No. J/S

463110

इन्टरमीडिएट परीक्षा, 2015

आई० एससी० (I.Sc.)

28 पृष्ठों की उत्तरपुस्तिका

वीक्षक का हस्ताक्षर

केन्द्राधीक्षक का हस्ताक्षर एवं मुहर

[हाशिया (Margin) छोड़कर पन्नों के दोनों पृष्ठों पर लिखें]

रोल कोड (Roll Code)	क्रमांक (Roll No.)	पंजीयन संख्या (Registration No.) No.	पंजीयन संख्या (Registration No.) वर्ष (Year)	विषय (Subject)	पत्र (Paper)	लिपि (Script)	तिथि (Date)
32010	10068	32010-RS-0069	2013	Physics	Compulsory	Roman	27/2/15

लब्धांक (MARKS OBTAINED)

Question Number	1	2	3	4	5	6	7	8	9	10	TOTAL
Marks Obtained	12	02	02	x	02	02	02	02	02	03	29
Question Number	11	12	13	14	15	16	17	18	19	20	TOTAL
Marks Obtained	03	02	02	01	03	02	01	04	05	04	27
Question Number	21	22	23	24	25	26	27	28	29	30	TOTAL
Marks Obtained	—										
Question Number	31	32	33	34	35	36	37	38	39	40	TOTAL
Marks Obtained	—										
Grand Total	(In Words)	fifty six							(In Figure)		56

परीक्षार्थी हेतु निर्देश

1. परीक्षार्थी ध्यान दें कि केवल एक ही उत्तर-पुस्तिका में पूरे प्रश्नों का उत्तर सीमित करना है। अतिरिक्त उत्तर-पुस्तिका नहीं दी जायेगी।
2. उत्तर लिखना शुरु करने के पहले प्रत्येक परीक्षार्थी के लिए अपनी उत्तर-पुस्तिका के आवरण पृष्ठ पर अपना रोल कोड, रोल नं., पंजीयन संख्या एवं वर्ष, विषय, पत्र, लिपि तथा तिथि लिखना अनिवार्य है। परन्तु परीक्षार्थी को अपना अथवा अपने कॉलेज का नाम कदापि नहीं लिखना है। परीक्षार्थियों को चेतावनी दी जाती है कि जिस उत्तर-पुस्तिका पर रोल कोड, क्रमांक और सूचीकरण संख्या स्पष्ट रूप से अंकित न होगी, उसे जाँची नहीं जायेगी।
3. यदि कोई परीक्षार्थी परीक्षा में दूसरे को सहायता करता या किसी प्रकार से अवैध सहायता लेने की चेष्टा करता हुआ अथवा परीक्षा में अनुचित लाभ उठाने के लिए किसी दूसरे अवैध उपाय का अवलम्बन करता हुआ पाया जायेगा तो उसे परीक्षा से निष्कासित कर दिया जायेगा। परीक्षा में परीक्षार्थियों को परस्पर किसी प्रकार से विचार विनिमय का अधिकार न होगा। परिषद द्वारा दिये गए प्रवेश पत्र, उत्तर-पुस्तिका, प्रश्न-पत्र तथा नियमानुकूल निर्दिष्ट उपकरणों के अतिरिक्त परीक्षार्थियों को अपने साथ परीक्षा कक्ष में मोबाईल, कैलकुलेटर, छाता, पुस्तक, किसी प्रकार का पत्र, पॉकेट बुक, नोट आदि या किसी भी प्रकार का कागज रखना वर्जित है, भले ही उसका सम्बन्ध उस समय की परीक्षा के विषय से हो या न हो। इसका उल्लंघन करने वाले परीक्षार्थियों को परीक्षा से निष्कासित कर दिया जायेगा।
4. लिखने का सम्पूर्ण काम उत्तर-पुस्तिका पर ही किया जाय और उसका कोई भी पृष्ठ फाड़ा न जाए। परीक्षा खत्म होने के बाद उत्तर-पुस्तिका वापस लौटा देना आवश्यक है। इस उत्तर-पुस्तिका के बदले दूसरी उत्तर-पुस्तिका नहीं दी जा सकती। जो लिखावट काटी हुई रहेगी उसकी जाँच नहीं होगी। उत्तर-पुस्तिका में यदि कोई फटा पृष्ठ मिले तो उसे निकाल नहीं देना चाहिए बल्कि वीक्षक को दिखाकर उसे मोड़ देना चाहिए।
5. प्रश्न-पत्र पर कोई उत्तर या कोई भी दूसरी बात लिखना वर्जित है।
6. प्रश्न-पत्र वितरण के बाद एक घंटे तक कोई भी परीक्षार्थी अपनी उत्तर-पुस्तिका वापस नहीं कर सकते हैं।

