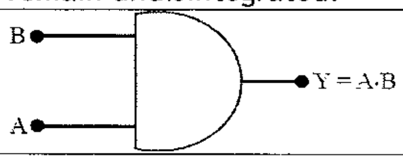
GOVERNMENT OF KARNATAKA
DEPARTMENT OF PRE UNIVERSITY EDUCATION BOARD
II PUC SUPPLIMENTARY EXAMINATION JUNE-2017
SCHEME OF VALUATION
PHYSICS(33) (NEW SYLLABUS)

I		PART - A	
	1	Force decreases OR Force varies inversely with dielectric constant	1
	2	The algebraic sum of current at a node in an electrical network is zero OR The sum of the currents entering the junction is equal to sum of currents leaving the junction	1
	3	Force experienced by a moving charged particle in a region containing both electric and magnetic field is called lorentz force.	1
	4	$I_{rms} = \frac{I_0}{\sqrt{2}} = 0.707\, I_0$	1
	5	It is the emf induced in a conductor moving in a plane perpendicular to a magnetic field.	1
	6	For pure capacitor, power factor=0 or cos Φ = 0	1
	7	Half life of a radioactive sample is the time taken for half of the number of atoms to disintegrate. OR It is the time during which half of the atoms of radioactive atoms remain undisintegrated.	1
	8		1
	9	Advantages of LED are i) They are compact i) Low operational voltage and less power, ii) Nearly monochromatic, iii) Fast action and no warm up time required, iv) Long life v) Fast on – off switching capability (any one correct answer)	1
	10	The loss of strength of a signal while propagating through a channel is known as attenuation.	1
II		PART - B	
	11	The total electric flux through a closed surface in free space is equal to $\frac{1}{\varepsilon_0}$ times the net charges enclosed by the surface. Total electric flux = $\Phi = \frac{1}{\varepsilon_0} \sum q$ Where ε_0 is permittivity of free space . $\sum q$ is the net charge enclosed by the surface	1 1

<table>
<tr><td></td><td>12</td><td>Mobility of free electron in a conductor is the magnitude of the drift velocity per unit electric field.
OR
Mathematical form for mobility $\mu = \frac{V_d}{E}$
V_d is drift velocity of electron, E is electric field
SI unit is $m^2V^{-1}S^{-1}$ or $mCN^{-1}S^{-1}$</td><td>1

1</td></tr>
<tr><td></td><td>13</td><td>The devices which obey ohm's law are called ohmic device.
OR
The device in which variation in current versus voltage is linear.

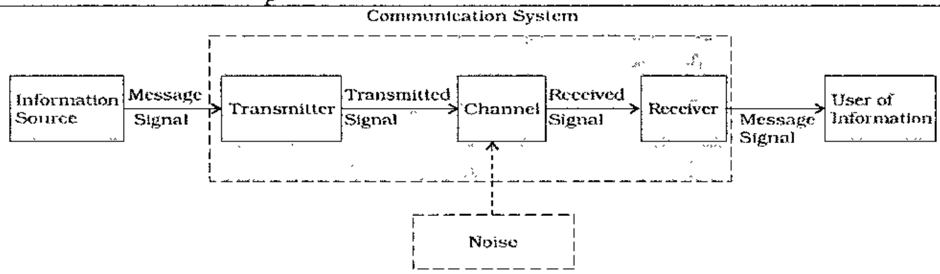
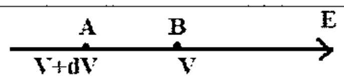
Ex: Voltmeter, Ammeter (any one correct ex)</td><td>1

