DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI – 6
HIGHER SECONDRAY SECOND YEAR EXAMINATION- MARCH -2020
PHYSICS KEY ANSWER (NEW SYLLABUS)

NOTE:

1. Answers written with Blue or Black ink only to be evaluated.
2. Choose the most suitable answer in Part A from the given alternatives and write the option code and the corresponding answer.
3. For answers in Part-II, Part-III and Part IV like reasoning, explanation, narration, description and listing of points, students may write in their own words but without changing the concepts and without skipping any point
4. In numerical problems, if formula is not written, marks should be given for the remaining correct steps.
5. In graphical representation, physical variables for X-axis and Y-axis should be marked.

TOTAL MARKS - 70

PART – I

Answer all the questions. **15×1=15**

A TYPE			B TYPE		
1	b)	$A^{2/3}$	1	c)	Space wave propagation
2	c)	10 cm	2	d)	$\frac{Q}{\sqrt{2}}$
3	c)	Decreases	3	a)	GaInN
4	b)	0.2 A	4	d)	$\sqrt{\frac{2q^3B^2V}{m}}$
5	d)	1.24 eV	5	b)	0.2 A
6	d)	$\frac{1}{R}$	6	c)	Decreases
7	a)	GaInN	7	b)	zero
8	c)	Space wave propagation	8	b)	$A^{2/3}$
9	b)	OR gate	9	d)	2:1
10	b)	zero	10	c)	10 cm
11	d)	$\frac{Q}{\sqrt{2}}$	11	b)	OR gate
12	d)	3 A	12	d)	$\frac{1}{R}$
13	d)	2:1	13	d)	C remains the same, Q is doubled
14	d)	$\sqrt{\frac{2q^3B^2V}{m}}$	14	d)	1.24 eV
15	d)	C remains the same, Q is doubled	15	d)	3 A

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PART II

Answer any Six questions. **6×2=12**

Q.No 24 is compulsory

16	The process of adding impurities to the intrinsic semiconductor.	2
17	**(Any 2 Points)** **Application of X-rays** 1. to detect fractures, diseased organs 2. to cure skin disease, malignant tumors 3. to detect faults / cracks / flaws / holes in welded joints / motor tyres / tennis balls / wood / finished metal products. 4. to study the structure of crystals (or) the structure of inner atomic shells.	2
18	$\frac{N_S}{N_P} = \frac{V_S}{V_P}$ (or) $V_S = \frac{N_S V_P}{N_P}$ (Any relevant formula)	1
	$V_S = \frac{230 \times 40000}{460} = 20000$ V $\frac{\text{Voltage}}{\text{turn}} = \frac{V_S}{N_S} = \frac{20000}{40000} = 0.5$ V	1
	(OR) **Alternative Method**	
	$\frac{V_S}{N_S} = \frac{V_P}{N_P}$	1
	$\frac{\text{Voltage}}{\text{turn}} = \frac{V_S}{N_S} = \frac{230}{460} = 0.5$ V	1
19	**Any 2 differences**	2

Fresnel diffraction	**Fraunhofer diffraction**
1) Spherical (or) cylindrical Wave front	1) Plane wave front
2) Source is at finite distance	2) Source is at infinity
3) difficult to observe	3) easy to observe
4) convex lens need not be used	4) convex lens is used.

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20	**Corona discharge** : The total charge of the conductor reduces near the sharp edge. **(or)** Leakage of charges from sharp points of charged conductor	2
21	**Skip area** The zone where there is no reception of electromagnetic waves neither ground nor sky.	2
22	**Any 2 properties** **Properties of neutrino** : i) Zero charge ii) has an antiparticle (called anti neutrino) iii) tiny mass iv) weak interaction with matter (or) difficult to detect.	2
23	The susceptibility of material X is $\chi_{m,X} = \frac{\lvert\vec{M}\rvert}{\lvert\vec{H}\rvert} = \frac{500}{1000} = 0.5$ The susceptibility of material Y is $\chi_{m,Y} = \frac{\lvert\vec{M}\rvert}{\lvert\vec{H}\rvert} = \frac{2000}{1000} = 2$	1 ½
	The ratio between two materials = $\frac{0.5}{2}$ = 0.25 (or) 1 : 4	½
24	X-rays cannot be deflected by electric and magnetic field and cannot be focused by electrostatic and magnetic lenses. **(or)** Electron beam can be deflected by electric and magnetic field and can be focused by electrostatic and magnetic lenses.	2

