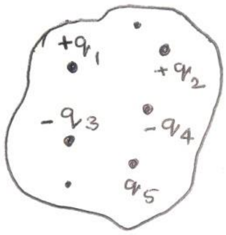
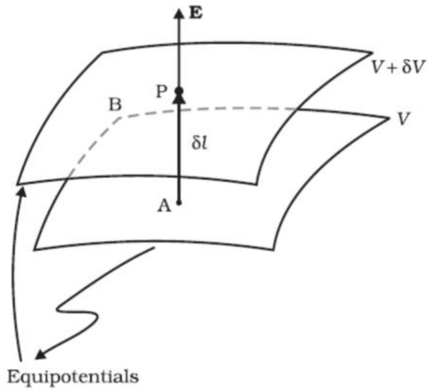
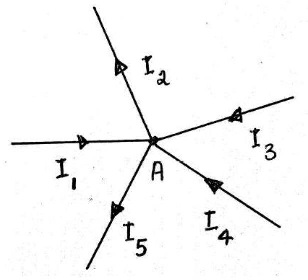
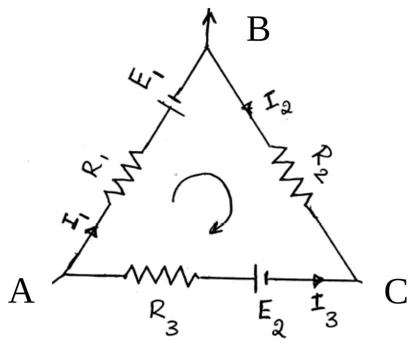
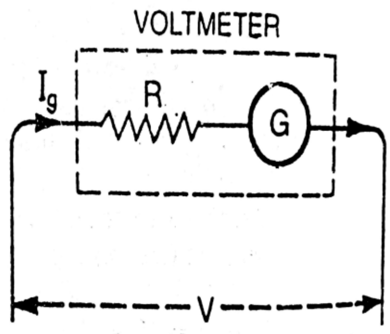
KARNATAKA SCHOOL EXAMINATION AND ASSESMENT BOARD
II PU EXAMINATION-2, APRIL/MAY-2024
SCHEME OF VALUATION
SUBJECT: PHYSICS (33)

Qn. No	PART-A	Marks
I.		
1.	b). 6.25×10^{18}	1
2.	b). The centres of positive and negative charges do not coincide	1
3.	b). area of cross section	1
4.	c). tesla	1
5.	a). magnetisation	1
6.	b). Faraday's law	1
7.	b). both the statements I and II are correct	1
8.	c). transformer	1
9.	d). Gamma rays	1
10.	a). absolute refractive index of the medium	1
11.	c). Both the statements are correct and statement II is correct confirmation of statement I	1
12.	d). electron	1
13.	a) J. J Thomson	1
14.	d). charge dependent forces	1
15.	a). a substance having equal number of free electrons and holes at room temperature	1
II.		
16.	attract	1
17.	Lenz's law	1
18.	diffraction	1
19.	Heavy nucleus	1
20.	decreases	1

Qn.No		Marks
III.		
21.	Gauss's theorem states that ***"the total outward electric flux through any closed surface is equal to $\frac{1}{\varepsilon_0}$ times the net charge enclosed by the surface."*** If $+q_1$, $+q_2$, $-q_3$, $-q_4$, $+q_5$………. are the charges inside a closed surface, then the total outward electric flux  $\Phi = \frac{1}{\varepsilon_0}$ [$+ q_1 + q_2 - q_3 - q_4$.........] $\Phi = \frac{1}{\varepsilon_0} \sum \mathbf{q}$ **(**Any other charge distribution can be consider)	1 1
22.	$C = \frac{C_1 C_2}{C_1 + C_2}$ $= \frac{3 \times 6}{3+6} = 2\mu F$	1 1
23.	i) when moving perpendicular to magnetic field or $\theta = 90^o$	1
	ii) when moving in the direction of magnetic field or opposite to magnetic field. or $\theta = 0^o$ or $\theta = 180^o$	1
24.	1. The magnetic field lines of a magnet (or a solenoid) form continuous closed loops. 2. The tangent to the field line at a given point represents the direction of the net magnetic field at that point. 3. The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field. 4. The magnetic field lines do not intersect. Any two correct properties	1 + 1
25.	$\boldsymbol{\varepsilon} = \boldsymbol{B\, l}\, \upsilon$ where B = magnetic field, l = length of the conductor and υ = velocity	1 1
26.	$I = I_0 \sin(\omega t + \frac{\pi}{2})$ where I_0 = peak value of current and $\frac{\pi}{2}$ = phase difference	1 1