परीक्षक का पूर्ण हस्ताक्षर एवं मुहर (Full Signature of Examiner with Seal)

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प्रधान परीक्षक का पूर्ण हस्ताक्षर एवं मुहर (Full Signature of Head Examiner with Seal)

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Lecturer in Physics
P.G. Deptt. of Physics
Patliputra University

नोट - प्रत्येक पृष्ठों में अंकित दोनों हाशिया (Margin) के बीच में प्रश्नों का उत्तर लिखें।

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(1) (i) (c) Electric field. 1

(ii) (b) $E = -\frac{dV}{dr}$ 1

12

(iii) (b) decreases two times 1

(iv) (a) increases 0

(v) (b) large length 1

(vi) (b) decreases 0

(vii) (b) 90° 1

(viii) (d) γ- rays 1

(ix) (d) Red 1

(x) (c) power of a lens 1

(xi) (a) spherical wavefront. 0

(xii) (c) 1.6×10^{-19} J 1

(xiii) (b) 1.66×10^{-27} kg 1

(xiv) (c) $\overline{A \cdot B} = 4$ 1

(xv) (c) electrons and holes both. 1

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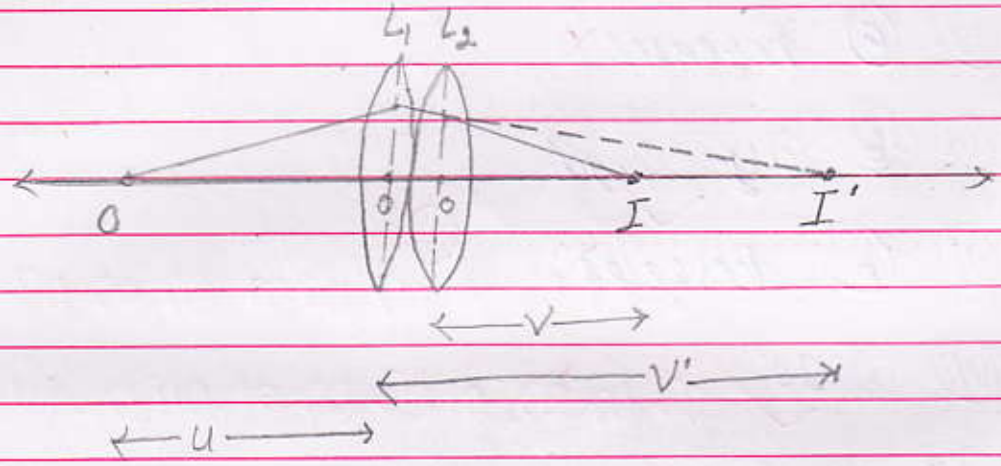
(18) An equivalent lens is the lens which can be used in place of a combination of lenses. It produces the image of the object just as image formed by combination of lenses.



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Let two thin lenses are kept in contact. Object O is placed in front of 1st lens whose image is formed at I' and this I' acts as a object for second lens whose final image is formed at I

<u>for lens I</u>

$$\frac{1}{v'} - \frac{1}{u} = \frac{1}{f_1} \quad (1)$$

wh f_1 = focal length of 1st lens

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For lens L_2

$$\frac{1}{v} - \frac{1}{v'} = \frac{1}{f_2} \quad \text{(ii)}$$ wh f_2 = focal length of 2nd lens

Adding (i) & (ii)

$$\cancel{\frac{1}{v'}} - \frac{1}{u} + \frac{1}{v} - \cancel{\frac{1}{v'}} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f_1} + \frac{1}{f_2} \quad \text{(iii)}$$

Now, an equivalent lens is used in its place which forms the image at I of object O.

$$\frac{1}{F} = \frac{1}{v} - \frac{1}{u} \quad \text{(iv)}$$

from (iii) & (iv)

$$\boxed{\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}}$$

or $\boxed{D = D_1 + D_2}$

This is the required expression.

