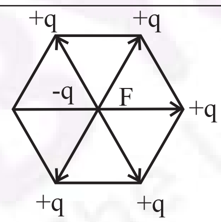
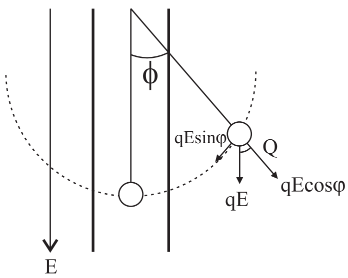
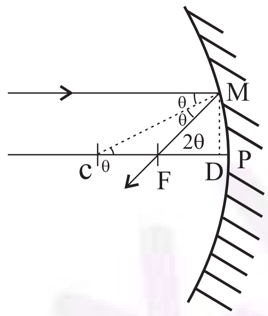
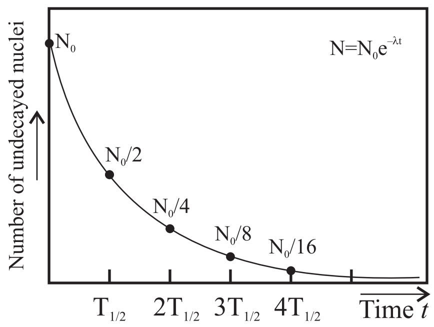
Set-1 MARKING SCHEME - PHYSICS 55/3/1

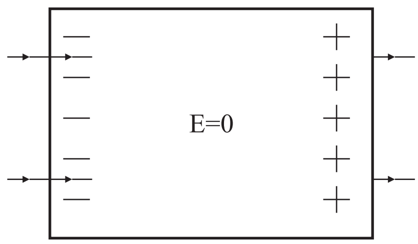
Sl. No.	Value Points / Expected Answers	Marks	Total
	SECTION - A		
Q1.	Sphere A will be negatively charged Sphere B will be positively charged Alternatively- B will be similarly charged to the rod and A will be oppositely charged. OR Sphere will be positively charged. Reason - Electrostatic Induction	½ ½ ½+½ ½ ½	1
Q2.	$57 \times 10^2 \Omega$	1	1
Q3.	$f_0 >> f_e$ Focal length of objective must be much greater than focal length of eyepiece OR Angle of minimum deviation decreases.	1 1	1
Q4.	(a) Intensity of incident radiation is constant (b) ν_1 is the highest frequency.	½ ½	1
Q5.	It is the process of varying the amplitude of the carrier wave in accordance with the amplitude of the message / modulating signal. (Also accept: Diagrammatic representation of AM.)	1	1
	SECTION - B		
Q6.	i) Diagram(or statement) for justification 1 ii) Net force (expression) 1  Alternatively The forces due to the charges placed diagonally opposite at the vertices of hexagon, on the charge -q cancel in pairs. Hence net force is due to one charge only. Net Force $\lvert\overline{F}\rvert = \frac{1}{4\pi \varepsilon_0} \frac{q^2}{l^2}$ Ne OR I) Diagram ½ ii) Derivation of period of oscillation 1½  Derivation $F_r = -qE\sin\varphi$ (Restoring force) $ma = -qE\sin\varphi$ when φ is small $ma = -qE\varphi$	 1 1 ½ ½	2

