Practice question Paper 1

Blue print

S.No.	Unit	MCQ (1mark)	A&R (1mark)	SA I (2Marks)	SA II (3Marks)	CSB (4Marks)	LA (5marks)	Total	Marks
1	Electrostatics	1(1)	1(1)	2(1)			5(1)	9(4)	16(7)
2	Current electricity		1(1)		6(2)			7(3)	
3	Magnetic effects of current and Magnetism	1(1)			3(1)	4(1)		8(3)	17(8)
4	Electromagnetic induction and Alternating current	3(3)	1(1)				5(1)	9(5)	
5	Electromagnetic Waves	1(1)		2(1)				3(2)	18(8)
6	Optics	2(2)		2(1)	6(2)		5(1)	15(6)	
7	Dual nature of radiation and matter	1(1)	1(1)		3(1)			5(3)	12(7)
8	Atoms & Nuclei	2(2)		2(1)	3(1)			7(4)	
9	Electronic devices	1(1)		2(1)		4(1)		7(3)	7(3)
		12(12)	4(4)	10(5)	21(7)	8(2)	15(3)	70(33)	70(33)

CLASS: XII

SESSION: 2023-24

PRACTICE QUESTION PAPER 1

SUBJECT: PHYSICS (THEORY)

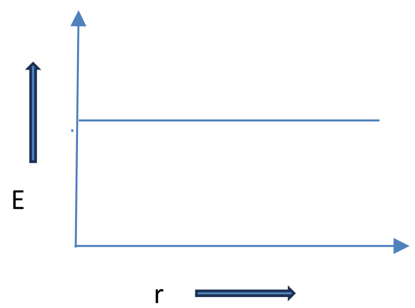
Maximum Marks: 70 **Time Allowed: 3 hours.**

General Instructions:

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 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, one question in each CBQ in Section D 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.
(7) You may use the following values of physical constants where ever necessary
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $e = 1.6 \times 10^{-19}$ C
iv. $\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}\ C^2N^{-1}m^{-2}$
vii. Avogadro's number = 6.023×10^{23} per gram mole

SECTION-A

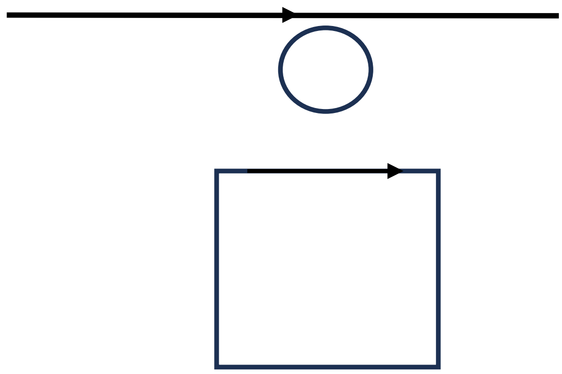
1. Name the charge distribution whose electric field Variation with separation is represented in the graph given below.



a. Uniformly charged thin wire
b. Infinitely charged thin plane sheet
c. charged spherical shell
d. a point charge

2. Ratio of specific charge of two charges is found to be 3:4, if these two charges enter into a uniform perpendicular Magnetic field with velocities in the ratio of 3:4 find the ratio of radii of the two charges.
a. 9:16
b. 16:9
c. 1:1
d: 4:3

3. Current through a straight conductor is increasing and current through the square loop is constant. How to move the square loop such that there would be no probability for induced current in the circular ring in between the two as shown.



a. Towards right
b. Downwards
c. towards left
d. upwards

4. In a given AC Circuit it is found that current is leading voltage, on adding which element in series in the circuit one can expect maximum current.
   a. Inductor
   b. Resistor
   c. capacitor
   d. transformer
5. Average power over a full cycle in a pure resistive circuit is P. If a capacitor of capacitive reactance R is connected in series with the resistor then the average power over full cycle is:
   a. 0
   b. P/2
   c. P
   d. $P/\sqrt{2}$
6. If an electromagnetic wave is propagated along +x direction what is the probable direction of oscillating electric and magnetic fields at any given instant?
   a. +X and +X
   b. +Y and -Z
   c. -Y and Z
   d. +Y and +Z
7. When a convex lens of power +10D is kept in contact with a lens, resultant power of the combination is observed to be -10D, focal length of the second lens is:
   a. 5cm b. 5m c. -5cm d. -5m
8. A plane wave front is incident on a concave mirror of radius of curvature R. The radius of curvature of the reflected wave front will be:
   a. 2R b. R c. R/2 d. R/4
9. Dynamic mass of a photon of energy E is:
   a. 0 b. EC^2 c. C^2/E d. E/C^2
10. If the velocity of electron in the ground state of hydrogen atom is v, it's velocity in the second excited state would be:
    a. 2v b. v/2 c. 3v d. v/3
11. nuclear forces are
    i. strongest force in nature
    ii. short range force
    iii. charge dependent
    iv. spin dependent
    a. i and ii only b. i, ii and iii only c. i, ii and iv only d. all are correct
12. Energy gap of a semiconductor decreases with
    i. increase in temperature ii. increase in doping concentration
    a. i only b. ii only c. either i or ii only d. both i and ii

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled 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 the correct explanation of Assertion.
b) If both Assertion and Reason are true but 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.