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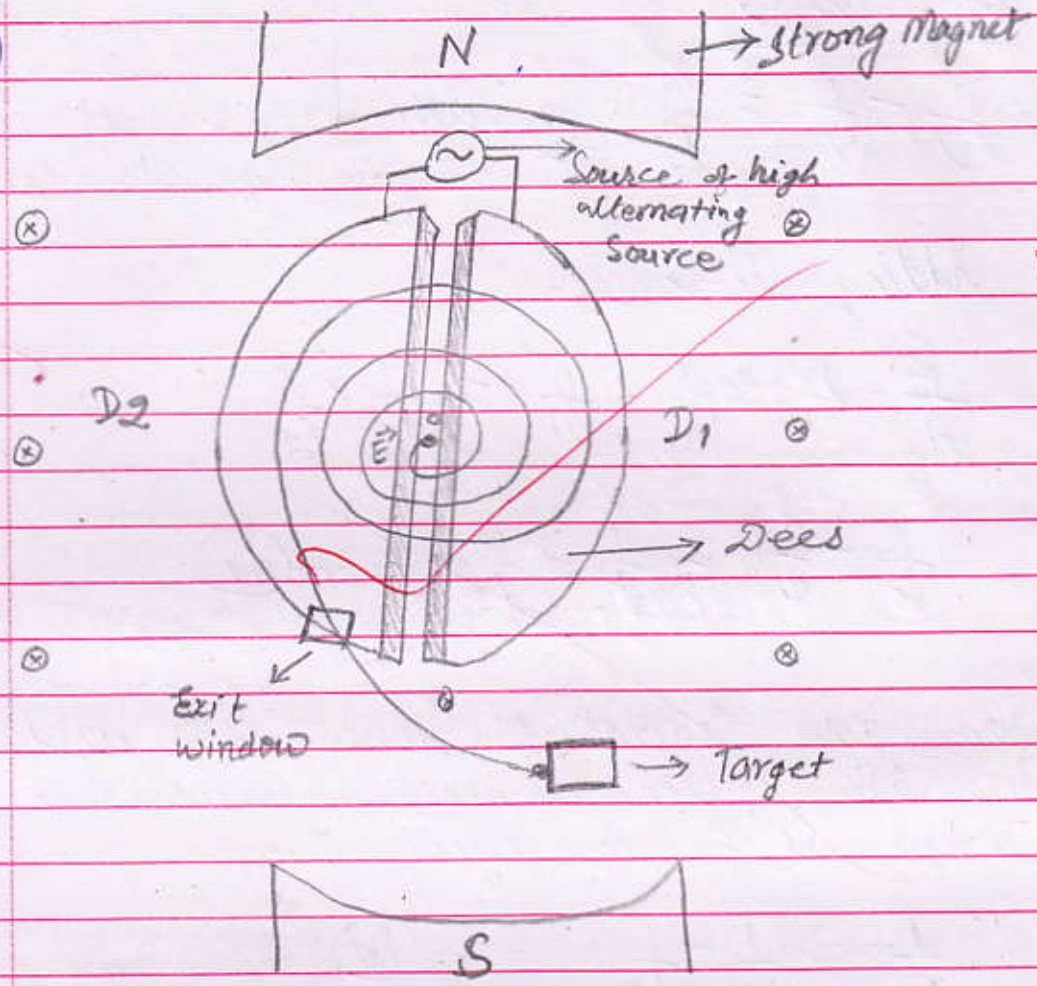

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Cyclotron

Cyclotron is an electronic device used to accelerate a positively charged particle to a very high energy level.