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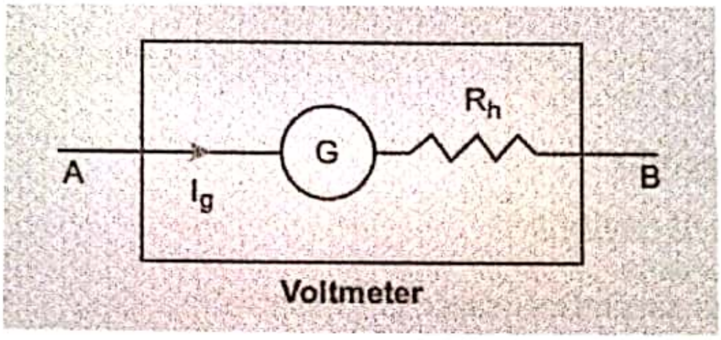
PART - III

Answer any Six questions: **6×3=18**

Q.No 33 is compulsory

<table>
<tr><td>25</td><td><u>Conversion of galvanometer into Voltmeter</u>
i) A galvanometer is converted into voltmeter by connecting high resistance in series.


ii) Explanation and steps
iii) $R_h = \frac{V}{I_g} - R_g$</td><td>1
½
1
½</td></tr>
<tr><td>26</td><td>$R_t = R_0(1+\alpha\Delta T)$ (or) $R_t=R_0(1+\alpha(T-T_0))$
R_{100}= 10x(1+0.004x100) (or) R_{100}=10x(1+0.004(100-0))
R_{100}=14 Ω
temperature increase resistance also increases</td><td>1
1
½
½</td></tr>
<tr><td>27</td><td>Any Three Points
Important inferences from average binding energy curve
i) Mass number increases $\overline{BE}$ increases upto 8.8Mev and slowly decreases.
ii) Average binding energy per nucleon is 8.5 Mev elements are more stable and non-radioactive
iii) For Higher mass number the curve reduces slowly they are unstable and radioactive.
iv) Two light nucleus combine to produce a nucleus of medium value. (Nuclear fusion)
v) Nucleus of heavy element is split into two or more nuclei of medium value.(Nuclear fission)</td><td>3</td></tr>
</table>

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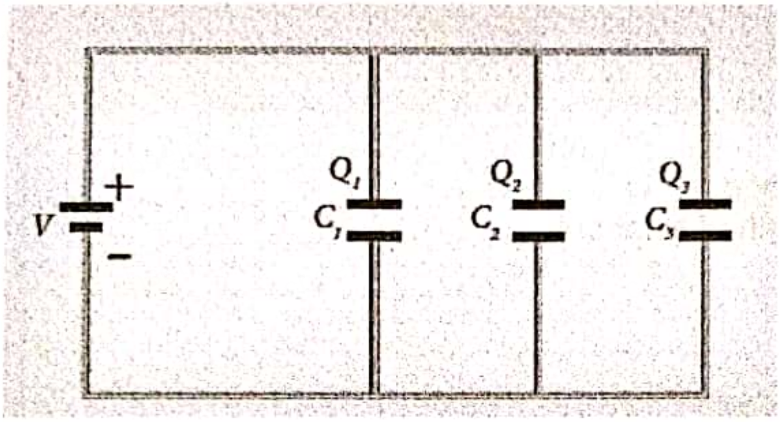
28	$I_B = V_i / R_B = 20v / 500\ k\Omega = 40\ \mu A$ $I_C = Vcc / R_c = 20v / 4\ k\Omega = 5\ mA$ $\beta = I_C/I_B = 5\ mA/40\ \mu A = 125$ **If formula only is written each formula can be given ½ mark**	1 1 1
29	Capacitors in parallel: i) Circuit diagram & explanation  $Q = Q_1 + Q_2 + Q_3$ $C_pV = C_1V + C_2V + C_3V$ $C_p = C_1 + C_2 + C_3$	1 ½ ½ 1
30	**Advantages of AC over DC (Any Two Points)** i) Generation of AC is cheaper than DC ii) AC supplied at higher Voltage, The transmission losses are small compared to D.C iii) AC can be easily converted into D.C with the help of rectifiers. **Disadvantages of AC over DC (Any one point)** i) Ac cannot be used in certain applications (Ex : charging of batteries, electroplating) ii) It is more dangerous to work with high AC Voltage than D.C	2 1