13. A: If a dielectric is inserted between the plates of a charged capacitor which is disconnected from the battery, then charge on the capacitor remains the same.

R: Charge on isolated system remains conserved.

14. A: if two charges of same magnitude and opposite polarity are projected against each other into a perpendicular magnetic field then they execute circular paths of the same sense of revolution. (i.e. either both in clockwise sense or in anti-clockwise sense).
    R: If velocity of two charge particles is in opposite direction in perpendicular magnetic field then the force will be in opposite direction.
15. A: An alternating current of frequency 50Hz becomes zero for 100 times in one second.
    R: Alternating current changes direction and becomes zero twice in a cycle.
16. A: Among the particles of same kinetic energy, lighter particles have greater de-Broglie wavelength.
    R: The de-Broglie wavelength of a particle depends only on the charge of the particle.

SECTION B

17. A circular loop of radius R has linear charge density $\boldsymbol{\lambda}$ C/m. Find the potential at a distance 2R from its centre on its axis.
18. Suppose that the electric field amplitude of an electromagnetic wave is E0 = 120 N/C and that its frequency $\boldsymbol{\nu}$=50M Hz. determine B_0, ω,K and $\boldsymbol{\lambda}$.

OR

How does an oscillating charge radiate an electromagnetic wave? give the relation between frequency of radiated wave and the frequency of oscillating charge.

19. Explain how one can convert a full cycle of AC into DC with the help of circuit diagram.
20. Plot the suitable graphs to show the variation of photoelectric current with the collector plate potential for the incident radiation.

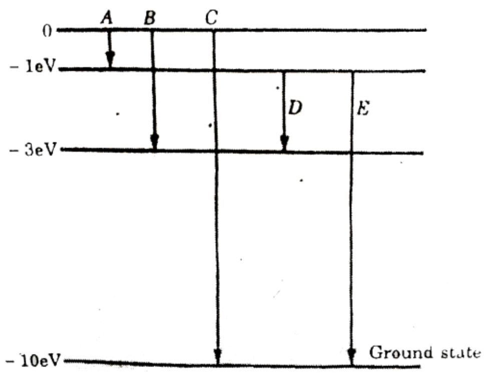
    i. the same intensity but different frequencies $\boldsymbol{\nu}_1$,$\boldsymbol{\nu}_2$ and $\boldsymbol{\nu}_3$ ($\boldsymbol{\nu}_1$<$\boldsymbol{\nu}_2$<$\boldsymbol{\nu}_3$)

    ii. the same frequency but different intensities I_1, I_2 and I_3 (I_1<I_2<I_3)

21. Light from a point source in air falls on a spherical glass surface (n = 1.5 and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. At what position the image is formed?

SECTION-C

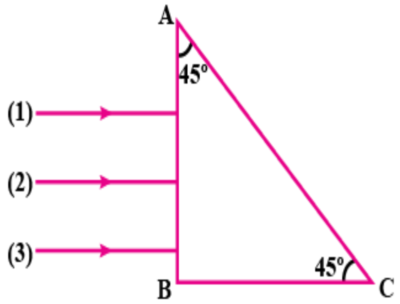
22. The energy levels of an atom of element X are shown in the diagram. Which one of the level transitions will result in the emission of photons of wavelength 620nm? support your answer with mathematical calculations.



b. name the hydrogen spectral series that can be observed in the visible region.

23. Draw the graph showing the variation of binding energy per nucleon with the mass number. Explain with the help of this plot the release of energy in the processes of nuclear fission and fusion.
24. Three rays (1,2,3) of different colours fall normally on one of the sides of an isosceles right-angle prism as shown. The refractive index of prism for these rays is 1.36, 1.44 and 1.51 respectively. find which of these

rays get internally reflected and which get only refracted from AC. Trace the paths of rays justify your answer with the help of necessary calculations.



25. Draw the ray diagram of image formation by a reflecting type of telescope. Write any three advantages of reflecting telescope over refracting telescope.
26. A bar magnet of magnetic moment 1.5 JT^{-1} lies aligned with the direction of a uniform magnetic field 0.22 T.
    a. what is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment.