27.	1. UV radiation is used in burglar's alarm. 2. UV radiation is used in checking the purity of vitamins 3. UV rays are used in LASIK eye surgery. 4. It is used in the study of molecular structure. 5. UV radiation used for sterilizing the surgical equipments. Any two correct applications	1 + 1
28.	Critical angle for a medium is the angle of incidence in the medium for which the angle of refraction is 90˚ $n = \frac{1}{sinC}$ where *n* is the refractive index of the medium and C is the critical angle	1 1
29.	p-type: 1. Majority charge carriers are holes. — n-type: 1. Majority charge carriers are electrons. p-type: 2. Minority charge carriers are electrons. — n-type: 2. Minority charge carriers are Holes p-type: 3. Trivalent atom is used as dopent. — n-type: 3. Pentavalent is used as dopent Any two correct differences. Each carries one mark	1 + 1
IV		
30.	1. Charges are additive in nature 2. Charges are conserved. 3. Charges are quantized.	1 1 1

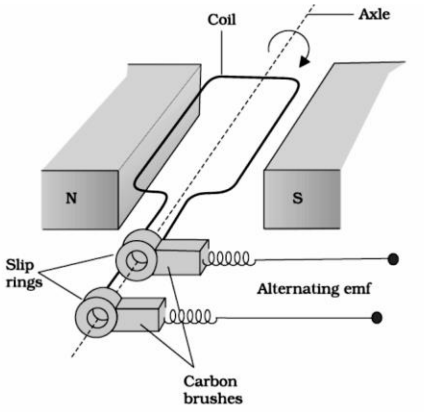
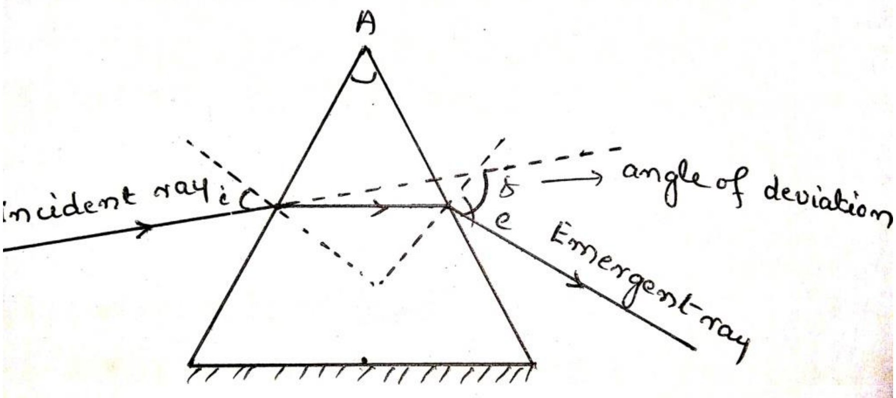
31.	The work done in moving a unit positive charge from B to A is dw = dV $\frac{F}{q_0}$ x (– dr) = dV But $\frac{F}{q_0} = E$ Therefore E x $(– dr)$ = dV $$\boldsymbol{E = -\frac{dV}{dr}}$$  	1 1 1
32.	At any junction in an electrical network, the sum of the currents entering the junction is equal to the sum of the currents leaving the junction. Or The algebraic sum of the currents at a node in an electrical network is zero. $I_1 + I_3 + I_4 = I_2 + I_5$ Or $\sum I = 0$  Loop rule: It states that "in any electrical closed loop, the algebraic sum of changes in potential around any closed loop involving resistors and cells in the loop is to zero". i.e. Apply Kirchhoff's voltage law electric loop ABCA. Then we can write $-I_1R_1 - E_1 - I_2R_2 - + E_2 + I_3R_3 = 0$ $\sum E + \sum IR = 0$  (Each statement carries one mark and explanation for any one law carries one mark.)	1 1 1

