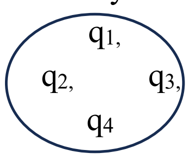
KARNATAKA SCHOOL EXAMINATION AND ASSESSMENT BOARD
II PUC EXAMINATION – 1 MARCH - 2024

Subject : **PHYSICS** Subject Code : **33**

MODEL ANSWERS

1.	(B) 60^0 or (C) 90^0 or (D) 180^0	1M
2.	(A) 0.12J	1M
3.	(C) Vector and its SI unit is A/m^2	1M
4.	GRACE MARK WILL BE AWARED IF STUDENT ATTENDED THE QUESTION	1M
5.	(A) diamagnetism	1M
6.	(B) no current will be induced in the coil	1M
7.	(C) 4H	1M
8.	(C) L and C	1M
9.	(A) $\mu_0 i_c + \mu_0 \varepsilon_0 \frac{d\varphi_E}{dt}$	1M
10.	(C) both I and II are true	1M
11.	(C) same as the wave	1M
12.	(D) their wavelength is negligibly small	1M
13.	(B) entire kinetic energy is converted into potential energy	1M
14.	(D) repulsive for distance $r < 0.8$fm	1M
15.	(C) neutral	1M
16.	Increasing	1M
17.	Decreasing	1M
18.	Diffraction	1M
19.	Helium	1M
20.	Greater	1M
	PART – B	
21.	Electric flux through a closed surface is $\frac{1}{\varepsilon_0}$ times total charge enclosed by the surface.	1M
	Let q_1, q_2, q_3, q_4 …….. be the charges enclosed by the surface. Or  The electric flux through closed surface is $\varphi_E = \frac{1}{\varepsilon_0}(q_1 + q_2 + q_3 + q_4 + \ldots\ldots)$	1M

22.	V = $\frac{1}{4\pi\varepsilon_0}\left[\frac{q_1}{x} + \frac{q_2}{d-x}\right]$ 0 = 9 x 10^9 $\left[\frac{5\ x\ 10^{-8}}{x} + \frac{-3\ x\ 10^{-8}}{d-x}\right]$ x= 6.25cm or x = 0.06m	1M 1M
23.	a) when charge is moving perpendicular to the magnetic field (i.e., θ= 90^0).	1M
	b) when charge is moving parallel or anti parallel to the magnetic field (i.e., θ= 0^0 or 180^0).	1M
	OR If a student answered in any one of the concept in terms of q or v or B or θ can be considered.	
24.	The ratio of magnetisation (M) of a sample and magnetic intensity (H) is called magnetic susceptibility.	1M
	The magnetic moment of a sample per unit volume is called magnetisation.	1M
25.	It works on the principle of ***electromagnetic induction***.	1M
	E = E_0sinωt or E = NABωsinωt	1M
26.	1. flux leakage loss 2. loss due to resistance of the windings 3. eddy current loss 4. hysteresis loss (Any two, each carry one mark)	1M + 1M
27.	1. LASIK (Laser-assisted in situ keratomileusis) eye surgery 2. UV lamps are used to kill germs in water purifiers **Marks will be awarded for other applications also, each carry one mark**	1M + 1M
28.	Ability of a lens to converge or diverge incident beam of light. Or It is a measure of the convergence or divergence of the light falling on it. Or It is defined as the tangent of the angle by which it converges or diverges a beam of light parallel to the principal axis falling at unit distance from the optical centre.	1M
	SI Unit : **dioptre**	1M

29.

S.No	Intrinsic semiconductors	Extrinsic semiconductors
1.	These are chemically pure semiconductors	These are chemically impure semiconductors
2.	These are undoped semiconductors	These are dopped semiconductors
3.	Number of holes are equal to number of free electrons ($n_h = n_e$)	Number of holes are not equal to number of free electrons ($n_h \neq n_e$)
4.	conductivity depends on the temperature	conductivity depends on the temperature and doping concentration.

- Any two differences, each carry one mark

1M + 1M

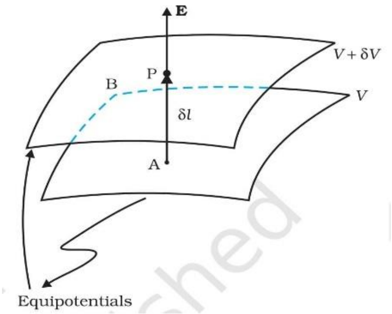
PART – C

30. **Properties of electric field lines**

1. They originate from positive charge and terminate at negative charge.
2. They do not form a closed loop.
3. They do not intersect each other.
4. They are crowded at strong electric field and are farther apart in weak electric field.
5. They are perpendicular to the charged surface.
6. They do not penetrate through conductors but can penetrate through insulators.
   - Any three properties, each carry one mark

1M + 1M + 1M

31.