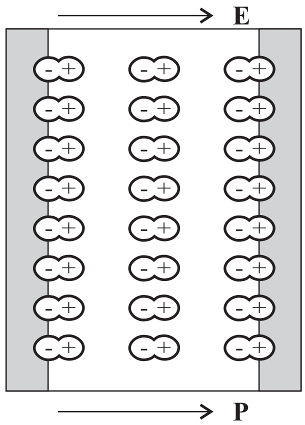
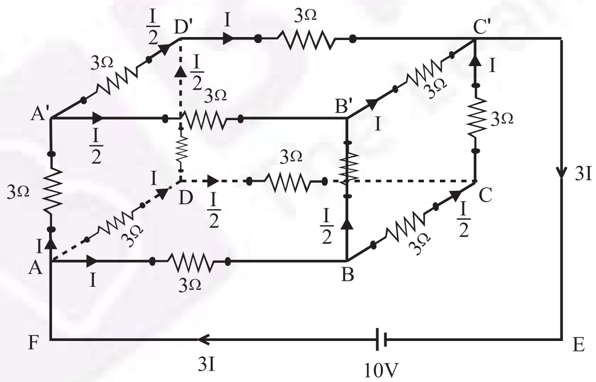
Sl. No.	Value Points / Expected Answers	Marks	Total
	$m\frac{d^2x}{dt^2} = -qE\frac{x}{l}$		
	$\frac{d^2x}{dt^2} = -q\frac{E}{m}\frac{x}{l}$	½	
	comparing with equation of linear SHM.		2
	$\frac{d^2x}{dt^2} = -\omega^2 x$		
	$\omega = \sqrt{\frac{qE}{ml}}$		
	$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{ml}{qE}}$	½	
	Alternatively - The student can use angular SHM expression also. Full marks to be awarded for correct answer even without intermediate steps.		
Q7.	i) Calculation of Equivalent capacitance 1 ii) Total Energy 1		
	i) Equivalent capacitance of two 3μF capacitor in parallel C_1=3+3 = 6μF Similarly equivalent capacitance of 1μF and 2μF in parallel $C_2 = 1 + 2 = 3\mu F$	½	
	Equivalent capacitance of C_1 and C_2 in series $C_{12} = \frac{6\times3}{6+3} = 2\mu F$		2
	Net capacitance $C = 2 + 2 = 4\mu F$	½	
	ii) Energy stored $E = ½ CV^2$	½	
	$= ½ \times 4 \times 10^{-6} \times (100)^2$		
	$= 0.02$ J	½	
	[Note: Award the 1 mark for correct calculation in part (ii) if the value of C_{eq} obtained in part (i) is correct]		
Q8.	Formula ½ Calculation of Induced Voltage 1½		
	Induced voltage $\lvert V\rvert = L\frac{dI}{dt}$	½	
	$\therefore \lvert V\rvert = \mu_0 n^2 la\frac{dI}{dt}$	½	
	$= 4\pi\times10^{-7}\times\left(\frac{10}{10^{-2}}\right)^2 \times 0.5 \times 1 \times 10^{-4} \times \frac{(2-1)}{0.1}$	½	2
	$= 6.28 \times10^{-4}$V or 0.628mV	½	
	OR		
	Calculation of (i) change of magnetic flux 1 (ii) induced emf 1		
	i) $\Delta\phi = \phi_2 - \phi_1 = 0 - NBA\cos\theta$ $= 140 \times 0.09 \times 5 \times 10^{-4} \cos0 = 63 \times 10^{-4}$ Wb	½	

Sl. No.	Value Points / Expected Answers	Marks	Total
	Alternatively If student assumes that the coil was initially kept with its plane parallel to the field, i.e. $\varphi = 90°$, $\Delta\phi = (0-0) = 0$ Wb award 1 mark	1	
	ii) $e = \frac{-\Delta\phi}{\Delta t} = \frac{-63\times10^{-4}}{\Delta t}$ V Alternatively, if the student takes $\Delta\phi = 0$, then e = o, [Note: Award this 1 mark, If a student writes that induced emf cannot be calculated as value of time interval Δt it is not given.]	½+½	2
Q9.	i) Ray Diagram 1 ii) Derivation of relation 1  	1	
	From ray diagram $\tan\theta = \frac{MD}{CD}$ and $\tan 2\theta = \frac{MD}{FD}$ for small θ, $\tan\theta \cong \theta$, $\tan 2\theta \cong 2\theta$	½	2
	$\therefore \frac{MD}{FD} = 2\frac{MD}{CD}$ $FD = \frac{CD}{2} \cong \frac{CP}{2}$ $\therefore f = \frac{R}{2}$	½	
Q10.	Obtaining Bohr's quantization condition using deBroglie hypothesis 2 Let λ be the deBroglie wavelength associated with electron orbiting (with speed v) in the with n^{th} orbit (of radius r) in hydrogen atom.		
	$\therefore \lambda = \frac{h}{mv}$	½	
	Also $2\pi r = n\lambda$	½	2
	$= \frac{nh}{mv}$		
	$\therefore L = mvr = \frac{nh}{2\pi}$	1	

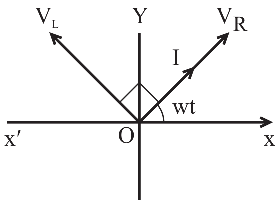
Sl. No.	Value Points / Expected Answers	Marks	Total
Q11.	i) Graph showing decay of radioactive nuclei 1 ii) Determination of half life and average life. 1		
	i) 	1	2
	ii) From figure when $N = \frac{N_0}{2}$ $t = T½$ (half life)	½	
	Average life $\tau = \frac{T½}{0.6931}$	½	
Q12.	i) Two features of nuclear force. ½+½ ii) Completion of equations ½+½		
	i) Any two points given : (Nuclear forces are charge independent, Non central, spin dependent, strong force, short ranged.)	½+½	
	ii) ${}^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}He + Q$ (Award this ½ mark even if the student writes the first term as ${}^{234}_{90}X$)	½	2
	${}^{22}_{11}Na \longrightarrow {}^{22}_{10}Ne + {}^{0}_{+1}e + \nu$	½	

