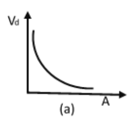
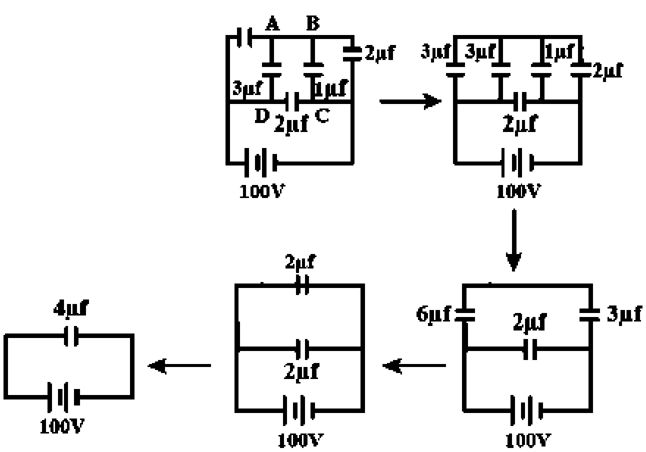
INDIAN SCHOOL AL WADI AL KABIR

Subject: Physics (042)

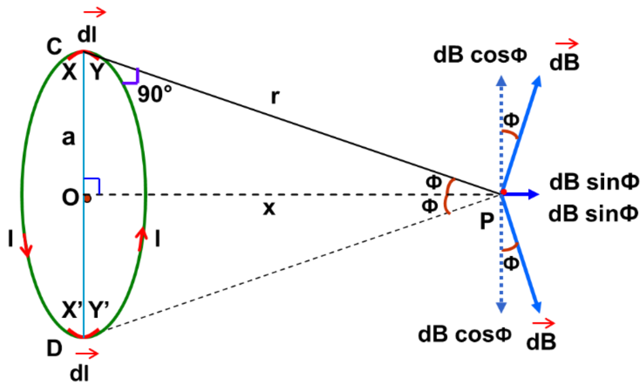
MARKING SCHEME ASSESSMENT 1

(24/09/2024)

SET I

1.	(b) +0.80 C	1
2.	(c) 3m	1
3.	(b) $\frac{Q}{\varepsilon_0}$	1
4.	(a) $\frac{1}{x^2}$	1
5	(c) Two in series and 1 in parallel	1
6	(b) Increase the area of the plate	1
7	(b) $m^2\ V^{-1}\ s^{-1}$	1
8	(c) decrease in relaxation time.	1
9	(c) $\frac{2}{3}$ E	1
10		1
11	(d) $9 \times 10^{-7}\ Nm^{-1}$, attractive	1
12	(a) small and negative	1
13	D	1
14	D	
15	B	
16	A	
17	 $E.\ \frac{1}{2}CV^2 = \frac{1}{2} \times (100)^2 \times 4 \times 10^{-6}$ $E = 0.5 \times 10^4 \times 4 \times 10^{-6}$ $E = 2 \times 10^{-2}$Joules	1 + 1
18	Drift velocity of the charge carrier per unit of an electric field. $\mu = e\tau/m$	1 + 1

19	MAGNETIC SUSCEPTIBILITY (χ_m) : It is defined as the ratio of intensity of magnetisation (I) induced in the material to the magnetising force (H) applied on it. MAGNETIC PERMEABILITY: - Defined as the ratio of flux density(B) in that material medium, to the flux density(B0) that would be present, if the medium were replaced by vacuum. $\mu_r = (\chi_m + 1)$.	1 + 1
20	(a) Along yzx (b) No induced current since field lines lie in the plane of the loop. Or here, $\frac{dI}{dt} = \frac{(I_2 - I_1)}{t}$ = - 50 A/s, e = 200 V, L =? $\lvert e \rvert = L \lvert \frac{dI}{dt} \rvert$ L = $\frac{e}{dI/dt}$ = 200/50 = 4H.	1 + 1
21	$\omega = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{30 \times 27 \times 10^{-6} \times 10^{-3}}} = \sqrt{\frac{1}{810 \times 10^{-9}}} = \sqrt{\frac{1}{81 \times 10^{-8}}}$ $= \frac{10^4}{9} = 1.1 \times 10^3$ *rad/s*	2
22	V = 12 x kq/R, E = 0 V = 12 x kq/R (scalar quantity, no change)	3
23	(i) def. of drift velocity. (ii) Vd = I/nAe, Vd is reciprocal to area of cross-section, vd decreases	3
24	Deflection per unit voltage. V = I(G + R) $3 = 4 \times 10^{-3} (16 + R)$ $R = ¾ \times 10^3 – 16 = 750 – 16 = 734$ ohm in series.	3
25	Definition + SI unit + dimension (2) Expression (1) Or **(a)** when velocity is normal to longer side, $l = 8$ cm $= 8 \times 10^{-2}$ m, $e = Blv = 0.3$ T x 8×10^{-2} m x 10^{-2} m/s $= 2.4 \times 10^{-4}$ V. **Time, t** = $\frac{\text{distance moved}}{\text{velocity}} = \frac{2 \times 10\text{-}2}{10^{-2}}$ = 2 sec. **(b)** when velocity is normal to shorter side, $l = 2$ cm $= 2 \times 10^{-2}$ m $e = Blv = 0.3$ T x 2×10^{-2} m x 10^{-2} m/s $= 0.6 \times 10^{-4}$ V. **Time, t** = $\frac{\text{distance moved}}{\text{velocity}} = \frac{8 \times 10\text{-}2}{10^{-2}}$ = 8 sec.	3