1</td></tr>
<tr><td></td><td>14</td><td><table>
<tr><th>Diamagnetic</th><th>Paramagnetic</th></tr>
<tr><td>1. weakly repelled by magnets</td><td>Weakly attracted by the magnet</td></tr>
<tr><td>2. do not obey curie law</td><td>Obey curie law</td></tr>
<tr><td>3.magnetisation is low and -ve</td><td>Magnetization is low and +ve</td></tr>
<tr><td>4. relative permeability $\mu < 1$</td><td>$\mu > 1$</td></tr>
<tr><td>5. susceptibility is low and negative</td><td>Susceptibility is low and positive</td></tr>
</table>
Any two correct differences</td><td>1 + 1</td></tr>
<tr><td></td><td>15</td><td>Magnetic flux $\varphi = 3t^2 + 4t + 9$
EMF induced = e = $\frac{d\varphi}{dt} = \frac{d}{dt}(3t^2 + 4t + 9)$

e = 6 t + 4
at t = 2 S
e = 6 x 2 + 4 = 16 V</td><td>1

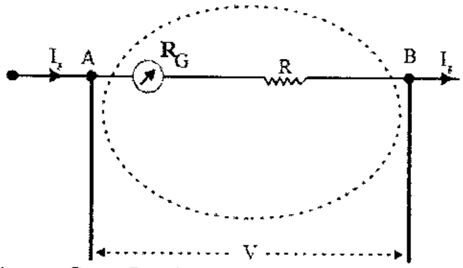
1</td></tr>
<tr><td></td><td>16.</td><td>The speed of electromagnetic waves in free space is
$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$
μ_0 is permeability of free space, ε_0 is permittivity of free space
OR
The speed of electromagnetic waves in medium is
$$c = \frac{1}{\sqrt{\mu \varepsilon}}$$
$\mu = \mu_0\mu_r$ = permeability of medium,
$\varepsilon = \varepsilon_0\varepsilon_r$ = permittivity of medium</td><td>1
1

1
1</td></tr>
<tr><td></td><td>17</td><td>Wave associated with the moving material particles is called De-Broglie wave.</td><td>1</td></tr>
</table>

		De-Broglie wave length varies inversely with momentum of particle, $\lambda = \frac{h}{p}$ or $\lambda \propto {}^{1}/_{p}$	1
	18	 	2
III		PART- C	
	19	 If A and B are two points on the two equipotential surfaces at a distance 'dx' , then $V_A - V_B = dV$ = work done in bringing q0 charge from B to A $dV = \frac{W_{AB}}{q_0}$ $dV = \frac{F \cdot dx}{q_0}$ $dV = \frac{-q_0 \; E \; dx}{q_0}$ Hence $E = -\frac{dV}{dx}$ **OR** Work done to move a unit positive charge from one point to other point against the field $\vec{E}$ through a displacement $\overrightarrow{dx}$ is $dW = \vec{E} . \overrightarrow{dx} = -E\, dx$ This is equal to potential difference dV . $dV = dW$ $dV = -E\, dx$ $E = -\frac{d\,V}{d\,x}$	1 1 1 1 1 1
	20	From Ohm's law $I = \frac{V}{R}$ but $R = \frac{\rho\, l}{A}$ Hence $I = \frac{V A}{\rho\, l}$ $\frac{I}{A} = \frac{V}{\rho\, l} = \frac{1}{\rho}\frac{V}{l}$	1 1

	Q. No.	Answer	Marks
		$\vec{J} = \sigma \vec{E}$	1

21 A galvanometer can be converted in to a voltmeter by connecting a large resistance in series with that galvanometer. — 1



— 1

Let, R_G - Resistance of the galvanometer,
R - series resistance,
Ig - Current flow through the galvanometer and resistance.
Then, potential drop across galvanometer and resistance is

$$V = I_g R + I_g R_G$$
$$R = \frac{V}{I_g} - R_G$$

— 1

22

1. Magnetic Brakes — 1
2. Induction heating — +1
3. electromagnetic damping — +1
4. electric power meter
5. Speedometer

(Any three correct answers)

