M. Mark : 70   **Class –XII, Subject (Physics)**   Time : 3 hr.

General Instructions:

1. **There are 33 Questions in all. All Questions are compulsory.**
2. **This Question paper has five sections.**
3. **All sections are compulsory.**
4. **Section – A contains sixteen questions, twelve MCQ and four Assertion – Reasoning based of one mark each, Section – B contains five questions of two marks each. Section – C contains seven questions of three marks each, Section – D contains two case study based questions of four marks each and Section – E contains three long answer questions of five marks each.**
5. **There is no overall choice. However, an internal choice has been provided in one question in Section – B, one question in Section – C and all three questions in Section – E . You have to attempt only one of the choices in such questions.**
6. **Use of Calculators is not allowed.**

SECTION –A [1 Mark each]

Q-1. Two charges of equal magnitude and at a distance of 'r' exerts a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is

[a] F/8   [b] F/4   [c] 4F   [d] F/16

Q – 2 The potential deference between two plates of a parallel plate capacitor is constant. When the air between the place is replaced by a dielectric material, the electric filed intensity between the plates

[a] decreases   [b] remain constant   [c] becomes zero   [d] increases

Q – 3 The current flows in a wire of resistance 5 ohm having a potential difference 7 volt for 20 minutes the heat produced is

[a] 1400 Joule   [b] 700 Joule   [c] 2100 Joule   [d] 11760 Joule

Q – 4 An arbitrary Gaussian surface encloses an electric dipole. The total electric flux through this surface will be

[a] Infinite   [b] zero   [c] q/ε_0 $(q.2l)/\varepsilon_0$

Q – 5 When an Intrinsic Semiconductor is doped with a small amount of trivalent impurity, then

[a] its resistance increases   [b] it becomes a P-type semiconductor

[c] there will be more free electron than holes.   [d] dopant atoms become donor type atom

Q – 6 The unit of coefficient of Self – Inductance of coil is

[a] Tesla   [b] Henry   [c] Weber / sec   [d] Gauss

Q – 7. A charged particle entering perpendicular with respect to direction of a uniform magnetic field with initial velocity, then the nature of its track will be

[a] Straight line   [b] spiral   [c] circular   [d] Hellical

Q – 8. What is the angle between electric – field direction and equi-potential surface?

[a] 90°   [b] 0°   [c] 60°   [d] 45°

Q – 9 Two wires A and B of the same metal and of same length have their area of cross- section in the ratio of 2 : 1. if the same potential difference in applied across each wire . What will be the ratio of currents flowing in wire A and B ?

[a] 1 : 1   [b] 1 : 2   [c] 2 : 1   [d] 2 : 2

Q – 10. The width of depletion layer of a PN junction diode.

[a] increases during Forward bias   [b]   unaffected during Forward bias.

[c] decrease during   Forward bias .   [d]   decrease during reverse bias.

Q-11. The force on a charge due to a magnetic field will be maximum

[a]   on a charge which is at rest.   [b] Which is moving in direction of Magnetic field.

[c] Moving in the opposite direction of the Magnetic field. [d] Moving in the perpendicular direction.

Q – 12 Which one obeys the ohm's law ?

[a] Conductor with variation in temperature .   [b] Semiconductor devices .

[c] Conductor at constant temperature   [d] None of these.

In the following questions (from Q No -13 to Q No -16), two statements are given – one labelled Assertion(A) and other Reason (R) . select the correct answer to these questions from the options as given below :
 (a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
 (b) If both Assertion and Reason are true and Reason is not the correct explanation of Assertion .
 (c) If Assertion is true but Reason is false .
 (d) If both assertion and Reason are false.

Q -13 **[Assertion]** The resistivity of a semiconductor decreases with increase of temperature.
     [Reason] In a conductor, the rate of collision between free electron and ions increases with increase in temperature.

Q – 14 **[Assertion]** The Diamagnetic substance do not obey Curie's law.
     [Reason] At Curie point a ferromagnetic substance start behaving as a Paramagnetic substance.