       (i) normal to the field direction? and (ii) opposite to the field direction

    b. what is the torque on the magnet in cases (i) and (ii)

       OR

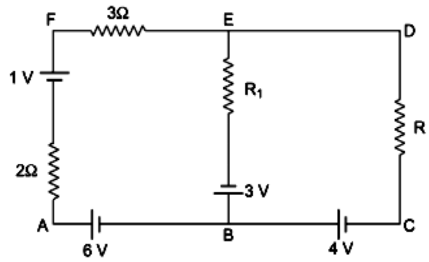
The magnitude F of the force between two straight parallel current carrying conductors kept at a distance d apart in air is given by

$$F = \frac{\mu_0 I_1 I_2}{2\pi d}$$

Where I_1 and I_2 are the currents flowing through the two wires. use this expression, and the sign convention that the: "Force of attraction is assigned a negative sign and force of repulsion is assigned a positive sign". Draw graphs showing dependence of F on

i. I_1I_2 when d is kept constant
ii. d when the product I_1I_2 is maintained at a constant positive value.
iii. d when the product I_1I_2 is maintained at a constant negative value.

27. Using Kirchhoff's rules to determine the potential difference between the points A and D when no current flows in the arm BE of the electric network shown in the figure.



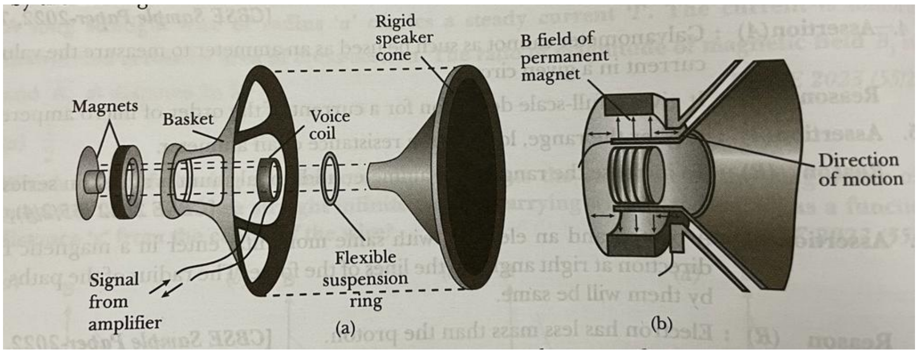
28. Show, on a plot, variation of resistivity of (i) a conductor, and (ii) a typical semiconductor as a function of temperature.

    Using the expression for the resistivity in terms of number density and relaxation time between the collisions, explain how resistivity in the case of a conductor increases while it decreases in a semiconductor, with the rise of temperature.

SECTION-D

(case study-based questions)

29. Loudspeakers: A common application of magnetic force on a current carrying wire is found in loudspeakers. the magnetic field created the permanent magnet exerts a force on the voice coil that is proportional to the current in the coil; the direction of the force is either to the left or to the right, depending on the direction of the current. The signal coming from the amplifier causes the current to oscillate in direction and magnitude. The coil and the speaker cone to which it is attached respond by oscillating with an amplitude proportional to the amplitude of current in the coil. Turning up the volume knob on the amplifier increase the current amplitude and hence the amplitudes of the cone's oscillation and of the sound wave produced by the moving cone.



The force is always perpendicular to both the conductor and the field, with the direction determined by the same right-hand rule we used for a moving positive charge. Hence, this force can be expressed as a vector product, just like the force on a single moving charge. we represent the segment of wire with a vector **l** along the wire in the direction of the current, then force **F** on this segment is

F=i(**l**x**B**) (i.e., magnetic force on a straight wire segment)

i. Loud speaker works on the principle of

a. detector b. generator c. amplifier d. motor

ii. Electrodynamic speaker can handle which type of audio power relative to a permanent magnet type speaker?

a. Lower b. Equal c. Higher d. both (a) and (b)

iii. To increase the power handling capacity in loudspeakers which type of magnet is used?

a. Temporary magnet b. Permanent magnet c. Electromagnet d. none

OR

A horizontal wire 0.1 m long carries 5 A. Find the magnitude and direction of the magnetic field, which can balance the weight of wire. Given the mass of the wire is $3x10^{-3}$ kg/m and g=10 m/s^2.

a. 6 x 10^{-3} T, acting horizontally perpendicular to wire
b. 6 x 10^{-3} T, acting vertically upwards
c. 6 x 10^{-2} T, acting vertically downwards
d. 6 x 10^{-2} T, acting horizontally perpendicular to wire

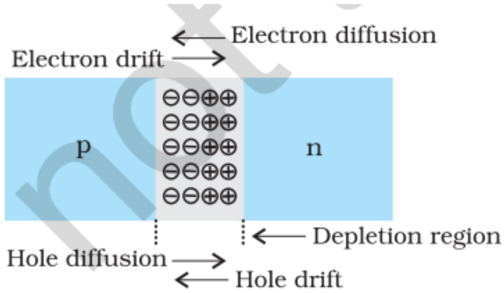
iv. A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. if the force on one arm of the loop is **F**, the net force on the remaining three arms of the loop is

a. **F** b. -**F** c. 3**F** d. -3**F**

30. Motions of the Charge Carriers: If you burst a helium-filled balloon, helium atoms will diffuse(spread) outward into the surrounding air. This happens because these are very few helium atoms in normal air. In

more formal language, there is a helium density gradient at the balloon-air interface (the number density of helium atoms varies across the interface), the helium atoms move so as to reduce the gradient.

