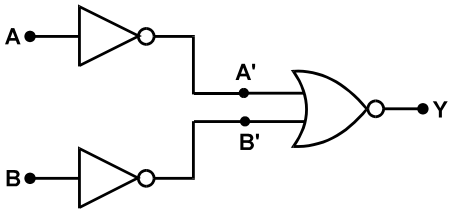
(d) Show the variation of the emf generated versus time as the armature is rotated with respect to the direction of the magnetic field

26. A student has to study the input and output characteristics of a npn silicon transistor in the common emitter configuration. What kind of a circuit arrangement should she use for this purpose? What do you understand by cut-off, active and saturation states of the transistor?
Draw the input and output characteristics curve for common emitter transistor why base is thin doped in transistors?

OR

a) Explain briefly the principle on which a transistor-amplifier works as an oscillator. Draw the necessary circuit diagram and explain its working.

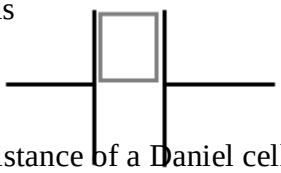
b) Identify the equivalent gate for the following circuit and write its truth table.



SAMPLE PAPER -3

Q.1> Draw an Equipotential surface for a uniform electric field.
Q.2 > Name the physical quantity whose SI unit is (a) Newton meter (b) Volt per meter
Q.3> Which electrical element tends does not allow direct current to flow through it?
Q.4> Explain why transformer can not be used to change DC.
Q.5> Name an EM wave that is used to destroy cancer cells.

Q.6> A proton and an alpha particle are accelerated by the same potential difference. Calculate the ratio of linear momenta acquired by the two. What is the ratio of their time period in magnetic field?
Q.7> Draw a schematic of an EM wave clearly showing the Electric and magnetic fields.
Q.8> A current I flows through a wire of radius 'r' and the drift velocity 'V_D'. What is the drift velocity of electrons through a wire of same material but having double the radius, when a current '2I' flows through it?
Q.9> Rank the following radiations according to their increasing wavelength:
i. X rays **ii.** Gamma ray **iii.** Light **iv.** Microwave
Q.10> Define mutual inductance and mention 2 factors on which it depends.
Q.11> An AC generator consist of a coil of 50 turns, area 2.5m^2 rotating at an angular speed of 60 rad/s in uniform magnetic field of B = 0.3 T between two fixed pole pieces. Given R = 500ohm.
(i) Find the maximum and RMS current drawn from the generator?
(ii) What will be the orientation of the coil (angle) with respect to B to have max magnetic flux?
Q.12> Show that the total energy of LC oscillations is conserved.
Q.13> Prove that a capacitor with ac source does not dissipate power. What is such circuit called?
Q.14> State Ampere's circuital law.
Q.15> A metal wire is stretched to increase its length by 10%. What is the percentage change in its resistance? How will the resistivity of the wire change?
Q.16> Give Reasons for (a) Long distance power transmission is done at very high voltage b) 220 volt AC supply is more dangerous than 220 volt DC supply
Q.17> A spherical balloon of radius 2m has a surface charge density 10 μC/m^2. What is total electric flux coming out of surface? Now balloon is blown to increase its radius. How would flux change?
Q.18> In a series LCR circuit, derive the resonance frequency. Draw a plot showing the variation of impedance of the circuit versus source frequency. Explain the dominant element in each region.
Q.19> A matrix of N x M cells each of emf E and internal resistance r is connected to an external resistor R. Write the current flowing in R. When will the power loss in R be maximum?
Q.20> The ends of a resistance are connected to 19 cells in series, each of internal resistance 0.1 ohm. The current is found to be 2A. The number of cells is reduced to 15 and an extra resistance of 9.5 ohm is connected in series to the given resistance. The current becomes half. Find the given resistance and the emf of each cell.
Q.21> Define the SI unit of capacitance. A dielectric material of dielectric constant 19 is inserted in half portion between the plates of a parallel-plate capacitor. If its initial capacitance is 40 μF, what will be the new capacitance?