Q – 15 **[Assertion]** [The direction of induced current is always such as to oppose the changes that causes it .
     [Reason] The direction of induced current is given by Lenz's Rule.

Q - 16 **[Assertion]** Electrical Conductivity of a semiconductor increases on doping.
   [Reason] Doping raises the temperature of semiconductor.

SECTION – B [2 mark each]

Q – 17 Draw labeled energy band Diagram for Intrinsic semiconductor for
(a) Below Room temp.   (b) at/ above room temp.

Q -18 A wire of resistance 5 ohm is uniformly stretched until its new length becomes four times of the original length . Find the new resistance of the wire ?

Q – 19 Find the Equivalent Capacitance Between A and B in the given Network of Capacitors?

Q – 20 Define Magnetic lines of force. Give their three prominent properties.

Q - 21 If a 19 meter long metallic rod moves in a direction at right angle to a magnetic field with a velocity 5 m/sec, an induced emf of 25 volt set up across its ends. Find the valve of magnetic field intensity ?

OR

A 200 turn coil of self - Inductance 20 m H carries a current of 4 m A. Calculate the magnetic – flux linked with each turn of the coil ?

SECTION – C [3 mark each]

Q – 22 Define internal resistance of a cell. Three identical cells, each of emf 2 volt and internal resistance of 0.2 ohm are connected in series to an external resistance of 7.4 ohm. Draw the circuit diagram and Calculate current in the circuit ?

Q – 23 Write three points for difference between Dia, Para and Ferro Magnetic substances also mention three examples for each.

Q -24 State Faraday's Law for Electro-magnetic Induction. If the magnetic flux through a coil perpendicular to the plane is varying according to relation

$$\varphi (t) = (5t^3 + 4t^2 + 2t - 5) \text{ weber}$$

Calculate the induced current through the coil at t = 2 second , if the resistance of the coil is 5 ohm?

Q – 25 Draw the circuit diagram for a Half wave Rectifier, Explain construction and working of it. Also draw the Input/output wave form.

Q-26 Two cells of emf 1.5 volt and 2.0 volt with internal resistance 1 ohm and 2 ohm respectively are connected in parallel so as to send the current in the same direction through an external resistance of 5 ohm.

[a] Draw the circuit – diagram.

[b] Using Kirchhoff 's laws in the drawn circuit calculate current through each branch of the circuit.

Q – 27 Derive an expression for Magnetic dipole moment for an electron revolving around nucleus. Define Bohr's Magneton and find its numerical value ?

Q -28 if three capacitors C_1 ,C_2 and C_3 are connected in series or in parallel . Mathematically show that total electrostatic energy is additive both in series and in parallel combination of capacitors .

OR

Charges of + 5 µC , + 10 µC and - 10 µC are placed in air at the corners A,B and C of an equilateral triangle ABC having each side equal to 5 cm . Determine the resultant force (i.e. magnitude & direction) on the charge at corner A ?

SECTION – D (CASE STUDY) [4 mark each]

[Read the following Paragraph and answer the Questions]

Q – 29 Velocity selector is a device in which charged particle moves inside the mutually perpendicular electric and magnetic field in such a way that the motion of the charged particle is also perpendicular to Both electric and magnetic field .

Here electric field E is vertically downward and the magnetic field B is into the plane . when a positive charged particle + q is allowed to move under this arrangement , then it experience an electric force as well as a magnetic force . For a particular value of v the electric and magnetic force will be equal in magnitude . The total force is then zero and +q charged particle travels in a straight line with a constant velocity.

[i] The net Lorentz force is given by

[a] F = q E + q (v x B)   [b] F = q B + q (v x B)

[c] F = q (B x E)   [d] F = q v + q v B

[ii] Electron beam passes through a region of crossed electric and magnetic fields of Intensity E and B. for what value of electron speed , the beam will remains un deflected.