Principle :- Cyclotron works on a principle that a positively charged particle is capable of being accelerated to a very

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high energy level when it crosses an alternating electric field again and again in the influence of a very strong magnetic field.

Construction :- A cyclotron is made up of two evacuated D-shaped hollow conductor known as Dees, which are placed parallel to each other. These Dees are connected to a very high alternating electric source and are placed between two strong magnets. The positively charged particle is kept at centre O.

Working :- A positively charged particle is placed at centre O at which electric field is $\vec{E}$ and magnetic field is $\vec{B}$. Under their combined effect, the particle starts to move in circular path of increasing radius because of perpendicular force acting (Centripetal Force) on its motion. Alternating current's frequency is such that when it comes close other Dee, its polarity is changed and attracted

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towards other Dee and this process is repeated again and again. Finally the charged particle comes out through exit window to hit the target.

Let the particle moves in circular path of the radius r having mass m, velocity v, charge q.

$\because$ Magnetic force = Centripetal force

$$qvB\sin 90^\circ = \frac{mv^2}{r}$$

$$qvB \times 1 = \frac{mv^2}{r}$$

$$qB = \frac{mv}{r}$$

$$\boxed{r = \frac{mv}{qB}}$$

$$\text{Velocity} = v = \frac{qBr}{m}$$

$$\text{Time period} = T = \frac{\text{Distance}}{\text{Speed}} = \frac{2\pi r}{\frac{qBr}{m}}$$

$$\boxed{T = \frac{2\pi m}{qB}}$$

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Frequency $\nu = \frac{1}{T} = \frac{qB}{2\pi m}$

Angular speed $= \omega = 2\pi\nu = 2\pi \times \frac{qB}{2\pi m}$

$$\boxed{\omega = \frac{qB}{m}}$$

Kinetic energy $= \frac{1}{2}mv^2 = \frac{1}{2}m \times \frac{q^2B^2r^2}{m^2}$

$$\boxed{K.E. = \frac{q^2B^2r^2}{2m}}$$

(20) Reactance :- The resistance offered by either inductor or capacitor in an alternating electric circuit is known as reactance.

opposition offered by the inductor to the flow of current in purely inductive reactance is known as inductive reactance. It is denoted by X_L

opposition offered by capacitor to the flow of current in purely capacitive circuit is known as Capacitive reactance. Denoted by X_C.

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(20) • Impedance :- The effective resistance of CCR circuit is known as Impedance denoted by Z

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

• Reactance :- $(X_L - X_C)$ is known as the reactance of the a.c. circuit.

Since average power of a.c. circuit is given by

• $P_{av} = I_{rms} E_{rms} \cos\phi$
wh ϕ is phase difference.

(4) for purely inductive circuit

phase difference is $-\frac{\pi}{2}$

$\therefore P_{av} = I_{rms} E_{rms} \cos\left(\frac{-\pi}{2}\right)$

$$\boxed{P_{av} = 0}$$

• Choke coil :- choke coil is an electric device used to control the current flowing through a.c. circuit.

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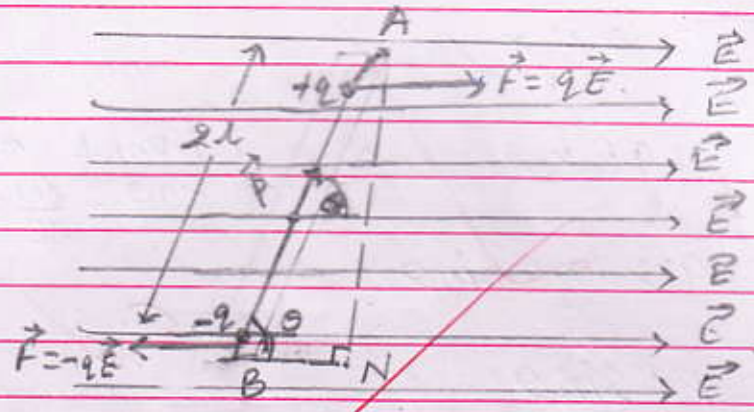
(10)



Electric dipole kept in uniform ~~magne~~ ~~ettic~~ electric field

Consider an electric dipole of charges -q, +q separated by a small distance 2l, placed in an uniform electric field $\vec{E}$, making an angle θ with it. AN is ⊥ drawn on it.