23 Critical angle is the angle of incidence in the denser medium for which the angle of refraction in is 90 degree. — 1

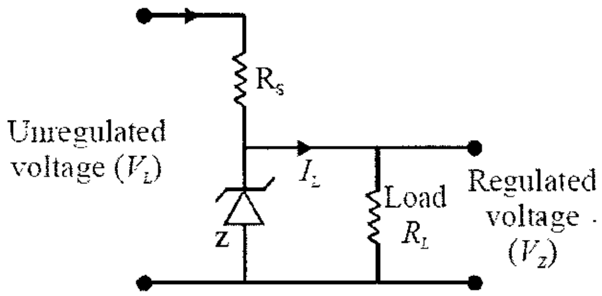
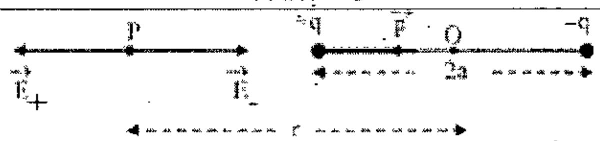
The conditions for total internal reflection are

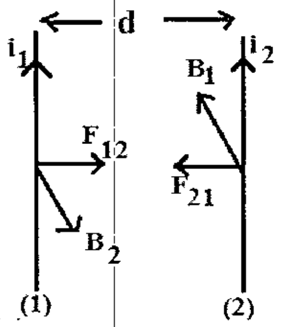
1. The ray of light must travels from denser medium to rarer medium. — 1
2. The angle of incidence in denser medium is greater than the critical angle — 1

24

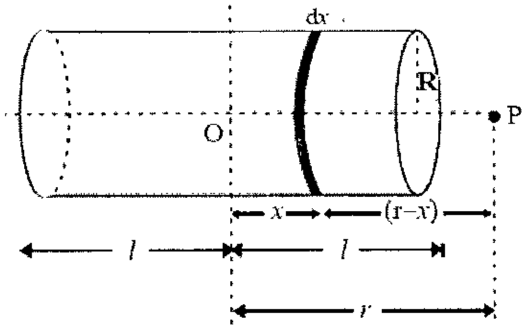
Interference	Diffraction
i) It is due to superposition of waves emerging from independent coherent sources	i) It is due to the superposition of secondary waves emerging from a single wave front.
ii) Interference fringes are of equal width.	ii)Diffraction bands are of unequal width.
iii) Intensity of all the bright fringes remains constant.	iii) Intensity of bright bands decreases with the increase in order.
iv)Condition for maxima	iv)Condition for maxima

1 + 1 + 1

		<table><tr><td>Path difference = $n\lambda$</td><td>Path difference= $(2n+1)\lambda/2$</td></tr><tr><td>v) condition for minima path difference = $(2n+1)\lambda/2$</td><td>v) condition for minima Path difference = $n\lambda$</td></tr></table>(Any three correct answers)	
	25	Threshold frequency : It is the minimum frequency of the incident radiation below which there is no photo emission. Work function: Work function of a metal is the minimum energy required to just liberate an electron from the metal surface. Stopping potential(Vs): It is the minimum negative potential applied to the anode to just stop the photo electrons reaching the anode.	1 1 1
	26	 Any increase in the input voltage results in increase of voltage drop across Rs without any change in voltage across the Zener diode. Any decrease in the input voltage results in decrease of voltage drop across Rs without any change in voltage across the Zener diode.	1 1 1
IV		PART - D	
	27	 The electric field at point 'P' due to $+q$ is $\overrightarrow{E_+} = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2}$ along OP The electric field at point 'P' due to $-q$ is $\overrightarrow{E_-} = -\frac{1}{4\pi\varepsilon_0}\frac{q}{(r+a)^2}$ along PO The resultant electric field at point 'P' is $\lvert\overrightarrow{E_a}\rvert = \lvert\overrightarrow{E_+}\rvert - \lvert\overrightarrow{E_-}\rvert$ $E_a = \frac{1}{4\pi\varepsilon_0}\frac{q}{(r-a)^2} - \frac{1}{4\pi\varepsilon_0}\frac{q}{(r+a)^2}$ $E_a = \frac{q}{4\pi\varepsilon_0}\left[\frac{4ra}{(r-a)^2(r+a)^2}\right]$	1 1 1 1