1M

Consider two closely spaced equipotential surfaces A and B with potential values V and V+dV respectively.

Where, dV is the potential difference between two surfaces

E be the electric field. Imagine a unit positive charge q_0 is moved from surface B to surface A through distance 'dl' against electric field E. The workdone in this process is

W = q_0(dV)

F.dl cosθ = q_0(dV)

∴ $\theta = 180^0$ and F = q_0E

1M

- (q_0E).dl = q_0(dV)

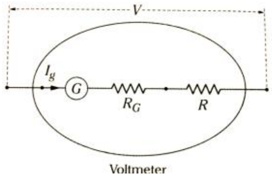
E = - $\frac{dV}{dl}$

1M

32. **Limitation of Ohm's law:**

1) It is applicable only for conductors not applicable for semiconductors.
2) It is applicable if temperature other physical conditions remains constant.
3) It is not applicable at very high and very low temperature.

1M + 1M + 1M

	4) It is not applicable for electrolytes. 5) It is not applicable for superconductors. • Any three each carry one mark	
33.	**<u>Conversion of Galvanometer into Voltmeter</u>.** Galvanometer can be converted into voltmeter by connecting a high resistance in series with the galvanometer.  Let R be the resistance connected in series with a galvanometer of resistance R_G to convert it into voltmeter of range (0 – V) volt. Let Ig be the current required for full-scale deflection. The value of R should be such that when I_g current flows, it measures the potential difference of (0 – V) volt $V = \begin{bmatrix} Potential\ difference\ across \\ galvanometer \end{bmatrix} + [Potential\ difference\ across\ resistor]$ $V = I_gR_G + I_gR$ $\therefore\ V = I_g\,(R_G + R)$ $R_G + R = \frac{V}{I_g}$ $R = \frac{V}{I_g} - R_G$	1M 1M 1M
34.	• Paramagnetic materials magnetise weakly in an external magnetic field in the direction of magnetising field. • Paramagnetic materials are weakly attracted by a powerful magnet. • When a bar of paramagnetic material is placed in an external magnetic field, the field lines tend to concentrate in the specimen and hence the field inside increases. • Relative permeability of paramagnetic magnetic materials is slightly greater than 1. ($\mu_r > 1$) • They have a low positive value of susceptibility. • Susceptibility of a paramagnetic substance varies inversely as its absolute temperature i.e., $\chi \propto \frac{1}{T}$. This is called Curie's law. **Any three properties, each carry one mark**	1M + 1M + 1M
35.	When north pole of a bar magnet is moved towards a coil, the direction of induced current in the coil is in such a way that near face of the coil acquires north pole. Therefore work has to be done against the force of repulsion to move the magnet towards the coil.	1M

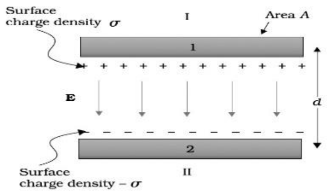
	Similarly, when north pole of the magnet is moved away from the coil, the direction of induced current in the coil is in such a way that, its near face acquires south polarity. Again work must be done against the force of attraction to move the magnet away from the coil. Thus work must be done to move the magnet. This work is stored as energy. Therefore energy is conserved.	1M 1M
36	• All the distances are measured from the pole of the spherical mirror along the principal axis. • The distances measured in the same direction as the incident light, are taken as positive. The distances measured opposite to the direction of incident light are taken as negative. • The height measured upwards and perpendicular to the principal axis of the mirror is taken as positive, the height measured downwards is taken as negative.	1M 1M 1M
37	**Bohr's first postulate :** An electron in an atom could revolve in certain stable orbits without the emission of radiant energy. **Bohr's second postulate :** The electron revolving around the nucleus only in those orbits for which the angular momentum is some integral multiple of $\frac{h}{2\pi}$. Where, h is the Planck's constant. $L = \frac{nh}{2\pi}$ **Bohr's third postulate :** An electron might make a transition from one of its specified non-radiating orbits to another of lower energy. When it does so, a photon is emitted having energy equal to the energy difference between the initial and final states. The frequency of the emitted photon is then given by, $h\upsilon = E_i - E_f$ where, E_i and E_f are the energies of the initial and final states.	1M 1M 1M
38	$E_b = \Delta m \times 931 MeV$ $= 0.11236 \times 931$ MeV $E_b = 104.60716$ MeV Binding energy per nucleon $(E_{bs}) = \frac{E_b}{A}$ $E_{bs} = \frac{104.60716}{14}$ $E_{bs} = 7.47194 MeV$	1M 1M 1M
	PART - D	
39.	**Polar molecules :** The molecules in which centre of positive and centre of negative charges are not coincided, are called polar molecules.	1M