Equal forces are applied on the two charges in opposite direction whose line of action is different. These forces constitute torque and rotate it clockwise.

(3)

According to the formula,

Torque = magnitude of either forces X perpendicular distance between these two arms of forces.

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$\tau = qE \times AN$

$\tau = qE \times 2l \sin\theta$ [from Δ ABN $\sin\theta = \frac{AN}{AB} = \frac{AN}{2l}$]

$\tau = q \times 2l \times E \sin\theta$

$\tau = pE\sin\theta$

$\boxed{\vec{\tau} = \vec{p} \times \vec{E}}$

→ It is vector quantity
→ Its S.I. unit is Nm
→ It is $\perp^r$ to $\vec{p}$ and $\vec{E}$ both.

• Electric Dipole moment :- It is the simple product of magnitude of the either charges and distance between these two charges.

Electric Dipole moment $\vec{p} = q \times 2\vec{l}$

→ S.I. Unit = Cm
→ It is a vector quantity.
→ Its direction is from negative charge to positive charge.

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(11) The average velocity with which an electron gets drifted in a direction opposite to the direction of applied electric field is known as drift velocity.

→ It is denoted by V_d

→ $V_d = \frac{I}{neA}$

Ohm's law

Let the conductor of length l, number density of electrons n, charge of electron e, area of cross-section A, drift velocity V_d, electric field $\vec{E}$, potential difference V.

Since $I = neAV_d$

$$I = neA \times \frac{eE\tau}{m}$$

$$I = \frac{ne^2A\tau E}{m}$$

$$I = \frac{ne^2A\tau}{m} \times \frac{V}{l}$$ $[\because E = -\frac{dV}{dx}]$ neglecting -ve sign.

$$I = \frac{ne^2A\tau}{ml} \times V$$

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$I = \frac{1}{R} V$

$IR = V$

or $V = IR$

or $V = RI$

$V \propto I$ [wh R is const Known as Resistance.]

or $\boxed{I \propto V}$

This is the required ohm's law.

(12) when a white light ray passes through a prism, it gets dispersed because the angle of deviation of all the constituent colours are different hence they bend by different angles, & split in a band of seven colours.

secondly, different colours have different wavelengths and travel with different velocity.

2

Red colour deviates least but violet colour deviates most because angle of deviation of red is least as its wavelength is greatest

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among the seven colours while wavelength of blue colour is least so it deviates most.

(13) Coherence means that the frequencies of the two or more sources of light are same and their phase difference is zero or any constant value.

Coherent sources are produced from the same light wave of single monochromatic light source by passing it through two thin slits.

(15) Radioactivity :- The phenomenon of disintegration of an atom with a ~~tran~~ release of tremendous amount of Energy is known as radioactivity.

Two properties of α- rays are :-

i) It is positively charged particle.
ii) Its mass is $4m_p$ and charge is $+2e$.