		$$E_a = \frac{1}{4\,\pi\,\varepsilon_0}\,\frac{P\,X\,2\,r}{(r^2-a^2)^2}$$ $$E_a = \frac{1}{4\,\pi\,\varepsilon_0}\,\frac{2\,P\,r}{(r^2-a^2)^2}$$ Where $P = q\,X\,2a$	1
	28	 The conductor 1 produces a magnetic field $\overrightarrow{B_1}$ at all the points along the conductor 2 and it is given by, $$B_1 = \frac{\mu_0 I_1}{2\pi d}$$ The force on the conductor 2 is given by, $$F_{21} = I_2 L B_1 = \frac{\mu_0 I_1 I_2}{2\pi d} L$$ $$\frac{F_{21}}{L} = I_2 B_1 = \frac{\mu_0 I_1 I_2}{2\pi d}$$ Similarly the force on conductor 1 due to current in conductor 2 is $$\frac{F_{12}}{L} = I_1 B_2 = \frac{\mu_0 I_1 I_2}{2\pi d}$$ Hence the force per unit length between two conductors is $$F = \frac{\mu_0}{4\,\pi}\,\frac{2\,I_1 I_2}{d}$$ If $I_1 = I_2 = 1$ A , d= 1m then $F = 2 \times 10^{-7}$ N/m One ampere current is that current which when flows in each of the two long parallel conductors separated by a distance of one meter kept in free space will attract or repel with a force of 2×10^{-7} N/m	1 1 1 1 1

29



1

To calculate magnetic field at a point on axis of solenoid, consider a small element of thickness 'dx' of solenoid at a distance 'x' from 'O'.

Number of turns in this element = n.dx

If current 'i' flows through element 'ndx' the magnitude of magnetic field at P due to this element is

$$dB = \frac{\mu_0}{4\pi}\frac{2\pi\,(n\,dx) i\, R^2}{[(r-x)^2 + a^2]^{3/2}}$$ 1

If point 'P' is at large distance from 'O'

i.e. r >> l and r>> a then $[(r-x)^2 + a^2] = r^2$

$$dB = \frac{\mu_0}{4\pi}\frac{2\pi\,(n\,dx) i\, R^2}{[\ r^2]^{3/2}} = dB = \frac{\mu_0}{4\pi}\frac{2\pi\,(n\,dx) i\, R^2}{[r]^3}$$ 1

The total magnetic field at 'p' due to the current 'i' in solenoid is

$$B = \int_{-l}^{l} dB = \int_{-l}^{l}\frac{\mu_0}{4\pi}\frac{2\pi\, ni\, R^2 dx}{[r]^3} = \frac{\mu_0}{4\pi}\frac{2\pi\, ni\, R^2}{[r]^3}[x]_{-l}^{l}$$ 1

$$B = \frac{\mu_0}{4\pi}\frac{2\pi\, ni\, R^2}{[r]^3}[l + l] = \frac{\mu_0}{4\pi}\frac{2\, i\, n\,\pi\, R^2\, .2l}{[r]^3}$$

$$B = \frac{\mu_0}{4\pi}\frac{2\, i\, n\ A\, .2l}{[r]^3} = \frac{\mu_0}{4\pi}\frac{2\ (n\, .2l) iA}{[r]^3}$$

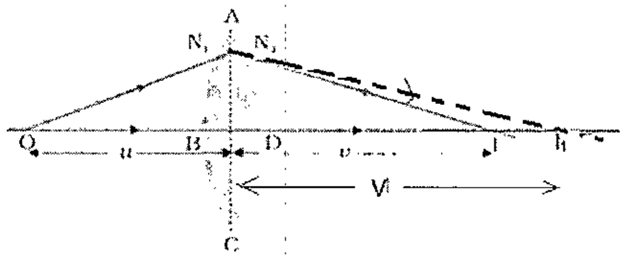
$$B = \frac{\mu_0}{4\pi}\frac{2\, N\, i\ A}{[r]^3}$$

(N = No of turns of solenoid = n x 2l)

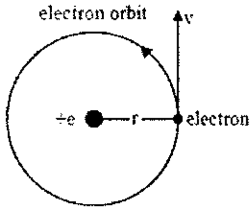
$$B = \frac{\mu_0}{4\pi}\frac{2\, m}{r^3}$$ 1

Where $m = N\ i\ A$ called magnetic dipole moment.