In the same way, electrons on n-side are close to the junction plane tend to diffuse across it and into the p-side, where there are very few free electrons. Similarly, holes on p-side are close to the junction plane tend to diffuse across that plane and into the n-side, where there are very few holes. The motions of both the electrons and the holes contribute to diffusion current (I_{diff}).



i. Silicon is doped with which of the following to obtain p-type semiconductor?

a. Phosphorus b. Gallium c. Germanium d. Bismuth

ii. A semiconductor has an electron concentration of $6x10^{22}$ per m^3 and hole concentration of $8.5x10^9$ per m^3. Then it is

a. n-tye b. p-type c. intrinsic d. conductor

iii. In p-n junction diode

a. the current in the reverse biased condition is generally very small (in micro Amp)
b. the current in the reverse biased condition is small but the forward biased current is independent of the biased voltage
c. the reverse biased current is strongly dependent on the applied voltage
d. the forward biased current is very small in comparison to reverse biased current

iv. In the middle of the depletion layer of a reverse biased p-n junction, the

a. electric field is zero
b. potential is maximum
c. electrified is maximum
d. potential is zero

OR

The dominant mechanism for the motion of charge carriers in forward and reverse biased silicon junctions are

a. drift in forward bias, diffusion in reverse bias
b. diffusion in forward bias, drift in reverse bias
c. diffusion in both forward and reverse bias
d. drift in both forward and reverse bias

SECTION-E

31. a. Use Gauss' law to derive the expression for the electric field due to a straight uniformly charged infinite line of charge density **λ** C/m.

b. Draw a graph to show the variation of E with perpendicular distance r from the line of charge.

c. Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_1<r_2$) from the line charge.

OR

i. finds the capacitance of a capacitor which is partially filled with a dielectric. hence write the expression for the capacitance when it is fully filled with dielectric.

ii. two parallel plate capacitors, X and Y, have the same area of plates and same separation between them. X has air between the plates while Y contains a dielectric of dielectric constant 4. calculate capacitance of each capacitor if equivalent capacitance of the combination is $4\mu F$.

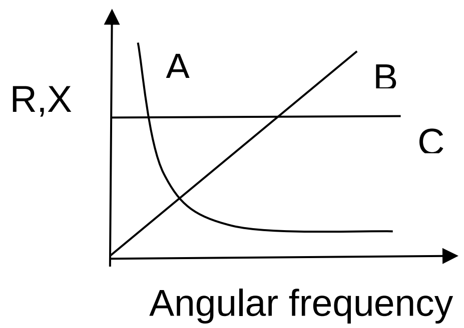
32. a. Draw the schematic arrangement for winding of primary and secondary coils in a transformer when the two coils are wound on top of each other.

    b. state the underlying principle of a step-up transformer and obtain the expression for the ratio of secondary to primary voltage in terms of number of turns.

    c. A transformer of 100% efficiency has 200 turns in the primary and 40,000 turns in the secondary. it is connected to a 220V a.c. mains and the secondary feeds to a 100 k Ohm resistance. calculate the output potential difference per turn.

OR

a. Figure shows the variation of resistance and reactance versus angular frequency. Identify the curve which corresponds to inductive reactance and capacitive reactance write the mathematical form of their reactances.



b. A series LCR circuit is connected to an ac source (200V, 50Hz). The voltages across the resistor, capacitor and inductor are respectively 200V, 250V and 250V.

   i. The algebraic sum of the voltages across the three elements is greater than the voltage of the source. How is this paradox resolved?

   ii. Given the value of the resistance of the resistance of R is 40 Ohm, calculate the current in the circuit.

33. a. Draw a ray diagram to show the refraction of a ray of light through a prism hence derive the expression for refraction through it.

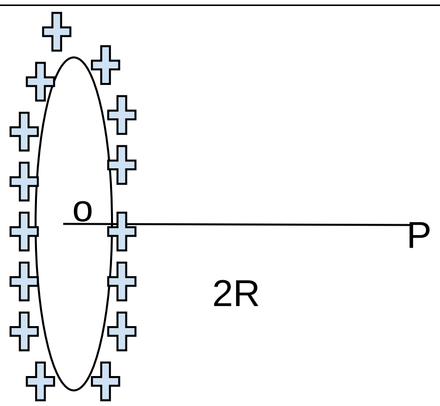
    b. A ray of light passing through an equilateral triangular glass from air undergoes minimum deviation when angle of incidence is 3/4th of the angle of prism. calculate the speed of light in the prism.