SECTION - C

Sl. No.	Value Points / Expected Answers	Marks	Total
Q13.	i) Explanation with diagram 2 ii) Definition of polarization and its expression for linear isotropic dielectric in terms of electric field. 1		
		½	
	For conductor Due to induction the free electrons collect on the left face of slab creating equal positive charge on the right face. Internal electric field is equal and opposite to external field; hence net electric field (inside the conductor) is zero.	½	

Sl. No.	Value Points / Expected Answers	Marks	Total
		½	
	For dielectiric Due to alignment of atomic dipoles (permanent or induced) along $\vec{E}$, the net electric field within the dielectric decreases.	½	
	ii) The net dipole moment developed per unit volume in the presence of external electric field is called polarization vector $\vec{P}$.	½	3
	Expression ∴ $\vec{P} = X_e \vec{E}$	½	
Q14.	i) Circuit Diagram ½ ii) Calculation of equivalent resistance 1½ iii) Calculation of Currents 1		
		½	
	Applying loop rule to ABCC′EFA $3I + 3\frac{I}{2} + 3I - 10 = 0$	½	
	$\frac{15}{2}\ I = 10$		
	$I = \frac{2\times10}{15} = \frac{20}{15}\ A = \frac{4}{3} A$	½	
	$R_{tot} = \frac{V}{3I} = \frac{10\times15}{3\times20} = 2.5\Omega$ 3	½	
	Current $= I_{AB} (= I_{AA'} = I_{AD} = I_{D'C'} = I_{B'C'} = I_{CC'}) = \frac{4}{3} A$	½	
	$I_{DD'} (= I_{A'B'} = I_{A'D'} = I_{DC} = I_{BC} = I_{BB'}) = \frac{2}{3} A$	½	3

Sl. No.	Value Points / Expected Answers	Marks	Total
Q15.	i) Reason for observation, resolving difficulty ½+½ ii) Stating function of resistance, effect on null point ½+½ iii) Method of increasing sensitivity 1		
	a) Reason :		
	Both ε_1 and ε have positive terminal connected at A whereas negative terminal of E_2 is connected to A.	½	
	By interchanging the terminal of ε_2, the difficulty can be resolved	½	
	b) Resistance R protects the galvanometer by reducing the current flowing through it. Null point position remains unaffected.	½ ½	3
	c) Sensitivity can be increased by : Increasing the length of potentiometer / reducing the value of ε / increasing resistance of rheostat / reducing value of current / decreasing value of potential gradient. (Any one reason)	1	
Q16.	i) Derivation of $T = 2\pi\sqrt{\frac{I}{mB}}$ 1 ii) Identification 1+1		
	a) Restoring torque $\tau = -mB\sin\varphi = -mB\,\varphi$ (for small φ)	½	
	$\tau = I\frac{d^2\varphi}{dt^2} = -mB\varphi$ $\frac{d^2\varphi}{dt^2} = \frac{-mB}{I}\varphi$ Comparing with equation of angular SHM $\frac{d^2\varphi}{dt^2} = -\omega^2\varphi$ $\omega = \sqrt{\frac{mB}{I}}$		3
	$T = 2\pi\sqrt{\frac{I}{mB}}$	½	
	b) I) diamagnetic	1	
	ii) Para magnetic	1	
Q17.	i) Generation of Eddy Current 1 ii) Two examples of application ½+½ iii) Method of minimizing 1		
	a) When the magnetic flux linked with a conductor changes with time, induced currents are set up inside the conductor.	1	3
	b) Induction furnace / Induction stove/Induction breaks/dead beat galvanometer (any two)	½+½	
	c) By lamination/cutting shots (any one) eddy current can be minimized.	1	

Sl. No.	Value Points / Expected Answers	Marks	Total
Q18.	i) Explanation using phasor diagram — 1 ii) Calculation of impedance — 1½ iii) Calculation of potential difference — ½		
			