Non – polar molecules :

The molecules in which centre of positive and centre of negative charges are coincided, are called non – polar molecules. 1M

Expression for capacitance of parallel capacitor:

Consider a parallel plate capacitor having two identical metallic plates 1 and 2 of area 'A' separated by small distance 'd'



Let + Q and –Q charges are given to the plate 1 and 2 respectively. A Uniform electric field 'E' is set up between the plate except at the edges.

The density (σ) of the charges on either plate is given by

$$\sigma = \frac{Q}{A} \ldots\ldots\ldots\ldots\ldots (1)$$

According to Gauss' theorem, intensity at a point between the two plates is

$$E = \frac{\sigma}{\epsilon_0}$$

$$\therefore E = \frac{Q}{A} x \frac{1}{\epsilon_0} \ldots\ldots (2)$$ 1M

If V be the potential difference between the two plates then

$$E = \frac{V}{d} \ldots\ldots (3)$$ 1M

From equation (2) and (3)

$$\frac{V}{d} = \frac{Q}{A} \frac{1}{\epsilon_0} \ldots\ldots (4)$$

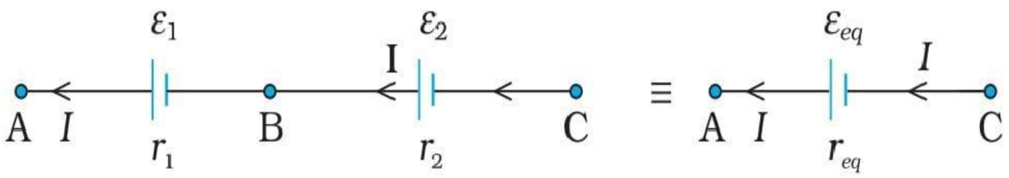
According to definition of capacitance of parallel plate capacitor.

$$C = \frac{Q}{V}$$

$$C = Qx \frac{A\epsilon_0}{Qd}$$

$$C = \frac{A\epsilon_0}{d}$$ 1M

40. **Expression for equivalent emf and equivalent internal resistance of two cells connected in series :**



1M

Consider two cells of emf E_1 and E_2 of internal resistance r_1 and r_2 respectively are connected in series as shown in figure.

Let V_1 and V_2 be the potential across cells of emf E_1 and E_2 respectively. I be the current flowing through the combination. 1M

From definition , $V = V_1 + V_2$

$V = (E_1 – Ir_1) + E_2 – Ir_2)$ 1M

$V = (E_1 + E_2) + I (r_1 + r_2)$----→ (1)

Suppose two cells are replaced by a single cell of emf E_{eq} and internal resistance r_{eq} such that it produces same effect as produced by two cells combinedly. 1M

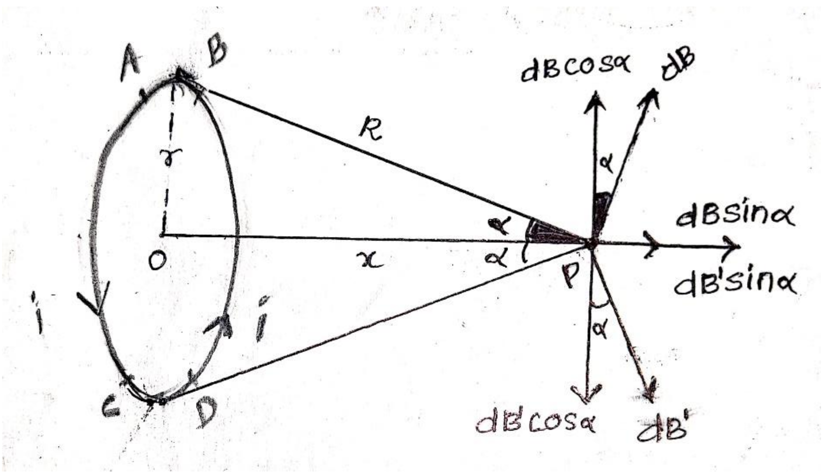
$V = E_{eq} – Ir_{eq}$ -----> (2)

From equation (1) and (2)

$E_{eq} = E_1 + E_2$ 1M

$r_{eq} = r_1 + r_2$

41.