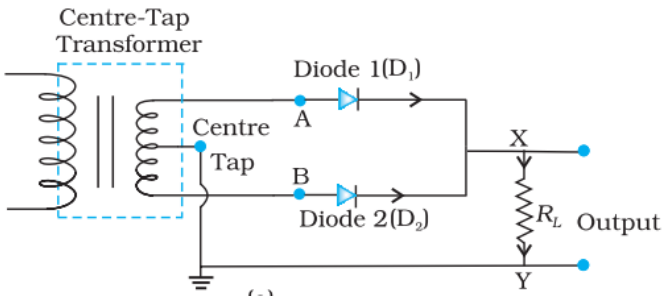
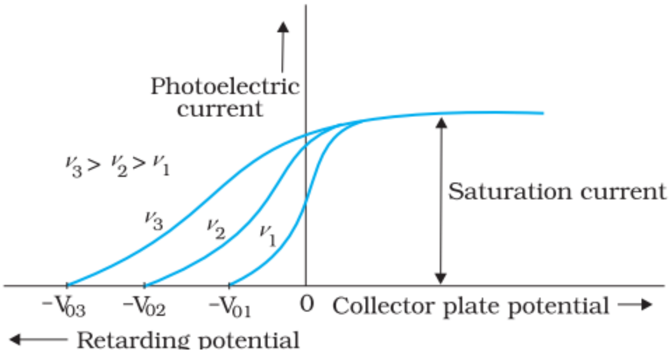
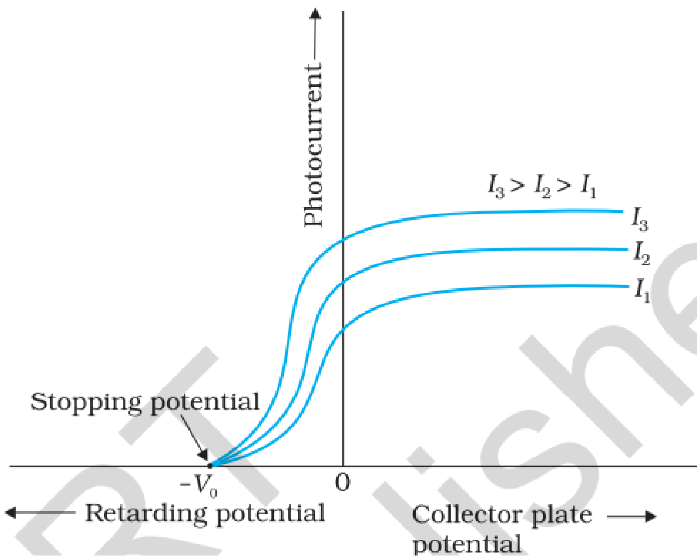
OR

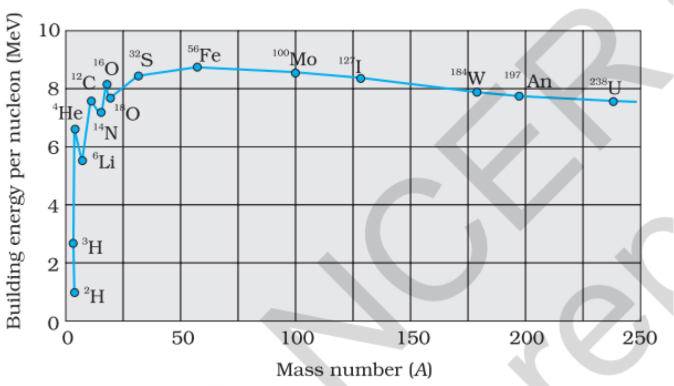
a. Plot the variation intensity of interference when a monochromatic source is incident on a plane of double slit with path difference. also plot the variation in intensity if one of the slits is closed.

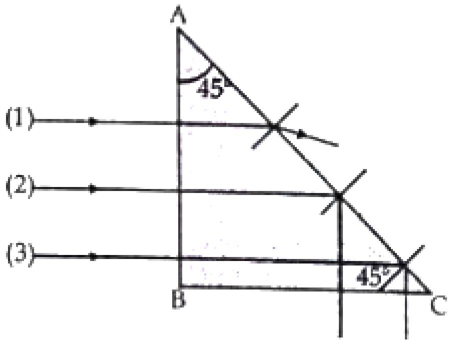
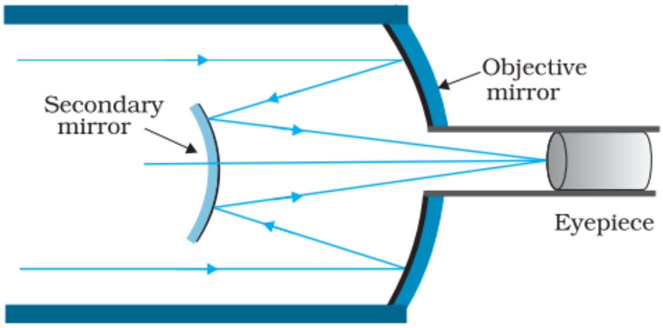
b. Write two characteristic features to distinguish between the interference fringes in YDSE and diffraction due to single slit.