[a] v = B / E   [b] v = E / B

[c] v = E X B   [d] v = µ E B

[iii] A magnetic field of 5 x 10^{-4} Tesla just balances a perpendicular electric field of 15 kV m^{-1}in their effect on an electron beam passing through the two fields in a direction perpendicular to both of them then the speed of the electron is

[a] 3 x 10^7 m/sec

[b] 3 x 10^8 m/sec

[c] 1.5 x 10^7 m/sec

[d] 1.5 x 10^8 m/sec

[iv] What is the magnitude of force experienced by a stationary charge when placed in a uniform magnetic field ?

[a] F = q v B sin Θ

[b] F = q v B

[c] F = 0

[d] None of these

Q – 30 The process of converting AC into DC called rectification and rectifier is a device which converts AC into DC. The rectifier which converts only one half of AC into DC is called half wave rectifier for a half wave rectifier, the frequency of output is equal the frequency of the input supply.

A Rectifier which convert both halves of AC into DC is called full – wave rectifier. For a full – wave rectifier the frequency of the output current is twice the frequency of the input supply.

[i]Rectifier is based on the principle of :

[a] when the p-n junction is reverse biased it will conduct.

[b] when the p-n junction is forward biased it will not conduct.

[c] when the p-n junction is forward biased it will conducts and when it is in reverse biased it will not conduct.

[d] None of these

[ii] An AC input signal of frequency 60 Hz , is rectified by a half – wave rectifier , the output frequency in this case will be :

[a] 100 Hz   [b] 120 Hz   [c] 40 Hz   [d] 60 Hz

[iii] Which of the following statements is not true ?

[a] A p-n junction can act as a semiconductor diode .

[b] A majority carriers in N- type semiconductors are holes .

[c] Doping pure Silicon with trivalent impurities give a p- type semiconductors.

[d] The resistance of intrinsic semiconductors decreases with increase in temperature .

[iv] The unidirectional flow of current through P-N junction makes it ideal to be used as

[a] Oscillator   [b] Rectifier   [c] Modulator   [d] Amplifier

SECTION – E [5 mark each]

Q – 31 (a) Describe the construction and working of a moving coil galvanometer using a labeled diagram . Mathematically show that current flowing through it is directly proportional to produce deflection .

(b) A galvanometer with a coil of resistance 12 ohm shows full scale deflection for a current 2.5 mA . How will you convert the galvanometer into
(i) An ammeter of range 0 to 7.5 Amp   (ii)A voltmeter of range 0 to 10 volt

OR

(a) Apply Biot – Savart's law to find the magnetic field due to a circular loop carrying at a point on the axis of the loop.

(b) Two identical circular loop P and Q each of radius R and carrying current I are kept in a perpendicular planes such that they have a common centre as shown in the figure . Find the magnitude and the direction of the net Magnetic field at the common centre of the two loops?

Q – 32 (a) Using Kirchhoff's laws obtain the condition for balanced Wheatstone Bridge.
(b) In the following circuit ,a Meter-Bridge is shown in its balanced condition. The meter-bridge wire has a resistance of 1ohm/cm.

[i] Calculate the value of unknown resistance X ?

[ii] The current drown from the battery ?

OR

[a] Define the term drift – velocity and relaxation-time ,derive the expression for resistivity of material in terms of electron - density and relaxation- time.

[b] Calculate resistivity of a material of a wire 10 meter long, 0.4 mm in diameter and having a resistance of 2 ohm.

Q – 33 (a) What do you mean by Electric – dipole. Derive an Expression for Electric – potential at a point along axial – line of an electric – dipole.

[b] Two point charges + q and + 4q are separated by a distance of 6a. Find the point on the line joining the two charges where the electric-field is zero ?

OR

[a] State Gauss's Theorem for electrostatics, A spherical Gaussian Surface encloses a charge of 8.85×10^{-8} Coulomb .
[i] Calculate the total Electric-flux passing through Gaussian Surface.
[ii] If the radius of Gaussian surface in doubled. How would the Electric- flux change.