Q.22> Derive an expression for the current in a C circuit and draw its phasor diagram.
Q.23> Ravi was performing the potentiometer experiment to determine the internal resistance of a Daniel cell using a shunt of 100ohm. He could not obtain the null point. As he moved the jockey from A to B, the galvanometer

reading goes on increasing. He tried several times but at last gave up. Then his friend came and solved the problem and finally a null point was obtained at 75cm with the shunt key open and 50cm with the shunt key closed.
(a) What value was displayed by the friend?
(b) What was the mistake that Ravi was doing?
(c) Mention one other mistake where a null point will not be obtained.
Q.24> State Gauss theorem. Using it derive Electric field intensity inside and outside a charged shell
Q.25> Define resistance, reactance and impedance. Show graphically their variation with source frequency. How will their value be affected if the source is DC.
Q.26> Show diagrammatically two different arrangements used for winding the primary and secondary coils in a transformer**. (b)** Assuming the transformer to be an ideal one, write the expressions for the ratio of its output voltage to input voltage**. (c)** The core of transformer is made of magnetic material. Give any two properties of such materials used. **(d)** Write any two types of energy losses in transformer
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SAMPLE PAPER -4

1. How does the relaxation time of electron in the conductor change when the temperature of the conductor decreases? (1)
2. A wire of resistance 8R is bent in the form of a circle. What is the effectiveresistance between the ends of a diameter AB?
3. Define gyromagnetic ratio. (1)
4. How does the angle of dip varies form equator to poles? (1)
5. Sketch the graph that shows change in reactance with frequency of a series LCR circuit.
6. In an a.c. circuit, instantaneous voltage and current are $V = 200 \sin 300t$ V and $i = 8 \cos 300t$ A espectively. What is the average power dissipated in the circuit?
7. Which part of electromagnetic spectrum has highest penetrating power? (1)
8. When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a decrease in the energy carried by the light wave? Justify your answer.
9. Show that electric field intensity at a point can be given as negative of potential gradient.
10. Two small identical electrical dipoles AB and CB, each of dipole moment 'p' are kept at angle of 120_0 as shown in figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field $\vec{E}$ directed along +X direction, what will be the magnitude and direction of torque acting on this?
11. Derive the expression for the resistivity of a good conductor in terms of the relaxation time of electrons.
12. Define relative permeability of a material. Out of two materials, 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of the materials 'A' and 'B'. Will their susceptibilities be positive or negative?
13. Use Lenz's law to determine the direction of induced current in the situations described by the figure: (a) A wire of irregular shape turning into a circular shape; (b) A circular loop being deformed into narrow straight wire.
14. A coil of inductance 0.50 H and resistance 100 Ω is connected to a 240 V, 50 Hz ac supply. (a) What is the maximum current in the coil? (b) What is the time lag between the voltage maximum and current maximum?

OR

Prove that an ideal capacitor, in an a.c. circuit does not dissipate power.

15. Answer the following questions: (a) Long distance radio broadcasts use shortwave bands. Why? (b) If the earth did not have an atmosphere, would its average surface temperature be higher or lower than what it is now?
16. Suppose that the electric field amplitude of an electromagnetic wave is $E_0 = 120$ N/C and that its frequency is $v = 50.0$ MHz. (a) Determine B_0, ω, k and λ. (b) Find expressions for $\vec{E}$ and $\vec{B}$.
17. Answer the following questions: (a) Does the apparent depth of a tank of water change if viewed obliquely? If so, does the apparent depth increase or decrease? (b) The refractive index of diamond than that of ordinary glass. Is this fact of some use to a diamond cutter?
18. When a low flying aircraft passes overhead, we sometimes notice a slight shaking of the picture on our TV screen. Suggest a possible explanation.