	a) From phasor diagram it is clear that V_R is in phase with I and V_L is ahead of I in phase by $\pi/2$. Hence the resultant voltage (= voltage in the circuit) will lead V_R and, therefore, the current in the circuit.	1	
	b) Let V be the effective potential difference across L-R circuit, therefore		
	$V = \sqrt{V_R^2 + V_L^2} = \sqrt{(160)^2 + (120)^2} = 200V$	½+½	
	$\therefore$ Impedance of the circuit, $Z = \frac{V}{I} = \frac{200}{1} = 200\Omega$	½	
	c) For d.c. (constant voltage source) V_L=0, therefore Potential difference in the circuit = V_R = potential difference across the resistor (Alternatively, if the student takes the d.c. also as 1A, the potential difference will be = 160V = V_R)	½	
	OR		3
	i) Naming the circuit element Y — ½ ii) Calculation of r.m.s value of current — 1½ iii) Effect of replacing a.c source by d.c source — 1		
	a) Y is a capacitor.	½	
	b) Phase angle, $\varphi = \pi/4$, Also $\cos\varphi = \frac{R}{Z}$	½	
	$\Rightarrow Z = \frac{R}{\cos\phi} = \frac{R}{\cos(\pi/4)} = \frac{100}{1/\sqrt{2}} = 100\sqrt{2} = 141.4\Omega$	½	
	$I_{r.m.s} = \frac{V_{r.m.s}}{Z} = \frac{141V}{141.4\Omega} \cong 1A$	½	
	c) The current becomes zero.	1	
Q19.	i) Naming the three radiations — ½+½+½=1½ ii) Writing their frequency ranges — ½+½+½=1½		
	a) Microwaves	½	
	$\nu = 10^{10}$ Hz to 10^{12} Hz	½	
	b) x-rays	½	
	$\nu = 10^{16}$ Hz to 10^{20} Hz	½	
	c) Infrared	½	
	$y = 10^{12}$ Hz to 10^{14} Hz	½	3

Set-1 MARKING SCHEME - PHYSICS 55/3/1

Sl. No.	Value Points / Expected Answers	Marks	Total

Q20.

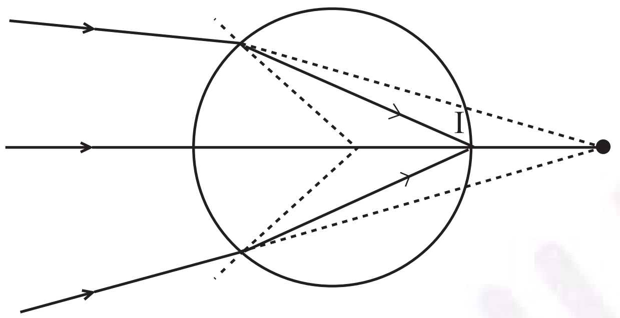
i)	Calculation of new image position	2
ii)	Ray diagram	1

a) $u = 20cm, n_2=1.5, n_1 = 1, R = 5cm$

Using $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ — ½

$\frac{1.5}{v} - \frac{1}{20} = \frac{1.5-1}{5}$ — 1

$v = 10$ cm — ½



— 1

OR

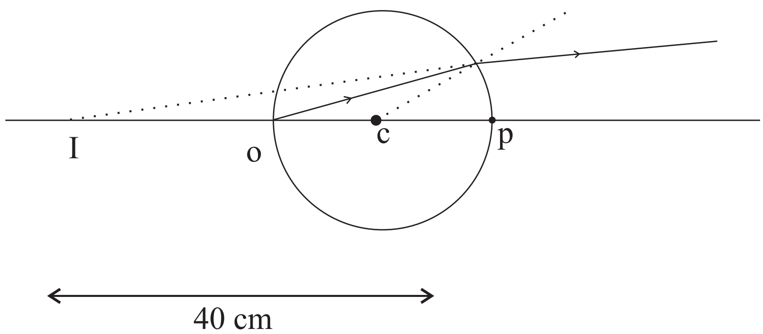
— 3

Formula - 1
substitution and calculation - 1
Ray diagram - 1

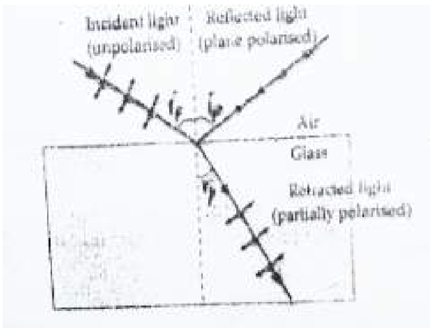
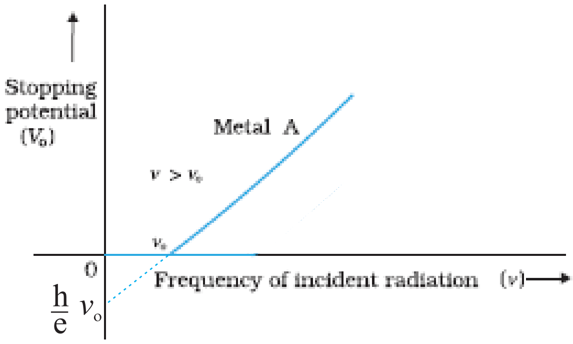
$\frac{n_1}{-u} + \frac{n_2}{v} = \frac{n_2 - n_1}{R}$ — 1