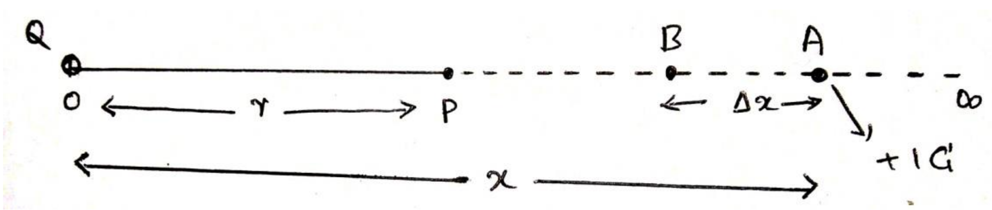
33.	A voltmeter can be converted into a voltmeter by connecting a high resistance in series with the galvanometer coil.	1
		1
	The value of the high resistance R to be connected in series with the galvanometer is given by $R = \frac{V}{I_g} - G$	1
	Where G = galvanometer resistance, I_g = current required for full scale deflection, and V = maximum voltage to be measured.	

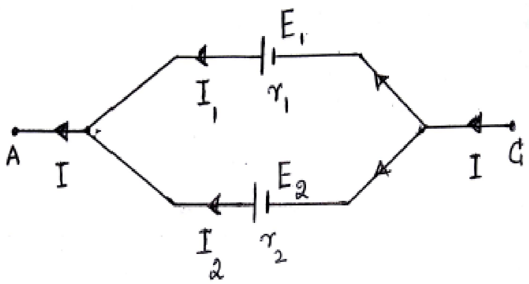
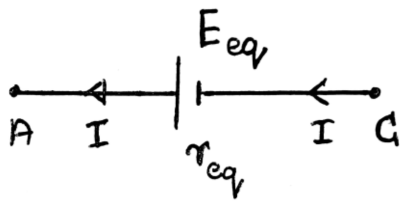
34.

Diamagnetic substance	**Ferromagnetic Substance**
1. These are repelled by a strong magnetic field	1. These are strongly attracted by magnetic field.
1. These substances move from stronger magnetic field region to weak field region.	2. These substances have strong tendency to move from weak magnetic field region to stronger field region
2. Magnetic susceptibility is small and negative ($-1 \leq \chi < 0$).	3. Magnetic susceptibility is large and positive ($\chi >> 1$).
3. Permeability is less than one	4. Permeability is greater than 1000.
5. Susceptibility is independent of temperature.	5. Susceptibility is temperature dependent and these obeys Curie's law i.e. $\chi = \frac{C}{T - T_C}$

Any three correct differences. Each differences carries one mark 1+1+1

35.	 The magnetic flux linked with the coil in its deflected position is $\boldsymbol{\phi} = NAB\ cos\theta = NABcos\omega t$ When the coil rotates, the induced emf is given by $\varepsilon = -\frac{d\phi}{dt} = -\frac{d}{dt}(NAB.cos\ \omega t)$ $\varepsilon = -NAB.(-sin\omega t)\ \omega$ $\varepsilon = NAB\omega\ sin\omega t$ $\boldsymbol{\varepsilon = \varepsilon_0\ sin\omega t}$ where $E_0 = NAB\omega$ is the maximum value of emf induced.	1 1 1
36.	 Deviation produced by a thin prism is given by $d = (n - 1)A$	2 1