This equation is similar to the expression for magnetic field on axis

		of a short bar magnet. Hence a solenoid carrying current behaves as a bar magnet.	
	30	 Figure with arrows	1
		Stage I. In the absence of second surface of the lens , the ray ON_1 would have traveled straight way to meet at I_1 . I_1 is real image at a distance V^I $\frac{n_1}{-u} + \frac{n_2}{V^I} = \frac{n_2-n_1}{R_1}$ → (1)	1
		Stage II. In the presence of second surface of lens, the ray ON_1 bends away from normal due to refraction at second surface .The real image I_1 acts as virtual object for second surface. The final image is formed at 'I' at a distance 'v'. For second surface V^I is the object distance and is positive as it is right of the surface. $\frac{n_2}{-V^I} + \frac{n_1}{V} = \frac{n_1 - n_2}{R_2}$ ---→ (2)	1
		Adding (1) and (2) $-\frac{n_1}{u} + \frac{n_2}{V^I} + \frac{n_2}{-V^I} + \frac{n_1}{V} = \frac{n_2-n_1}{R_1} + \frac{n_1 - n_2}{R_2}$ $n_1\left(-\frac{1}{u} + \frac{1}{V}\right) = (n_2 - n_1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $-\frac{1}{u} + \frac{1}{V} = \left(\frac{n_2}{n_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ - ->(3)	1
		If u = ∞ then v = f (focal length) $\frac{1}{f} = (n_{21} - 1)(\frac{1}{R_1} - \frac{1}{R_2})$	1

31



The potential energy of electron in the nth orbit is

$$U_n = -\frac{1}{4\pi\varepsilon_o}\frac{Ze^2}{r_n}$$ 1

from Bohr postulate

$$\frac{mV^2}{r_n} = \frac{1}{4\pi\varepsilon_0}\frac{Ze.e}{{r_n}^2}$$

$$\frac{1}{2}mV^2 = \frac{1}{2}\cdot\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n}$$

Thus kinetic energy is

$$E_k = \frac{1}{2}X\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n}$$ 1

The total energy E$_n$ of the electron in the nth orbit is the sum of kinetic energy and potential energy in the nth orbit.

$$E_n = E_k + U_n$$ 1

$$E_n = \frac{1}{2}X\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n} - \frac{1}{4\pi\varepsilon_o}\frac{Ze^2}{r_n}$$

$$E_n = -\frac{Ze^2}{8\pi\varepsilon_0}X\frac{1}{r_n}$$

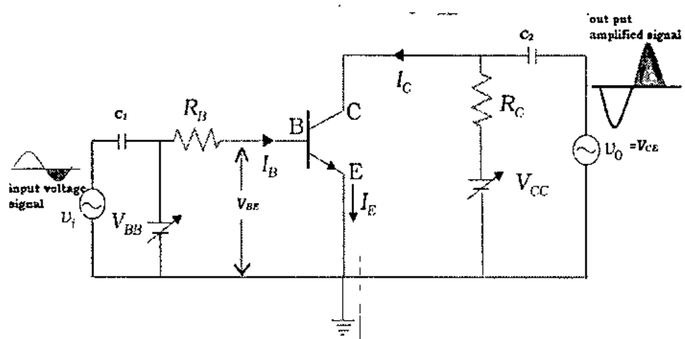
But the radius of nth orbit is

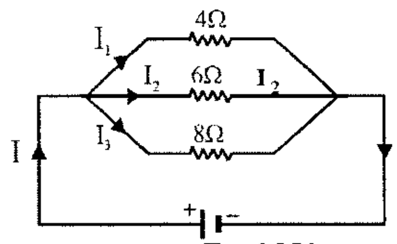
$$r_n = \frac{n^2h^2\varepsilon_o}{\pi mZe^2}$$ 1