$\frac{1.5}{20} + \frac{1}{v} = \frac{1-1.5}{-10}$ — ½

$v = -40$cm — ½



— 1

Sl. No.	Value Points / Expected Answers	Marks	Total
Q21.	a. Diagram - ½ Explaination - 1 b. Calculation of (i) Polarizing angle - ½ (ii) Refractive index - 1		
a.		½	
	When unpolarized light propagates from a rarer into a denser medium, it gets partly reflected and partly refracted. If the reflected and refracted lights are perpendicular to each other, the reflected light gets polarized.	1	
	(Alternatively if the student explains using Brewster's law award full marks.)		
b.	(i) $i_p = 90 - r_p$		
	$i_p = 90 - 30 = 60°$	½	
	(ii) $\mu = \tan i_p = \tan 60° = \sqrt{3}$	½+½	3
Q22.	a) Graph showing variation of stopping potential with frequency - 1 b) Showing the determination of (i) Threshold frequency - 1 (ii) Planck's constant (from the graph) - 1		
	a. 	1	
	b. From Einstein's Equation $eV_o = h\nu - h\nu_o$		
	$V_o = \frac{h}{e}\nu - \frac{h}{e}\nu_o$	½	

Sl. No.	Value Points / Expected Answers	Marks	Total
	comparing $y = mx + c$		
	(i) Threshold frequency ν_o is the intercept along ν axis.	½	
	(Alternatively, intercept on V_o axis, $c = \frac{h}{e}\nu_o$ $\nu_o = \frac{ec}{h}$)		
	(ii) Planck's constant h = e x slope	1	
	OR		3
	a. Explanation of emission of electron from a photosensitive surface - 1 b. Explanation and justification - 1 c. Finding the maximum KE - 1		
	a. When a photon of the energy $h\nu$ is absorbed by an electron in the photosensitive material, a part of the energy absorbed is used up in liberating it from the surface (the work function). The remaining energy appears as KE of the photoelectron.	1	
	Alternatively: $K_{max} = h\nu - \phi_o$ if $h\nu \geq \phi_o$, k_{max} is positive and electron is emitted		
	b. Emission of electron will not take place. Energy $h\nu$, of a single photon, is less than the work function ϕ_o	½ ½	
	(Alternatively - $k_{max} = h\nu - \phi_o$ $h\nu < \phi_o$ so k_{max} is negative; Hence no emission will take place.)		
	c. $V_o = 1.5$ V $k_{max} = eV_o = 1.6 \times 10^{-19} \times 1.5 = 2.4 \times 10^{-19}$ J	1	
	[If a student just writes, $k_{max} = 1.5$ eV award ½ mark]		
Q23.	a. (i) Truth tables for P and Q - ½ + ½ (ii) Truth tables for circuit - 1 b. Explanation for why NOR gates are considered as universal gates - 1		

Sl. No.	Value Points / Expected Answers	Marks	Total

a. P Q

(I)

A	Y
O	1
1	O

A	B	Y
O	O	1
O	1	O
1	O	O
I	I	O

Marks: ½+½

(ii)

A	B	Y
O	O	O
O	1	O
1	O	1
I	I	O

Marks: 1

b. All basic logic gates can be realized by using NOR gates
(Also accept if the student draws the diagrams for getting OR & AND gates using NOR gates.)

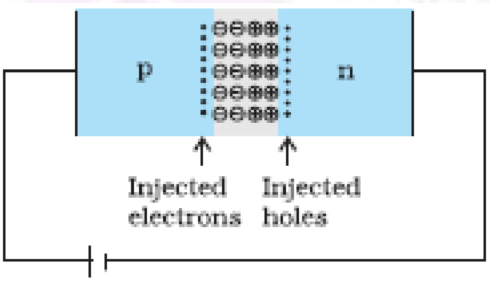
Marks: 1

Total: 3

OR

a. Formation of potential barrier (with diagram) - 1½
b. Circuit diagram and plotting graph - 1½

a.

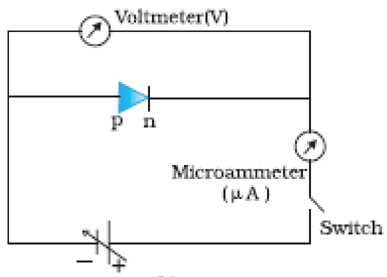
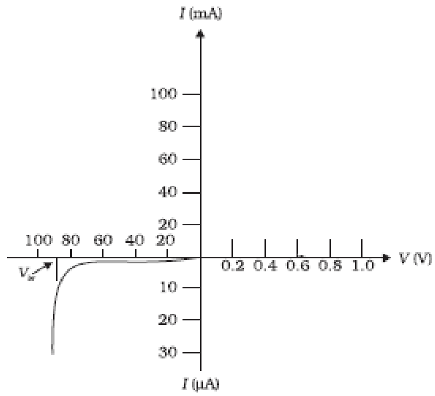
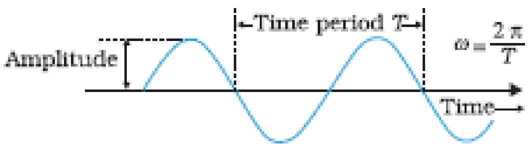