Two properties of β- rayes are :-

i) It is negatively charged
ii) Its charge is $-e$

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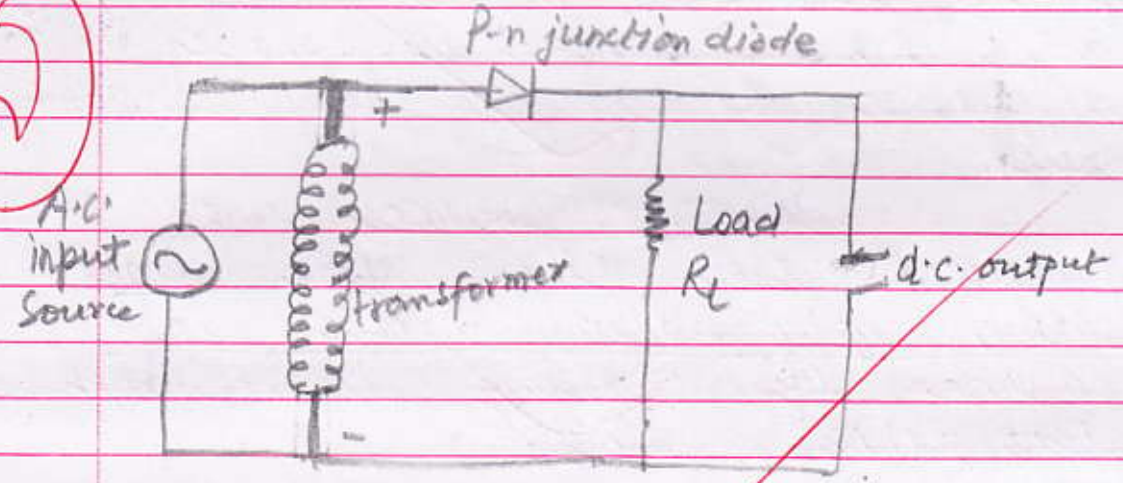
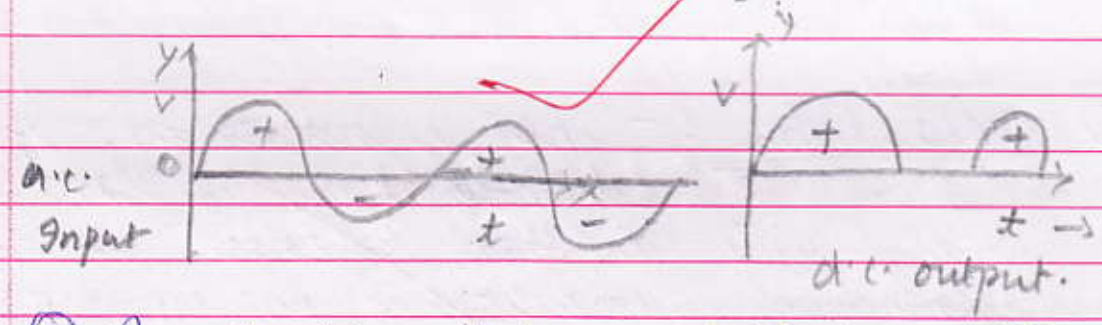
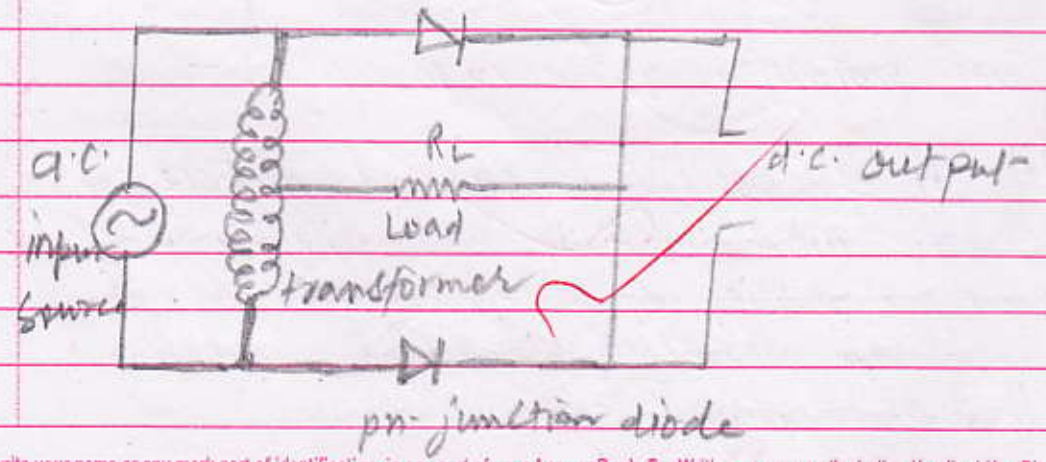
(16) (a) P-n junction diode as half-wave rectifier

2





(b) P-n junction diode as full wave rectifier.