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31	The intensity is, $I \propto 4a^2\cos^2(\phi/2)$ or $I = 4I_0\cos^2(\phi/2)$ Resultant intensity is maximum when, $\phi = 0, \cos 0 = 1, I_{max} \propto 4a^2$ Resultant amplitude is minimum when, $\phi = \pi, \cos(\pi/2) = 0, I_{min} = 0$ $I_{max} : I_{min} = 4a^2 : 0$ (or) Any alternative method.	1 ½ ½ 1
32	DeBroglie wavelength of electron: $\frac{1}{2}mv^2 = eV$ $v = \sqrt{\frac{2eV}{m}}$ $\lambda = \frac{h}{mv} = \frac{h}{\sqrt{2emV}}$ (or) $\lambda = \frac{12.27}{\sqrt{V}} A^\circ$ (or) $\lambda = \frac{h}{\sqrt{2mK}}$	1 1 1
33	i) Antenna is used in transmitter and receiver end – important parameter - the height of the antenna h= $\lambda/4$, ii) For baseband signal Eg : $\nu = 10KHz$, h=$\lambda/4$=c/4ν=7.5Km For modulated signal Eg : ν=1MHz, h=$\lambda/4$=c/4 ν=75m iii) Antenna of height 75m is feasible to construct and 7.5km is not possible. (or) Modulated signals of high frequency reduce the antenna height	1 1 1

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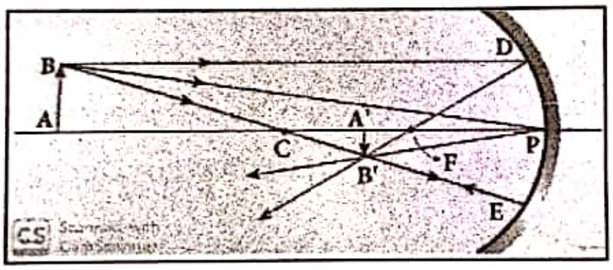
PART- IV

Answer all the questions : 5×5=25

34 (a)	i) Explanation	1
	ii) flux linked in the deflected position $N\varphi_B = N\varphi_M \cos\omega t$	1
	iii) induced emf $\varepsilon = -\frac{d(N\varphi_B)}{dt}$ (or) $= -\frac{d(N\varphi_m \cos\omega t)}{dt}$ $= N\varphi_M \omega (\sin\omega t)$	1
	iv) maximum value of induced emf $\varepsilon_m = N\varphi_M \omega$ (or) $\varepsilon_m = NAB\omega$	1
	$\varepsilon = \varepsilon_m \sin\omega t$	1
34 (b)		1
	Δ BPA, Δ B'PA' Similar triangles A'B'/AB=PA'/PA ΔDPF, Δ B'A'F Similar triangles A'B'/AB=A'F'/PF PA'/PA=PA'-PF/PF to -v/-u=-v-(-f)/-f	2
	1/v+1/u=1/f	1
	$m = \frac{\text{height of image}}{\text{height of the object}}$ (or) $m = \frac{h^1}{h} = \frac{-V}{u}$ (or) $m = \frac{f-V}{f}$ (or) $m = \frac{f}{f-u}$	1