37.	The kinetic energy (K) of the electron in hydrogen atom is given by $K = \frac{1}{2}mv^2 = \frac{e^2}{8\pi\epsilon_0 r}$ and the potential energy (U) of the electron in hydrogen atom is $U = -\frac{e^2}{4\pi\epsilon_0 r}$ Hence the total energy of the electron in hydrogen atom is $E = K + U = \frac{e^2}{8\pi\epsilon_0 r} + -\frac{e^2}{4\pi\epsilon_0 r}$ $E = -\frac{e^2}{8\pi\epsilon_0 r}$ .... (1)	1 1 1
38.	$\Delta m = [\, Z \text{ x } m_p + (A - Z)\, m_n \,] - M$ $= [\, 8 \text{ x } 1.00727 + 8 \text{ x } 1.00866 \,] - 15.99053$ $= [\, 8.05816 + 8.06928 \,] - 15.99053$ = 0.13691u B.E = 0.13691 x 931 MeV = 127.46321 MeV	1 1 1
V		
39.	 Consider a point charge +Q at O. Let P is a point in the electric field at a distance r from O. The electrostatic force experienced by a unit positive charge q_0 placed at an intermediate point A is given by $F = \frac{1}{4\pi\varepsilon_0} \frac{Q \text{ x } 1}{x^2}$	1

	Work done per unit charge moved from A to B through a small distance Δx against field is	
	$\Delta w = \frac{1}{4\pi\varepsilon_0}\frac{Q}{x^2} \;.-\Delta x$	1
	Total work done to move the unit positive charge from infinity to the given point P against the field is given by	
	$w = \int_{\infty}^{r} \Delta w = \int_{\infty}^{r} \frac{1}{4\pi\varepsilon_0}\frac{Q}{x^2} \;.-\Delta x$	1
	$w = -\frac{Q}{4\pi\varepsilon_0}\left[-\frac{1}{x}\right]_{\infty}^{r}$	
	$w = \frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r}-\frac{1}{\infty}\right] = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$	1
	This is the electric potential at P	
	$\mathbf{V(r) = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}}$	1
40.	Consider two cells of emf E_1 and E_2 and internal resistances r_1 and r_2 respectively are connected in parallel.	
	 	1
	The potential difference across the first cell is	
	$V_{AC} = V(A) - V(C) = E_1 - I_1 r_1$	
	The potential difference across the second cell also	1
	$V_{AC} = V(A) - V(C) = E_2 - I_2 r_2$	

The total current through the circuit is $I = I_1 + I_2$

$$I = \frac{E_1 - V}{r_1} + \frac{E_2 - V}{r_2} = \left(\frac{E_1}{r_1} + \frac{E_2}{r_2}\right) - V\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$$ 1

Hence, V is given by

$$V = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - I\,\frac{r_1 r_2}{r_1 + r_2}$$

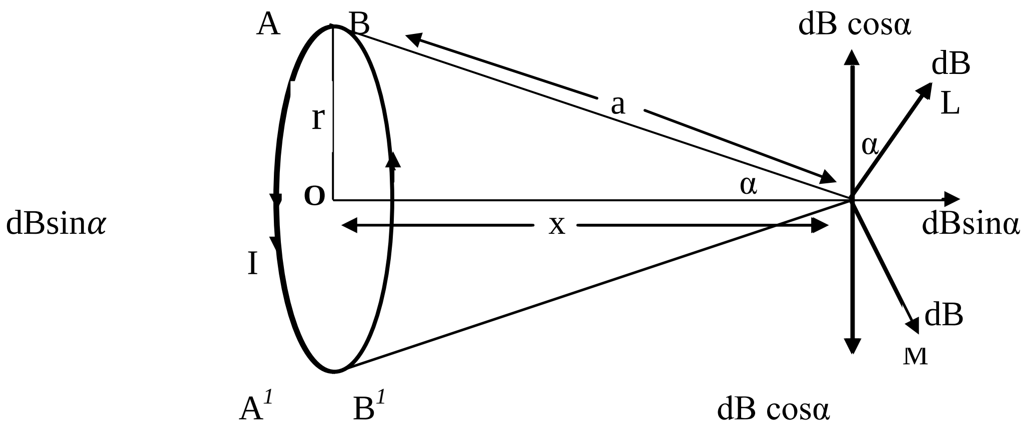
If we replace two cells by a single equivalent cell of emf E_{eq} and internal resistance r_{eq} then

$$V = E_{eq} - I.r_{eq}$$ 1

From the last two equation we can write

$$E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} \quad \text{and} \quad r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$$ 1

41. Consider a circular coil of radius r, number of turns n and carrying a current I. Let P be a point on the axis of the coil at a distance x from the centre O of the coil.