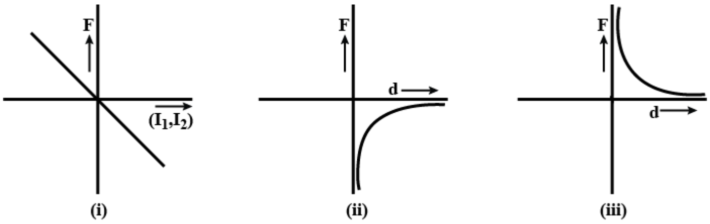
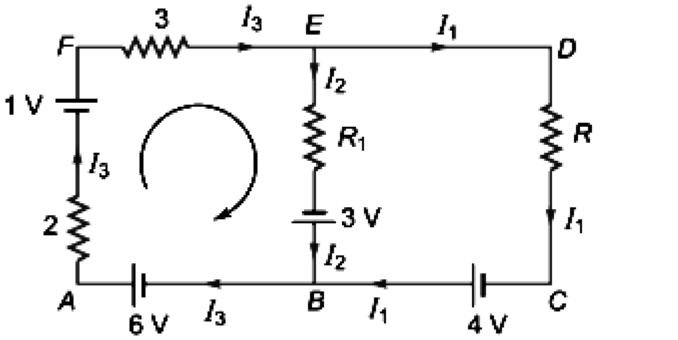
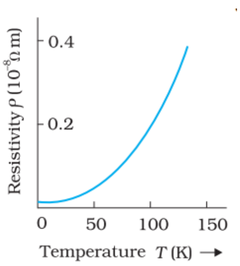
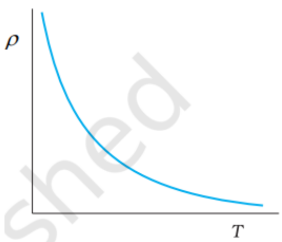
c. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is a distance of 2.5 mm away from the centre. find the width of the slit.

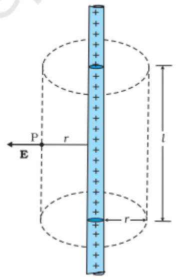
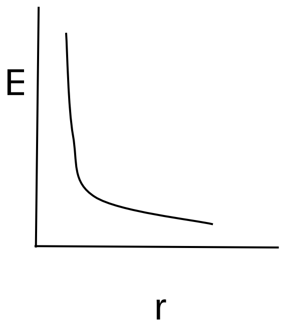
Q.No.	Option/Ans/Key point	weightage	Marks
SECTION: A			
1.	B infinitely charged thin plane sheet	1	1
2.	C r= mv/Bq	1	1
3.	D upwards	1	1
4.	A inductor	1	1
5.	D $P/\sqrt{2}$	1	1
6.	D $\hat{j}\ X\ \hat{k} = \hat{\imath}$	1	1
7.	C -5cm $P_2=P-P_1=-10-10=-20$, $f_2=100/P_2$ cm = -5cm	1	1
8.	C R/2	1	1
9.	D $E=MC^2 \Rightarrow M = E/C^2$	1	1
10.	D $v_3=v/3$, as $v \propto 1/n$ and for second excited state n=3	1	1
11.	C nuclear forces are charge independent	1	1
12.	D	1	1
13.	A	1	1
14.	D	1	1
15.	A	1	1
16.	C	1	1
SECTION: B			
17.	 Potential at P due to any small elemental length dl on the loop is dV=Kdq/r here r = $(R^2+4R^2)^{1/2}$ V = $\int dV = \int Kdq/r = \int K\lambda dl/r$ $= K\lambda 2\pi R/(R^2+4R^2)^{1/2} = \frac{\lambda}{2\sqrt{5}\,\epsilon_0}$	½ ½ ½ + ½	2