19. Define electric flux. Write its SI unit. A uniformly charged conducting sphere of 2.4m diameter has a surface charge density of 80.0 μC/m. (a) Find charge on sphere. (b) What is the total electric flux leaving the surface of the sphere?
20. Determine the current drawn from a 12V supply with internal resistance 0.5 Ω by the infinite network shown in figure. Each resistor has 1 Ω resistance.
21. Figure shows a potentiometer circuit for comparison of two resistances. The balance point with a standard resistor R = 10.0 Ω is found to be 58.3 cm, while that with the unknown resistance X is 68.5 cm. Determine the value of X. What might you do if you failed to find the balance point with the given cell of emf ε
22. (a) State Ampere's circuital law, expressing it in the integral form. (b) A long straight wire of circular cross-section of radius 'a' carries a steady current 'I'. the current is uniformly distributed across the cross-section.Apply Ampere's circuital law to calculate the magnetic field at point 'r' in the region for (i) r < a and (ii) r > a.
23. (a) Define self inductance. Write its SI unit. (b) Derive an expression for self inductance of long solenoid of length *l*, cross sectional area A and having N number of turns.
24. (a) Describe briefly, with the help of a labelled diagram, working of a step-up transformer.
(b) A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain.
25. 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 prism 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'? Justify your answer. Trace the path of these rays after passing through face 'ab'. **OR**
(a) The far point of a myopic person is 80 cm in front of the eye. What is the power of the lens required to enable him to see very distant objects clearly?(b) In what way does the corrective lens help the above person? Does the lens magnify very distant objects? Explain carefully. (c) The above person prefers to remove his spectacles while reading a book. Explain why?
26. (a) How does an unpolarised light gets polarised when passed through a polaroid? (b) Two polaroids are set in crossed positions. A third polaroid is placed between the two making an angle θ with the pass axis of first polaroid. Write the expression for the intensity of light transmitted from the second polaroid. In what orientations will the transmitted intensity be (i) minimum and (ii) maximum?
27. Four persons went out for an excursion on a hill top where the temperature is quite low. One of them fell sick. The other persons put a blanket on him, collected the pieces of dry wood and ignited fire in his vicinity. After sometime the sick person felt better. Read the above passage and answer the following questions:
(a) What are the type of rays coming from fire? (b) Why did the sick person feel better while sitting near the fire? (c) What basic values do you learn from this study?
28. (a) Derive an expression for capacitance of parallel plate capacitor of thickness t (t < d) between the plates separated by the distance d. (b) If the dielectric slab is introduced with the battery connected, then how do the following quantities change (i) charge, (ii) potential, (iii) capacitance, and (iv) energy.
OR
State Gauss's law in electrostatics. Deduce an expression for electric field intensity due to a charged spherical shell at a point (i) inside (ii) on its surface (iii) outside it. Graphically show the variation of electric field intensity with distance from the centre of the shell.

29. Draw a schematic sketch of a cyclotron. Explain briefly how it works and how it is used to accelerate charged particles. (i) Show that the time period of ions in a cyclotron is independent of both the speed and radius of circular path. (ii) What is resonance condition? How is it used to accelerate the charged particles? **OR**

(a) Two straight long parallel conductors carry currents I_1 and I_2 in the same direction. Deduce the expression for the force per unit length between them. Depict the pattern of magnetic field lines, around them. (b) A rectangular current carrying loop EFGH is kept in uniform magnetic field as shown in the figure. (i) What is the direction of magnetic moment of the current loop? (ii) When is the torque acting on the loop (A) maximum, (B) zero?

30. (a) For a ray of light travelling from denser medium of refractive index n_1 to a rarer medium of refractive index n_2, prove that critical angle of incidence for the media. (b) Explain with the help of a diagram, how the above principle is used for transmission of video signals using optical fibres.**OR**

(a) State Huygen's principle. Using this principle explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a narrow beam coming from a monochromatic source of light is incident normally. (b) Show that the angular width of the first diffraction fringe is half of that of the central fringe. (c) If a monochromatic source of light is replaced by white light, what change would you observe in the diffraction pattern?