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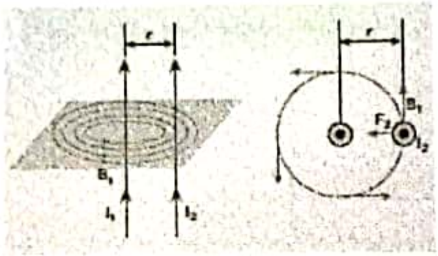
Q. No.	Answer	Marks
35 (a)	Force between two long parallel current carrying conductors	
	 Anyone diagram	1
	$\vec{B}_1 = \frac{\mu_o I_1}{2\pi r}(-\hat{i}) = -\frac{\mu_o I_1}{2\pi r}\hat{i}$	½
	$d\vec{F} = (I_2 d\vec{l} \times \vec{B}_1) = -I_2 dl \frac{\mu_o I_1}{2\pi r}(\hat{k} \times \hat{i}) = -\frac{\mu_o I_1 I_2 dl}{2\pi r}\hat{j}$	½
	$\frac{\vec{F}}{l} = -\frac{\mu_o I_1 I_2}{2\pi r}\hat{j}$	½
	$\vec{B}_2 = \frac{\mu_o I_2}{2\pi r}\hat{i}$	½
	$\vec{F} = (I_1 d\vec{l} \times \vec{B}_2) = I_1 dl \frac{\mu_o I_2}{2\pi r}(\hat{k} \times \hat{i}) = \frac{\mu_o I_1 I_2 dl}{2\pi r}\hat{j}$	½
	$\frac{\vec{F}}{l} = -\frac{\mu_o I_1 I_2}{2\pi r}\hat{j}$	½
	current in the conductors same direction – attractive force. current in the conductors opposite direction--repulsive force	1
35 (b)	Maxwell's equations in integral form	
	i) $\oint \bar{E}.\, d\bar{A} = \frac{\varphi_{enclosed}}{\epsilon_0}$	1
	ii) $\oint \bar{B}.\, d\bar{A} = 0$	1
	iii) $\oint \bar{E}.\, d\bar{l} = -\frac{d(\varphi_B)}{dt}$	1
	iv) $\oint \bar{B}.\, d\bar{l} = \mu_o I_{enclosed} + \mu_o \epsilon_0 \frac{d}{dt} \int_S \bar{E}.\, d\bar{A}$	1
	Explanation	1

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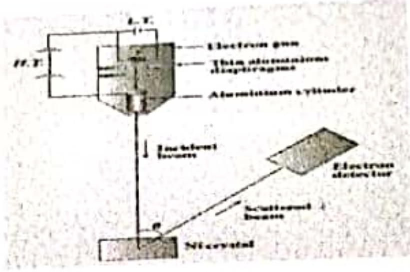
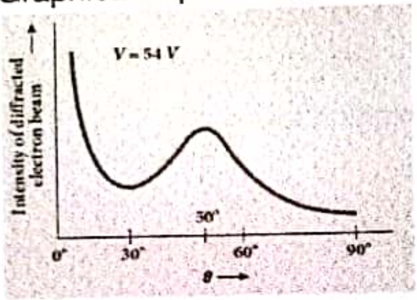
36 (a)	Davisson –Germer Experiment Diagram  	1
	Explanation	2
	Graphical explanation  	1
	$\lambda = 12.27/\sqrt{V}$ A°=1.67 A°	½
	Value agrees with experimentally observed wavelength 1.65A°	½
36 (b)	i) Energy of electron in hydrogen atom	1
	potential energy $U_n = \frac{-1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n} = -\frac{Z^2me^4}{4\varepsilon_0^2h^2n^2}$	1
	kinetic energy $KE_n = \frac{1}{2mv_n^2} = \frac{Z^2me^4}{8\varepsilon_0^2h^2n^2}$	1
	Total energy $E_n = KE_n + U_n = -\frac{Z^2me^4}{8\varepsilon_0^2h^2n^2}$	½
	For hydrogen z=1 $E_n = -\frac{me^4}{8\varepsilon_0^2h^2n^2} = -13.6/\mathrm{n}^2\mathrm{eV}$	½
	ii) total energy E_n=-13.6/-3.4=4 $n^2 = 4$ (or) $n = 2$ angular momentum $L = \frac{nh}{2\pi} = \frac{h}{\pi}$	1