26	$B = \int dB\sin\phi = \int \frac{\mu_o}{4\pi}\frac{I\,dl}{r^2}\frac{a}{r} =$ $\int \frac{\mu_o}{4\pi}\frac{I\,dl\,a}{r^3}$ $B = \frac{\mu_o}{4\pi}\frac{Ia}{r^3}\int dl$ $B = \frac{\mu_o}{4\pi}\frac{Ia}{(x^2+a^2)^{3/2}}(2\pi a)$ $\boldsymbol{B = \frac{\mu_o I a^2}{2(x^2+a^2)^{3/2}}}$ At the center of the coil, x = 0. $B = \frac{\mu_o I}{2a} = \frac{\mu_o}{4\pi}\left(\frac{I}{r}\right)2\pi$  	3
27	(i) X : Resistor Y : real inductor (such that its reactance is equal to its resistance) / Inductor Z : real capacitor (such that its reactance is equal to its resistance)/ Capacitor Definition of wattless current.	2 + 1
28	To change Ac voltage, Causes of energy loss	1 + 2
29	(i)a, (ii)b, (iii)c, (iv)(a) c, Or (b) b	4
30	(i) (a) (ii) (c) (iii) (d) (iv)(a), (c) (iv)(b) (d)	4
31	(i)Diagram + derivation (2) (ii) The magnetic field is made radial in a galvanometer to concentrate the field in a circular region uniformly in all directions and hence, make it linear in angular direction. (1) (iii) (2) τ = NIABsinθ τ = 20 x 12 x 10^{-2} x 0.80 x sin 30° τ = 20 x 12 x 10^{-2} x 0.80 x 1/2 τ = 10 x 12 x 10^{-2} x 0.80 τ = 9.6 x 10^{-1} τ = 0.96 Nm Or (i) diagram + derivation + definition of 1A (2 + 1) (ii) Force on AB = $F^{ab} = (\mu_0 I_1 I_2/2\pi r)\, L$ $= (2 \times 10^{-7} \times 1 \times 0.2 \times 5 \times 10^{-2}) \times 10 \times 10^{-2}$ $= 2 \times 10^{-8}$N (Attractive). Force acting on CD = $F^{cd} = (2 \times 10^{-7} \times 1 \times 0.2 \times 5 \times 10^{-2})/15 \times 10^{-2} = 1.3 \times 10^{-8}$ N (Repulsive.) $F^{net} = F^{ab} - F^{cd} = 7 \times 10^{-9}$ N (ii) Since, Both the forces are collinear, do not produce any torque.	2 + 2 + 1

	Therefore, Torque = 0 (2)	
32	(i) Definition of mutual induction and SI unit, (1) (ii) diagram + derivation of mutual induction (2) (iii) ϕ = LI, L = ϕ/I = slope, $L_Q > L_P$ Or (i) definition of impedance (1) (ii) (2) (a) $I_0 = E_0/Z$, $Z = \sqrt{R^2 + (X_c - X_L)^2} = \sqrt{(300)^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2}$ $= \sqrt{(300)^2 + \left(\frac{1}{2\pi \times \frac{50}{\pi} \times 20 \times 10^{-6}} - 2\pi \times \frac{50}{\pi} \times 1\right)^2}$ $= \sqrt{(300)^2 + \left(\frac{10^4}{20} - 100\right)^2} = 500$ (iii) At $I_0 = \frac{E_0}{Z} = \frac{50}{500} = 0.1$ A resonance, $X_L = X_C$, $\omega L = \frac{1}{\omega C}$, $\omega^2 = \frac{1}{LC}$, $\omega = \sqrt{\frac{1}{LC}}$, $2\pi\nu = \sqrt{\frac{1}{LC}}$, $\nu = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$ (2)	5
33.	(i) laws of EMI (1 + 1) (ii) conversion of mechanical work as electric energy,(1) (iii) $e_0 = NAB\omega = N(\pi r^2) B\omega$ = 20 x 3.14 x (8 x 10^{-2})2 x 3.0 x 10^{-2} x 50 = 0.603 V. Average emf in one cycle = zero. Maximum current, $I_0 = E_0/R$ = 0.603 /10 = 0.0603A. $P = E_0 I_0 / 2$ = 0.018 W. (2) Or (i) Ac generator diagram, elements, principle (3)	

(ii) Area of the circular loop = πr^2 (2)

$= 3.14 \times (0.12)^2\ m^2 = 4.5 \times 10^{-2}\ m^2$

$E = -\frac{d\varphi}{dt} = -\frac{d}{dt}(BA) = -A\frac{dB}{dt} = -A \cdot \frac{B_2 - B_1}{t_2 - t_1}$

For $0 < t < 2s$

$E_1 = -4.5 \times 10^{-2} \times \left\{\frac{1-0}{2-0}\right\} = -2.25 \times 10^{-2}\ V$

$\therefore I_1 = \frac{E_1}{R} = \frac{-2.25 \times 10^{-2}}{8.5}\ A = -2.6 \times 10^{-3}\ A = -2.6\ mA$

For $2s < t < 4s$,

$E_2 = -4.5 \times 10^{-2} \times \left\{\frac{1-1}{4-2}\right\} = 0$

$\therefore I_2 = \frac{E_2}{R} = 0$

For $4s < t < 6s$,

$I_3 = -\frac{4.5 \times 10^{-2}}{8.5} \times \left\{\frac{0-1}{6-4}\right\} A = 2.6\ mA$