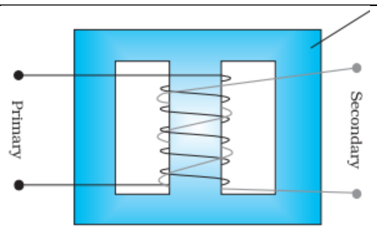
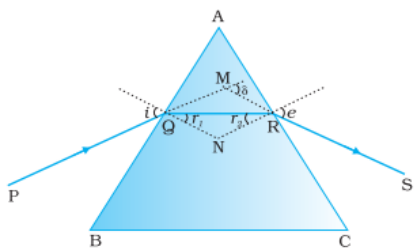
18.	$c=E_0/B_0 \Rightarrow B_0=E_0/c=120/3\times10^8 = 4\times10^{-7}$T $\omega = 2\pi\nu = 2 \times 3.14 \times 50 \times 10^6 = 3.14 \times 10^8$ rad s^{-1} $k = \omega/c = 3.14 \times 10^8 / 3 \times10^8 = 1.05$ rad m^{-1} $\lambda = c/\nu = 6.00$ m **OR** An oscillating charge produces an oscillating electric field in space, which produces an oscillating magnetic field, which in turn, is a source of oscillating electric field and so on. The oscillating electric and magnetic fields thus regenerate each other, as the wave propagates through space. The frequency of the electromagnetic wave equals the frequency of oscillation of the charge.	½ ½ ½ ½ 1 1	2
19.	 correct explanation of conversion of full cycle of AC into DC	1 1	2
20.	 	1 1	2
21.	Here u = – 100 cm, v = ?, R = + 20 cm, n1 = 1, and n2 = 1.5.		

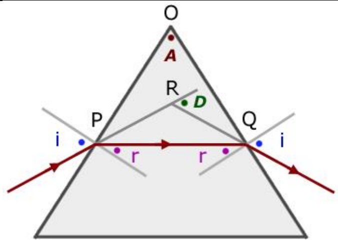
	$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ we then have $\frac{1.5}{v} - \frac{1}{-100} = \frac{(1.5-1)}{20}$ v= +100 cm The image is formed at a distance of 100 cm from the glass surface, in the direction of incident light.	½ ½ 1	2
	SECTION: C		
22.	Energy of Photon $E = \frac{hc}{\lambda} = \frac{6.6X10^{-34}X3X10^{8}}{620X10^{-9}}$ $E = 3.2X10^{-19}J$ $= \frac{3.2X10^{-19}}{1.6X10^{-19}} = 2\ eV$ This corresponds to the transition D will result in emission of wavelength 620 nm. The Balmer series of Hydrogen spectrum can be observed in visible region.	½ ½ ½ ½ 1	3
23.	 Release of energy in nuclear fission: when a heavy nucleus (A>235 say) breaks into two lighter nuclei, the binding energy per nucleon increases i.e. nucleons get more tightly bound. This implies that energy would be released in nuclear fission. Release of energy in nuclear fusion: when two very light nuclei join to form a heavy nucleus, the binding energy per nucleon of fused heavier nuclei is more than the binding energy of lighter nuclei, so again energy would be released in nuclear fusion.	1 1 1	3
24.	As the rays incident normally on face AB they refract without any deviation, thereby they incident at an angle of 45^0 on the face AC if i > i_c then the ray will undergo TIR sin i > sin i_c	½ ½	

	$\frac{1}{\sin i} < \frac{1}{\sin i_c} = \mu$ as i =45^0 $\frac{1}{\sin 45^0} = \sqrt{2} = 1.414$ as refractive index of 2 and 3 being more than 1.414 these two rays will undergo TIR, and 1 will refract through AC  	½ ½ 1	3
25.	 Any three advantages such as 1. No chromatic aberration 2. economical 3. high resolving power	1 ½ 3 x ½ = 1½	3
26.	(a) work done is aligning a magnet from orientation θ_1 to θ_2 is given by W = -mb ($\cos\theta_2 - \cos\theta_1$) i. θ_1=0^0, θ_2=90^0 W = -mB(0-1) = mB = 1.5 X 0.22 = 0.33 J ii. θ_1=0^0, θ_2=180^0 W = -mB(-1-1) = 2mB = 2X1.5 X 0.22 = 0.66 J (b) Torque = mb sinθ i. torque = mb Sin 90^0 = 1.5 X 0.22 X 1 = 0.33 J ii. torque = mb Sin 180^0 = 0 **OR** We know that F is an attractive (-) force when the currents are like currents. i.e. the product of currents is positive.	½ ½ ½ ½ ½ ½	3

	similarly F is a repulsive(+) force when the currents are unlike. i.e. the product of currents is negative.  	3 X 1 = 3	
27.	 According to Kirchhoff's junction rule at E or B $I_3=I_1+I_2$ Since $I_2=0$, $I_3=I_1$ using loop rule in AFEBA $2I_3+3I_3+I_2R_1=10$ $\Rightarrow 5I_3=10 \Rightarrow I_3=I_1=2A$ The potential difference between A and D, along the branch AFED of the closed circuit, $V_A-2I_3+1-3I_3-V_D=0$ $V_A-V_D = 2I_3-1+3I_3=2X2-1+3X2=9V$	1 ½ ½ ½ ½	3
28.	i.  ii  we know that $\rho = \frac{m}{ne^2\tau}$	1 1	3