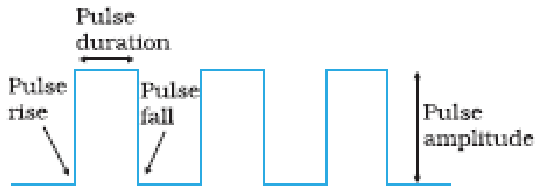
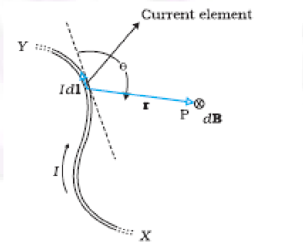
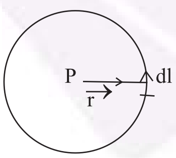
Marks: ½

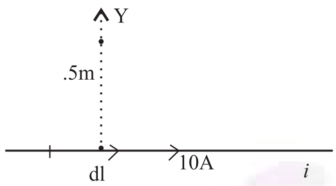
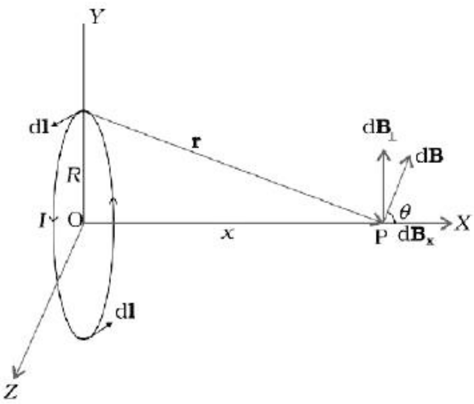
During the formation of p - n junction diode: due to the concentration gradient across p and n sides of a diode, holes diffuse from p side to n side and electrons diffuse from n side to p side giving rise to development of immobile positive charges on the n side and the negative charges on the p side across the junction. Thus a potential barrier is formed at the junction.

Marks: 1

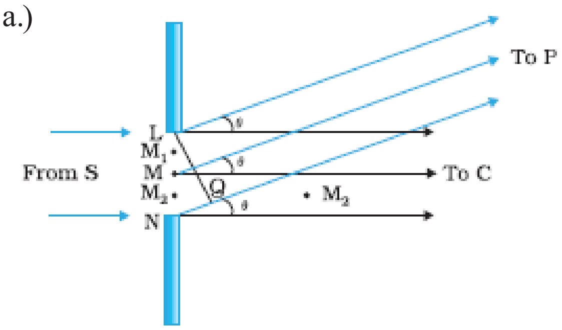
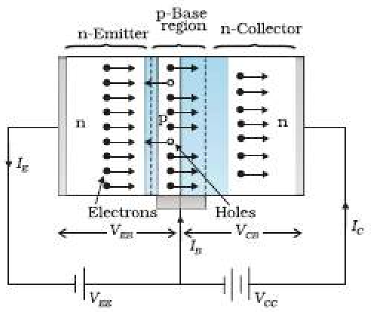
Alternatively: if a student explains with depletion region, award this 1 mark.

Sl. No.	Value Points / Expected Answers	Marks	Total
	b.  (b)	1	
	c. 	½	
Q24.	a. Meaning of bandwidth and importance - 1 b. Differentiation between analog & Digital signal - 1 c. Functions of transducers and repeaters - 1		
	a. Bandwidth of a signal is the range over which the frequencies in that signal vary. (Also accept bandwidth is the frequency range over which an equipment/device operates)	½	
	The knowledge of bandwidth helps in designing equipment used in communication/essential for communication.	½	
	b. In digital communication, digital signals are used which have two discrete current or voltage values in a signal.	½	
	Analog signals are used which have continuous current or voltage values in a signal.	½	3
	Alternatively, if a student draws the diagram of the digital signals and analog signals give these (½+½) mark.  (a)		

Sl. No.	Value Points / Expected Answers	Marks	Total
	 (b)		
	c. A transducer converts one from of energy into another. A repeater enhances the range of a communication system.	½ ½	
	SECTION - D		
Q25.	a. Statement of the law and expression for the magnetic field - 1+2 b. Finding the magnitude and direction of magnetic field - 1½ +½		
	a. According to Biot Savart law, the magnetic field due to a current element is given by $\vec{dB} = \frac{\mu_o}{4\pi} I \frac{\vec{dl} \times \vec{r}}{[\vec{r}]^3}$  Alternatively award this 1 mark if a student makes statement of Biot Savart law.	1	
	Derivation of magnetic field 	½	
	Magnetic field due to current element dl $\vec{dB} = \frac{\mu_o}{4\pi} I \frac{\vec{dl} \times \hat{r}}{[\vec{r}]^2}$ where $\hat{r}$ is a unit vector along $\vec{r}$ $\vec{r} \perp \vec{dl}$ Direction of $\vec{dB}$ is perpendicular, pointing outward.	½	