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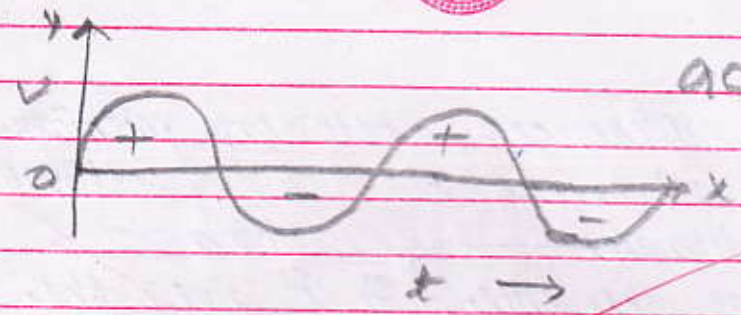
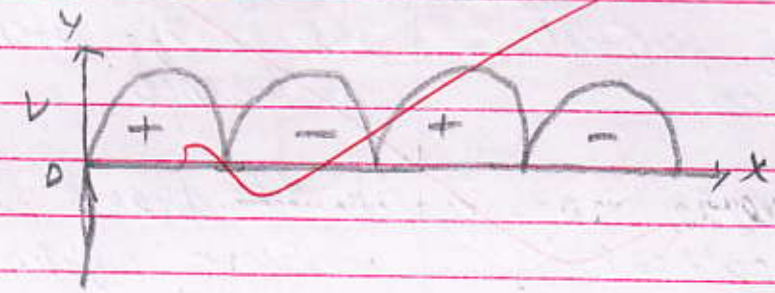


a.c. input



d.c. output

(17) Different types of modulation are as follows:-

(1)

i) A.M. or Amplitude Modulation
ii) F.M. or Frequency Modulation
iii) P.M. or Phase Modulation.

(2) Electric flux :- Electric flux is defined as the total number of electric lines of force passing through a given closed surface.

(2)

→ It is represented by ϕ
→ $\phi = \vec{E} \cdot \vec{ds}$
→ Its SI unit is $NC^{-1}m^2$
→ It is a scalar quantity.

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(3) Two differences between potentiometer and voltmeter are as follows:

Potentiometer	Voltmeter
i) It gives the true value of potential difference.	i) It gives the virtual value of potential difference
ii) It draws no any current from the circuit	ii) It draws some current from the circuit.

2

(5) The core of a transfore is laminated to the prevent the loss magnetic flux passing through the coils. The coils of a transformer.

It is laminated to prevent the loss of energy.

2

(8) LED stands for Light Emitting Diode. It is a p-n-junction diode. It is connected in forward bias. when it is connected in forward bias the electron-hole recombination takes place and during this process some of the energy is released in the

2

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form of light or heat. But the light energy is mostly released.

Its uses are:-

i) It is used in electric lamps.
ii) It is used in signals.

(9) Signal :- The information which is propogated for the purpose of transmitting datas is known as signal.

(2) There are two types of signal:-

i) Analog signal
ii) Digital signal

(7) Rydberg's constant represents the climating value of highest wave number of any photon that can be emitted from the hydrogen atom.

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(7) A Rydberg showed that all the series of lines ~~of~~ in hydrogen spectrum is described as

$$\frac{1}{\lambda} = \bar{\upsilon} = 109677 \, cm^{-1} \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

2

where $\frac{1}{\lambda} = \bar{\upsilon}$ = wave no.

Unit :- cm^{-1}.

(6) The remote sensing is the acquiraition of information about it without making physical contact.

Its applications are :-

2

i) It is used to communicate with people in remote area.

ii) It is useful for sending information in those areas where communication system is properly set up.

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(14) $E = h\nu = h\frac{c}{\lambda}$

$= \frac{6.626\times10^{-34}\times3\times10^{8}}{6000A^{\circ}\times1.6\times10^{-19}}$

$= \frac{19.878\times10^{-26}}{6\times10^{3}\times10^{10}\times1.6\times10^{-19}}$

$=$

1

Prof. Hemlal Mahto
Deptt. of Physics
College, Sangdar (Giridih)

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