	i. In case of conductors with increase in temperature, relaxation time decreases, so resistivity increases. ii. In case of semiconductors with increase in temperature, the number density (n) of free electrons increases, hence resistivity decreases.	½ ½	
	SECTION: D		
29.	i. d, ii. c, iii. c or a iv. b	4x1	4
30.	i. b, ii. a, iii. a iv. a or b	4x1	4
	SECTION: E		
31.	 Flux through the Gaussian surface = flux through the curved cylindrical part of the surface = E × 2πrl The surface includes a charge equal to = λ l. Gauss's law then gives E × 2πrl = λl/ε 0 i.e., $E = \lambda/2\pi\varepsilon_0 r$ Vectorially, E at any point is given by **E**= $\lambda/2\pi\varepsilon_0 r\ \hat{n}$  work done in moving the charge q through small distance dr is dW = **F**.**dr** = qEdr = $\frac{q\lambda dr}{2\pi\epsilon_0 r}$ on integrating between r_1 to r_2 W=$\frac{\lambda q}{2\pi\epsilon_0} ln\frac{r_2}{r_1}$ **OR** Correct derivation of $C = \frac{\epsilon_0 A}{d-t+\frac{t}{k}}$ expression in case of fully filled dielectric $C = \epsilon_0 A/d$ given C_x = c and C_y = 4c as both are in series C_{eff} = c*4c/(c+4c) = 4C/5 = 4	1 1 1 1 1 2 ½ ½ ½ ½	5

	=> c = 5μF and Cy = 20 μF	½ + ½	
32.	 a. b. Principle: mutual Induction, i.e. change in current passed through one coil will induce the emf in the inductively coupled second coil. derivation of $V_s/V_p = N_s/N_p$ c. Es/Ep = Ns/Np => Es= (40000/200) x 220 = 44,000V potential difference per turn is Es/Ns = 44000/40000= 1.1 V **OR** a. a- capacitive $X_c = \frac{1}{\omega C}$ b- Inductive $X_L = \omega L$ b. i. Phase difference between voltage and current in all the three components are not the same, we cannot add them algebraically. The phasors are to be treated as vectors. So, the vector sum of voltages which is equal to voltage of the source. $V_{eff} = \sqrt{V_R^2 + (V_L - V_C)^2}$ $= \sqrt{200^2 + (250 - 250)^2}$ = 200V ii. As we know $I_{rms} = \frac{V_{rms}}{Z}$ here, as $V_L = V_C$ circuit is in resonance in resonance Z=R $I_{rms} = \frac{V_{rms}}{Z} = \frac{V_{rms}}{R} = 200/40 = 5A$	1 1 1 1 1 1 1 1 1 1	5
33.	 derivation of $\delta = i + e - A$	1 2	



½

½

in minimum deviation $r^1 = r^2 = r \Rightarrow r = A/2 = 30^0$ ½

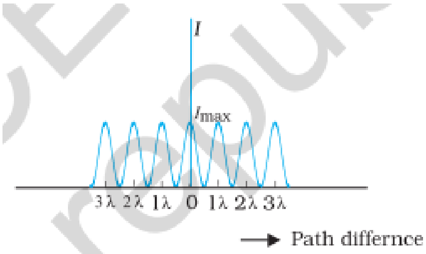
as $i = ¾\ A = 45^0$ ½

5

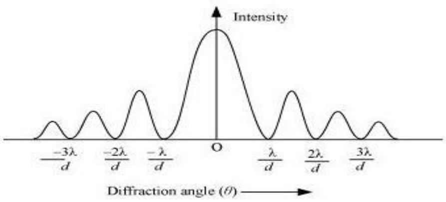
$\mu = \frac{c}{v} \Rightarrow v = c/\mu = c \sin r / \sin i = 3 \, x \, 10^8 / \sqrt{2}$

v= 2.12×10^8 m/s 1

OR



1



b. any two differences such as 2 x 1 = 2

(i) The interference pattern has a number of equally spaced bright and dark bands. The diffraction pattern has a central bright maximum which is twice as wide as the other maxima. The intensity falls as we go to successive maxima away from the centre, on either side.

(ii) We calculate the interference pattern by superposing two waves originating from the two narrow slits. The diffraction pattern is a superposition of a continuous family of waves originating from each point on a single slit.

(iii) For a single slit of width, a, the first null of the interference pattern occurs at an angle of λ/a. At the same angle of λ/a, we get a maximum (not a null) for two narrow slits separated by a distance a.

c. given $\lambda = 5 \, x \, 10^{-7} m, D = 1m, y = 2.5x10^{-3} m$

we know that the half of the width of the central maximum, $y = \frac{\lambda D}{a} \Rightarrow a = \frac{\lambda D}{y}$ ½

a= 2×10^{-4} m ½