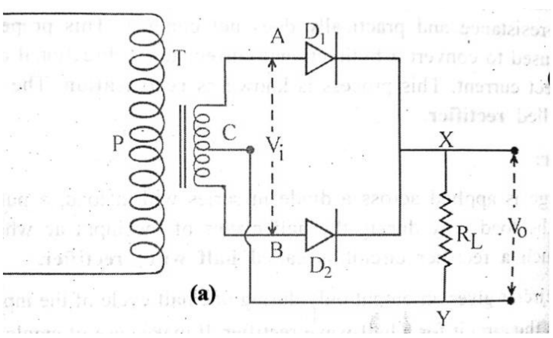
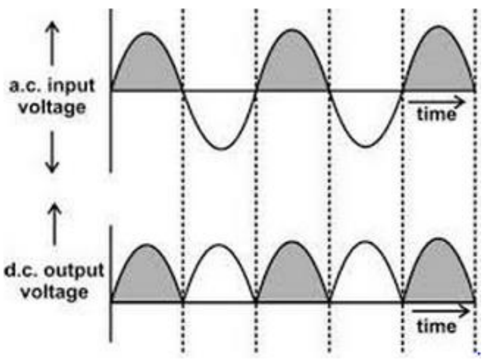
1

The magnetic field at P due to a small element AB of length *dl* is given $dB = \frac{\mu_0}{4\pi}\frac{I\,dl}{a^2}$ along PL direction

Consider another element A^1B^1 opposite to AB. The magnetic field at P 1

$$dB = \frac{\mu_0}{4\pi}\frac{I\,dl}{a^2}$$ along PM direction

	The field dB is resolved in to $dB.sin\alpha$ along axis of the coil and dB.cosα perpendicular to the axis of the coil. Two perpendicular components cancel each other. The net magnetic field at P is $dB = \sum dB\sin\alpha$ $dB = \sum \frac{\mu_0}{4\pi} \frac{I\, dl \sin\alpha}{a^2}$ $B = \frac{\mu_0}{4\pi} \frac{I .2\pi r.sin\alpha}{a^2}$ But $\sin\alpha = \frac{r}{a}$ $B = \frac{\mu_0}{4\pi} \frac{2\pi I r^2}{a^3}$ But $a^3 = (r^2 + x^2)^{3/2}$ $B = \frac{\mu_0}{4\pi} \frac{2\pi I r^2}{(r^2 + x^2)^{\frac{3}{2}}}$	1 1 1
42.	(a). The sources of light which emit the light with same wavelength or frequency and constant phase difference are called coherent sources. (b). Condition for constructive interference Path difference $\delta = n\lambda$ For destructive interference Path difference $\delta = (2n + 1)\frac{\lambda}{2}$ or $(n + \frac{1}{2})\lambda$ Where n s the order of the fringe and λ is the wavelength of the light (c) The Polaroids are used in 1. Polaroids are used in sun glass. 2. Polaroids are used in windowpanes of trains and airplanes. 3. Polaroids are used in three dimensional movie cameras. 4. Polaroids are used for viewing three-dimensional pictures. 5. Polaroids are used in photographic cameras etc. Any two uses. Each carries one mark	1 1 1 1 + 1