1M

Consider a circular coil of 'n' turn and radius 'r' carrying a current I as shown in figure.

The plane of the coil is perpendicular to the plane of paper so that its axis lies on the plane of the paper. Let 'P' be a point on the axis of the coil at a distance 'x' from the centre 'O' of the coil.

Consider two diametrically opposite current element AB and CD of length 'dl'.

Let R be the distance between current element and the point 'P'.

From fig. $R^2 = r^2 + x^2$ ⟶ (1)

According to Biot- Savart's law, the magnetic field at point 'P' due to current element 'AB' is given by

$dB = \frac{\mu_0}{4\pi}\frac{Idl\sin\theta}{R^2}$ ⟶ (2) 1M

∵ $\theta = 90^o$, we have $\sin 90^o = 1$, and $R^2 = r^2 + x^2$

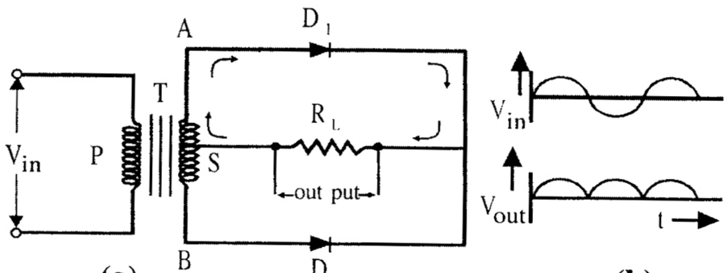
$\therefore\ dB = \frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)}$ ⟶ (3)

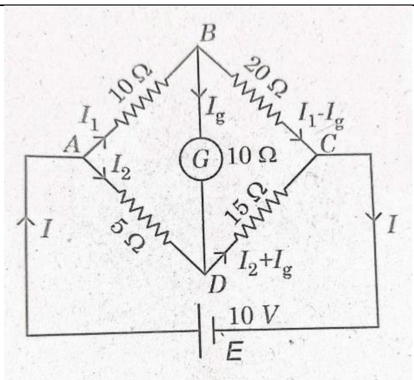
The field resolved into two rectangular components as horizontal component of dB. i.e. Along Px is dB sin α.

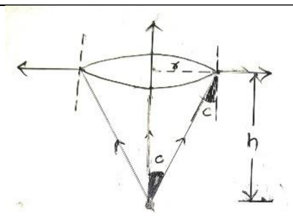
The vertical component of dB i.e., along PY is dB cos α.

The magnetic field at 'P' due current element CD is dB'.

	Let dB' is resolved into two rectangular components as horizontal and vertical. The horizontal component of dB i.e., along PX' = dB' sinα. The vertical component of dB' i.e. along PY' = dB' cos α. The vertical components of dB' to current element AB and CD are equal in magnitude but opposite in direction hence cancel each other. The horizontal components of dB due to current element AB and CD add up. ∴ The resultant field at P is B'=2 dBsinα for complete coil. B= ΣB' B = Σ2dB sinα $= \Sigma 2\left[\frac{\mu_0 Idl}{4\pi(r^2+x^2)} sin\,\alpha\right]$ From fig , $sin\,\alpha = \frac{r}{R} = \frac{r}{(r^2+x^2)^{1/2}}$ $B = \Sigma 2\left[\frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)}\frac{r}{(r^2+x^2)^{1/2}}\right]$ $= \left[\frac{\mu_0}{4\pi} I\Sigma 2dl \frac{r}{(r^2+x^2)^{1/2}}\right]$ Since, $\sum 2dl = 2\pi r$ B $=\frac{\mu_0}{4\pi} I.2\pi r \frac{r}{(r^2+x^2)^{3/2}}$ B $= \frac{\mu_0}{4\pi}\frac{2\pi I.r^2}{(r^2+x^2)^{3/2}}$	1M 1M 1M
42.	a) The modification in the distribution of light energy due to the superposition of two or more waves of light is called interference of light.	1M
	b) (i) For constructive interference, the path difference must be equal to the integral multiple of λ. where λ is the wave length of light. Or (i) $\Delta x = n\lambda$ = where $n = 0, 1, 2, 3$ (ii) For destructive interference, the path difference must be equal to the odd integral multiple of $\frac{\lambda}{2}$. Or (ii) $\Delta x = (2n+1)\frac{\lambda}{2}$ where $n = 0, 1, 2, 3$	1M 1M
	c) **Uses of polaroids** • Polaroids are used as sunglasses. • Automobile head lights are covered with polaroids to minimise glare. • Polaroids are used in cameras, microscope objectives to eliminate glare of reflected light. • Polaroids are used as sun films in window panes of aeroplanes. • Polaroids are used to view 3-D pictures and movies. • Polaroids are used to improve colour contrast in old oilpaintings. • Polaroids are used in laboratory to study plane polarized light.	1M + 1M