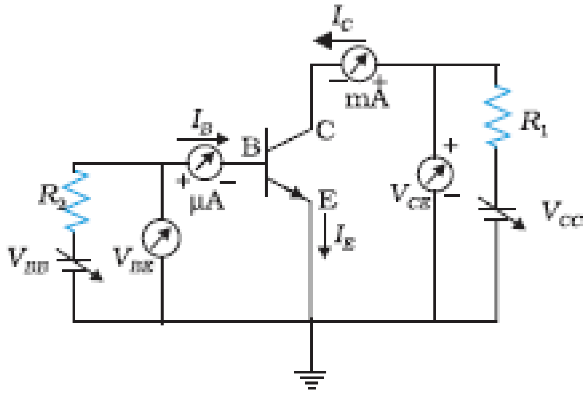
Sl. No.	Value Points / Expected Answers	Marks	Total
	∴ Field due to the whole loop		
	$\left\|\vec{B}\right\| = \int dB = \frac{\mu_o I}{4\pi r^2}\int dl = \frac{\mu_o I}{4\pi r^2} \times 2\pi r$	½	
	$\left\|\vec{B}\right\| = \frac{\mu_o I}{2r}$	½	5
	b. 		
	$\left\|\vec{dB}\right\| = \frac{\mu_o I}{4\pi}\frac{dl \sin\theta}{[\vec{r}]^2}$	½	
	$= \frac{4\pi \times 10^{-7}}{4\pi} \times \frac{10 \times (1\times10^{-2}) \times \sin 90^0}{(0.5)^2}$	1	
	$= 4\times10^{-8} T$	½	
Q25.	OR		
	a) Derivation of expression with diagram 3 b) Calculation of magnitude of magnetic field at the center of the arc. 1½ Direction of field ½		
		1	
	According to Biot Savart law		
	$\left\|\vec{dB}\right\| = \frac{\mu_0}{4\pi}\frac{I\, dl \sin 90^0}{\|\vec{r}_1\|^2}$		
	Where $r_1 = \sqrt{x^2 + r^2}$		
	$\left\|\vec{dB}\right\| = \frac{\mu_0}{4\pi}\frac{I\, dl}{(x^2+r^2)^{\frac{3}{2}}}$	½	
	Direction of $\vec{dB}$ is perpendicular to $\vec{dl}$ and $\vec{r}_1$.		5
	It has components dB_x and $dB_\perp$. The components $dB_\perp$ due to the whole coil cancel out in pairs.	½	
	Net field $B = \int dB_x = \int dB \cos\theta$		

Sl. No.	Value Points / Expected Answers	Marks	Total
	$\vec{B} = \frac{\mu_0 I r^2}{2(r^2+x^2)^{\frac{3}{2}}}\hat{i}$	1	
	b) $B = \frac{\mu_0 I}{4r}$	½	
	$= \frac{4\pi \times 10^{-7} \times 5}{4 \times 2 \times 10^{-2}}$	½	
	$= 7.85 \times 10^{-5}$ T	½	
	The field is directed inwards perpendicular to the plane of the page.	½	
Q26.	i) Production of Interference pattern and explanation. 1+1 ii) Obtaining expression for intensity at the point P 1½ iii) Calculating wavelength of light 1½		
	a) No. Sustained interference pattern cannot be obtained	1	
	Light waves emitted from a source undergoes abrupt phase changes in times of the order of 10^{-10}s. So light from two independent sources will not have fixed phase relationship and will be incoherent.	½+½	
	b) $x = \frac{\beta}{3}$, path difference = $\frac{\lambda}{3}$	½	
	phase diff = $\frac{2\pi}{3}$		
	$I = I_0 \cos^2 \frac{\phi}{2}$	½	
	$I = I_0 \cos^2 \left(\frac{2\pi}{3\times2}\right) = I_0 \cos^2 \left(\frac{\pi}{3}\right)$		
	$I = I_0 \left(\frac{1}{4}\right) = \frac{I_0}{4}$	½	
	c) Distance of 5th bright fringe from 2nd dark fringe		
	$x = \frac{5\lambda D}{d} - \frac{3}{2}\frac{\lambda D}{d} = \frac{7}{2}\frac{\lambda D}{d}$	½	5
	$\lambda = \frac{2xd}{7D} = \frac{2\times4.13\times10^{-3}\times 0.5\times10^{-3}}{7\times1}$	½	
	$\lambda = 0.59 \times 10^{-6}$m = 5900 Å	½	
	OR		
	i) Derivation of relation 2 ii) Effect on linear width of central maximum ½+½ iii) Determination of slit width 2		