43.	(a). Photoelectric effect is the phenomenon of emission of electrons from certain metal surfaces when radiation of suitable frequency is incident on it.	1
	(b). The experimental observations of photoelectric effect are 1. The photoelectric effect is almost instantaneous. 2. For a given frequency of radiation and plate potential, the photoelectric current is proportional to the intensity of incident radiation. 3. For a given photo sensitive cathode there is a minimum frequency of radiation, below which no photoelectric effect takes place, whatever may be the intensity. This limiting or minimum frequency is called threshold frequency (ν_0). 4. As the plate potential V is increased the photoelectric currents increases gradually up to a certain constant value called the saturation current. 5. If the plate potential is made negative, current still flows, but decreased. At particular negative potential Vs, the photoelectric current becomes almost zero. This potential is called stopping potential. Any two correct observations. Each carries one mark	1 + 1
	(c). Einstein's photoelectric equation is given by $h\nu = \Phi_0 + \frac{1}{2} mv^2_{max}$. Or $h\nu = h\nu_0 + \frac{1}{2} mv^2_{max}$	1
	Where ν = frequency of incident light, ν_0 = threshold frequency, Φ_0 = work function, m = mass of electron and v_{max} = maximum velocity of electrons.	1
44.	 	1 + 1

	Working: During the positive half-cycle of secondary voltage the end A becomes positive and end B becomes negative. This makes the diode D_1 forward biased and D_2 reverse biased. Therefore D_1 conducts and D_2 does not conduct. The current flows through the diode D_1 and load resistance R_L. During negative half cycle, A end becomes negative and B becomes positive. Hence diode D_1 is reverse biased and D_2 in forward bias. Therefore D_2 conducts while D1 does not. The current flows through D_2 and load resistance R_L. Hence in both halves of A.C, the current in load resistance is in the same direction. Therefore a pulsating unidirectional D.C is obtained across load resistance R_L. The output voltage wave form is as shown in figure.	1 1 1
VI		
45.	$q_1 = 0.4\mu C$ a) $F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{d^2}$ $q_1 = -0.8\mu C$ F = 0.2N $0.2 = 9 \times 10^9 \frac{0.4^{-6} \times 0.8 \times 10^{-6}}{d^2}$ $d^2 = 14.4 \times 10^{-3}$ $d = 0.12m$ b) The force on the second sphere due to the first is 0.2N Attractive force	1 1 1 1 1
46.	$n = 8.0 \times 10^{23}\, m^{-3}$ $v_d = \frac{I}{nAe}$ $A = 1.5 \times 10^{-6} m^2$ I = 2.0A $v_d = \frac{2.0}{8.0 \times 10^{23} \times 1.5 \times 10^{-6} \times 1.6 \times 10^{-19}}$ v_d = ? $= 1.042 \times 10^{-4}\ ms^{-1}$ J = ? $J = \frac{I}{A}$ $J = \frac{2.0}{1.5 \times 10^{-6}} = 1.33 \times 10^6\ Am^{-2}$	1 1 1 1 1

47.	V = 10V $X_L = \omega L = 2\pi\nu L$ ν = 50Hz $X_L = 2 \times 3.142 \times 50 \times 12.75 \times 10^{-3}$ R = 3Ω = 4Ω L = 12.75mH $Z = \sqrt{R^2 + X_L^2}$ Z = ? $= \sqrt{3^2 + 4^2} = 5\Omega$ I = ? $I = \frac{V}{Z} = \frac{10}{5} = 2A$ φ = ? $\tan\varphi = \frac{X_L - X_C}{R} = 4/3 = 1.333$ $\varphi = \tan^{-1} 1.333$ or φ can also find using $\varphi = \cos^{-1} R/Z = 3/5 = 0.6$	1 1 1 1 1
48.	$n_g = 1.52$ $\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$ $f = 25cm$ $\frac{1}{25} = (1.52-1)\left[\frac{1}{R} + \frac{1}{R}\right]$ $n_w = 1.33$ $\frac{1}{25} = 0.52 \times \frac{2}{R}$ R = 26cm $\frac{f_w}{f_a} = \frac{(n-1)}{(\frac{n_g}{n_w} - 1)}$ $\frac{f_w}{25} = \frac{(1.52-1)}{(\frac{1.52}{1.33} - 1)}$ $f_w = \frac{25 \times 0.52}{0.143} = 90.91\ cm$	1 1 1 1 1