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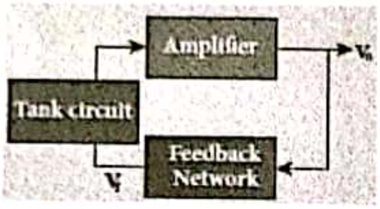
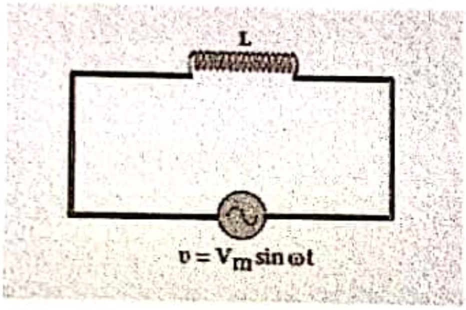
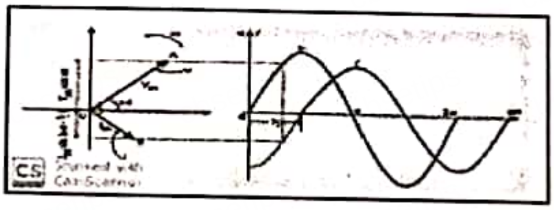
37 (a)	Explanation of oscillator : Block diagram of an oscillator	1
		1
	Explanation of feedback circuit and tank circuit	2×1=2
	Equation for frequency $f = \frac{1}{2\pi\sqrt{LC}}$	1
37 (b)	Ac circuit with inductor with explanation	
		1
	V= V_m sinωt ϵ= -L di/dt	1
	upto $i = \frac{V_m}{L\omega}(-cos\omega t) + constant$	1
	$i = \frac{V_m}{L\omega}\sin(\omega t - \frac{\pi}{2})$ (or)	1
	$i = I_m \sin(\omega t - \frac{\pi}{2})$ Current lags behind the applied Voltage by $\pi/2$ Phasor diagram (any one)	½
		½

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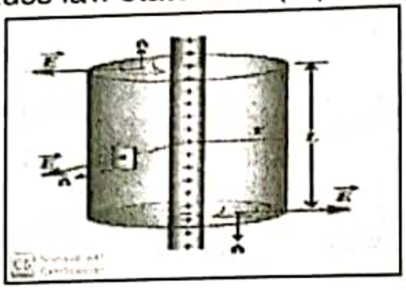
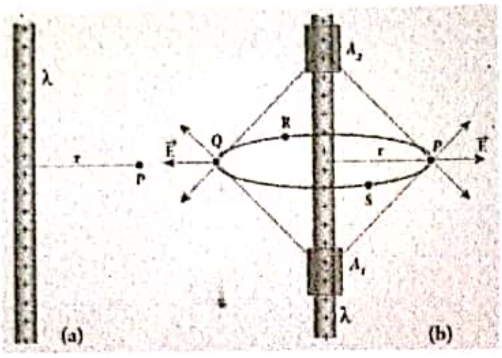
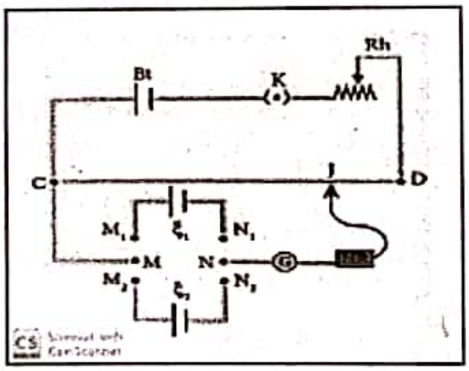
38 (a)	i) Gauss law statement (or) $\emptyset_E = \oint E dA = \emptyset_{closed}/\varepsilon_0$	1
	 **Any One of the diagram**	
		1
	Explanation	1
	$\emptyset_E = E \oint dA = \frac{\lambda L}{\varepsilon_0}$	1
	$E.2\pi r L = \frac{\lambda L}{\varepsilon_0}$ (or) $E = \frac{1}{2\pi\varepsilon_0}\frac{\lambda}{r}$	1
38 (b)		1
	Explanation	1
	$\xi_1 = irl_1$	1
	$\xi_2 = irl_2$	1
	$\xi_1 / \xi_2 = l_1/l_2$	1

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