Sl. No.	Value Points / Expected Answers	Marks	Total
	a.) 	½	
	From diagram path difference between the waves from L and N $= a \sin\theta$	½	
	When first minimum is obtained at P then path difference $= \lambda$	½	
	[imagine the slit be divided into two halves, for each wavelets from first half of the slit has a corresponding wavelet from second half of the slit differing by a path of $\frac{\lambda}{2}$ and cancel each other]		
	Condition for first minimum		
	$\therefore\ \lambda = a \sin\theta$		
	b.) $\beta_{cm} = \frac{2\lambda D}{d}$	½	5
	(i) increases	½	
	(ii) increases	½	
	c.) $10\frac{\lambda}{d} = 2\frac{\lambda}{a}$	1	
	$a = \frac{d}{5} = 0.2\text{mm}$	1	
Q27.	a. Circuit diagram and its working - 2 Explanation of low and high resistance at input and output respectively - 1 b. Derivation of voltage gain - 1½ Input and output phase relation. - ½		
	a.  (b)	1	

Sl. No.	Value Points / Expected Answers	Marks	Total

(Also accept the following circuit diagram.

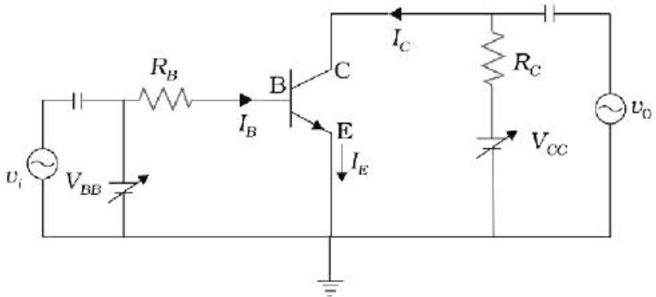


)

When Emitter Base junction is forward biased, electron from emitter enter the base where a few free charge carriers combine with the holes present in the base. As base is thin, most of the electron go into the collector, since collector junction is reverse biased, it gives rise to a collector current. — 1

Since Emitter-Base junction is forward biased, input resistance is low and base-collector is reversed biased, so output resistance is high. — ½+½

b. — 1



Applying Kirchoff's loop rule to input loop and taking variation

$\Delta V_{BE} = \Delta I_B (R_B + r_i)$ ....(1)

Output loop and taking variations

$\Delta V_{CE} = - R_L \Delta I_C$ ....(2)

Voltage gain, $A_V = \frac{v_0}{v_i} = \frac{\Delta V_{CE}}{\Delta V_{BE}} \; - \frac{R_L \Delta I_C}{\Delta I_B (R_B + r_i)} = -\beta_{ac} \frac{R_L}{r}$

Where, $R_B + r_i = r$ ....(3)

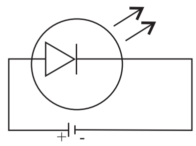
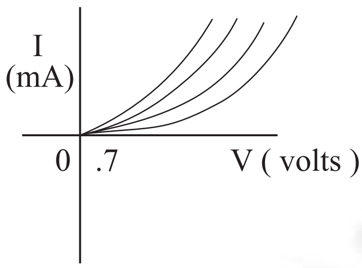
and $\beta_{a.c}$ = Current gain in C.E. $= \frac{\Delta I_C}{\Delta I_B}$ — ½

The negative sign in equation (3) indicates that the input and output voltages are in opposite phase. — ½

Total: 5

OR

a)	Two considerations for fabricating p-n junction diode used as LED	1
	Order of band gap	1
	Circuit diagram and action	1
b)	V-I characteristics of LED	1
	Two advantages of LED lamps over conventional lamps	½+½

	Marks	Total
a) Important fabricating consideration i) Heavily doped ii) Encapsulated with transparent cover.	½+½	
<u>For visible light:</u> order of band gap for LED = 1.8 eV to 3eV	1	
	½	
When the diode is forward biased, electron are sent from n side to p side and holes are sent from p side to n side and at the junction boundary, the excess minority carrier recombines with the majority carriers releasing energy in the form of photons.	½	
	1	
Two advantage of LED over ordinary Lamps Low operational voltage/Less power consumption / fast action / No warm up time required / Nearly monochomatic / Long life / ruggedness / fast switching capacity (Any two)	½+½	