	Any two uses, each carry one mark	
43.	[Energy of incident photon] = [work function] + [KE of photoelectron] **or** KE = hυ – W **or** KE = hυ – hυ_0 or KE = h (υ – υ_0) where υ_0→threshold frequency	1M
	<u>Einstein's explanation for photo-emission :</u> **<u>Einstein's explanation for experimental observations of photo-emission:</u>** 1. It is a simple elastic collision between two micro particles which takes place in very short time. Hence the process is instantaneous. 2. According equation, KE of photo electron is KE= h[υ - υ_o] If $\nu < \nu_o$, KE is negative, that is if frequency of incident light is less than threshold frequency, KE of photoelectrons is negative. It is not possible. Hence photoemission is not possible. 3. When intensity of incident light increases, number of photons falling on photo emissive surface increases. As a result, number photo electron and hence photoelectric current increases. 4. From Einstein's equation, KE = hν - w In above equation, for a given metal surface work function 'w' remains constant hence as frequency ν increases KE of photoelectrons increases.	1M 1M 1M 1M
44.	It is a device which converts AC into DC.	1M
	<u>Circuit diagram</u> **<u>Wave Forms</u>**  **(a)** **(b)** Circuit diagram one mark Input and output waveform one mark	1M + 1M
	<u>Working</u> : • AC voltage which is to be rectified is applied to primary P of the transformer, it induces a voltage in the secandary S of the transformer. • During positive half cycles of the input, A is positive & B is negative, diode D_1, is forward biased and D_2 is reverse biased, hence current flows through load resistance R_L due to D_1 and gives output.	1M

	• During negative half cycles of the input, A is negative, B is positive, diode D_1 is reverse biased and diode D_2 is forward biased so current flows through load R_L due to D_2 and gives output. • Thus, in either case current flows through one or the other diode giving rise to current over the complete cycle.therefore this rectifier is called full wave rectifier.	1M
45.	$E = E_1 + E_2$ $E = \frac{1}{4\pi\varepsilon_0}\frac{q_1}{x^2} + \frac{1}{4\pi\varepsilon_0}\frac{q_2}{x^2}$ $E = 9 \times 10^9 \frac{15 x 10^{-6}}{(10 x 10^{-2})^2} + 9 \times 10^9 \frac{10 x 10^{-6}}{(10 x 10^{-2})^2}$ $E = 2.25 \times 10^7 NC^{-1}$ $F = q_0E$ $F = 20 \times 10^{-3} \times 2.25 \times 10^7$ $F = 45 \times 10^4 N$ $F = 4.5 \times 10^5 N$	1M 1M 1M 1M 1M
46.	 Apply KVL for loop ABDA $-10I_1 - 10I_g + 5I_2 = 0$ or $10I_1 + 10I_g - 5I_2 = 0$ --------→ (1) Apply KVL for loop BCDB $-20I_1 + 45I_g + 15I_2 = 0$ --------→ (2) Solve equation (1) and equation (2) $10I_1 + 10I_g - 5I_2 = 0$ x 3 $-20I_1 + 45I_g + 15I_2 = 0$ $10 I_1 + 75I_g = 0$ --------→(3) Apply KVL for loop ABCA $-30I_1 + 20I_g + 10 = 0$ $-30I + 20I_g = -10$ -----------→ (4) Solve equation (3) and equation (4) $10I_1 + 75Ig = 0$ x by 3 $-30I_1 + 20I_g = -10$ $245I_g = -10$	1M 1M 1M 1M

	$I_g = -\frac{10}{245}A = -\frac{2}{49}$ A **Steps can be reduced by any alternative method**	1M
47.	$X_L = 2\pi fL = 7.85\Omega$ $X_C = \frac{1}{2\pi fC} = 4\Omega$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$ Z = 7.13Ω Power factor = $\cos\varphi = \frac{R}{Z}$ = 0.8415	1M 1M 1M 1M 1M
48.	 $\sin C = \frac{1}{n}$ $C = 48.75^0$ from trigonometry, $\tan C = \frac{r}{h}$ r = h x tanC = 80 x 10^{-2} x tan(48.75^0) r = 0.91m	1M 1M 1M 1M 1M
PROBLEMS SOLVED BY USING ANY ALTERNATE METHOD, MARKS CAN BE AWARDED		