$$E_n = -\frac{Ze^2}{8\pi\varepsilon_0}X\frac{1}{\frac{n^2h^2\varepsilon_o}{\pi mZe^2}} = -\frac{mZ^2e^4}{8n^2h^2{\varepsilon_o}^2}$$

$$E_n = -\frac{mZ^2e^4}{8n^2h^2{\varepsilon_o}^2}$$

For hydrogen Z = 1, The total energy of electron in H- atom is

		$$E_n = -\frac{m\,e^4}{8n^2h^2\varepsilon_o{}^2}$$	1
	32	Amplification is the process of increasing the strength of weak signal.	1
			1
		$V_o = V_{CE} = V_{CC} - I_C R_C$ --------→ (1)	1
		During positive half - cycle of the input voltage V_i, the forward bias voltage V_{BE} between base - emitter junction is increased. As a result the base current i_B and the collector current i_C also increases. The increased collector current i_C flows through the collector resistor R_C and produces the large voltage drop across resistor R_C. Therefore output voltage $V_o = V_{CE}$ decreases [as per equation (1)].	1
		During the negative half cycle of the input voltage V_i. the base emitter voltage V_{BE} decreases. As a result base current i_B and collector current i_C decreases. Thus voltage across R_C decreases. Therefore output voltage $Vo = V_{CE}$ increases. Amplified positive half - cycle is produced at the output. Thus for a transistor amplifier in a CE - configuration, the input and output signals are 180° out of phase with each other.	1
	33	Capacitance of capacitor is $C = \frac{A\,\varepsilon_0}{d}$	1
		$$C = \frac{8\,X\,10^{-3}\,X\,8.85X\,10^{-12}}{2\,X\,10^{-3}}$$	1
		$$C = 35.4\,X10^{-12}\,F$$	1
		Charge on each plate of capacitor is Q = C V	1
		$Q = 35.4\,X10^{-12}X\,50$ $Q = 1.77 \times 10^{-9}$ C	1

	34	 Effective resistance in parallel combination is $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ $\frac{1}{R_P} = \frac{1}{4} + \frac{1}{6} + \frac{1}{8}$ $R_P = 1.85\ \Omega$ Current through 4 Ω = $I_1 = \frac{25}{4} = 6.25\ A$ Current through 6 Ω = $I_2 = \frac{25}{6} = 4.167\ A$ Current through 8 Ω = $I_3 = \frac{25}{8} = 3.125\ A$ Total current drawn from battery = $I = \frac{E}{R_p}$ OR $I = I_1 + I_2 + I_3$ $I = \frac{25}{1.85} = 13.5\ A$	1 1 1 1 1
	35	Resonant frequency = $\nu = \frac{1}{2\pi\sqrt{L\,C}}$ $\nu = \frac{1}{23.142\sqrt{28.5\ X 10^{-3} X\ 800 X 10^{-6}}}$ $\nu = 33.33\ Hz$ b) At resonance Impedance =resistance Z = R = 5 Ω Maximum Current = $i_0 = \frac{V_0}{Z}$ $i_0 = \frac{285}{5} = 57\ A$ Power dissipated= P = $i_0\, V_0 = 57\ X\ 285$ P = 16245 W	1 1 1 1 1

	36	Distance of nth bright fringe is given by $$x_n = \frac{n\,\lambda\,D}{d}$$ $$\lambda = \frac{x_n d}{n\,D}$$ $\lambda = \frac{8.835X10^{-3}X\ 0.5\ X10^{-3}}{9\ X\ 1}$ (substitution with SI system) calculation $\lambda = 4.908\ X\ 10^{-7}\ m$ Answer with unit	1 2 1 1
	37	Mass defect = $\Delta m = Zm_p + (A - Z)m_n - M_N$ $\Delta m = 8(1.007825) + 8(1.008665) - 15.995$ $\Delta m = 0.13692\ u$ Binding energy =E=$\Delta m\ X\ 931\ MeV$ E = 127.47 M eV $\frac{BE}{A} = \frac{127.47\ MeV}{16}$ $\frac{BE}{A} = 7.967\ MeV$	1 1 1 1 1