ENGLISH MEDIUM

माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल

मु.उ.पु. 24 पृष्ठ

2009

कार्यालयीन उपयोग के लिए

H.S.S.C. Exam.

निम्न रिक्तियों की सही प्रविष्टि परीक्षार्थी द्वारा की जाए।

1. विषय कोड 2 1 0 परीक्षा का विषय Physics

2. परीक्षा का माध्यम English परीक्षा की दिनांक 01/03/09

3. परीक्षार्थी प्रश्न पत्र का पूर्ण कोड नम्बर (सेट A, B, C, या D) अनिवार्यतः भरें — कोड U-2043 सेट C

स्टीकर तीर के निशान से मिलाकर लगायें

केन्द्र क्रमांक की सील

511049

सरल क्रमांक K 149258

4. परीक्षार्थी का अनुक्रमांक (अंग्रेजी अंकों में)

2	9	5	1	1	8	1	0	9

5. नीचे दिये प्रत्येक कालम में ऊपर दिये गये अनुक्रमांक के अंकों को उसी क्रम में शब्दों में लिखा जाए :–

two	nine	five	one	one	eight	one	zero	nine

पर्यवेक्षक/केन्द्राध्यक्ष का प्रमाणीकरण

प्रमाणित किया जाता है कि परीक्षार्थी द्वारा निम्नानुसार पूरक उत्तरपुस्तिका ली गई है :–

क :– संख्या शब्दों में 3 अंकों में तीन

ख :– परीक्षार्थी की बैठक व्यवस्था कक्ष क्रमांक [ ] में है।

ग :– उत्तर पुस्तिका पर प्रश्न–पत्र का कोड नम्बर एवं सेट सही लिखा है।

BSEMP

हस्ताक्षर (पर्यवेक्षक) ---------

नाम Mic Jesi पद Teacher

पता/संस्था ---------

परीक्षार्थी द्वारा ली गई सभी पूरक उत्तर पुस्तिकायें, मुख्य उत्तर पुस्तिका के साथ संलग्न हैं।

हस्ताक्षर केन्द्राध्यक्ष

1	
2	
3	
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5	
6	
7	
8	
9	
10	
कुल प्राप्तांक	

परीक्षार्थी, परीक्षक से अपेक्षा है कि वे पृष्ठ भाग पर दिये गये निर्देशों का यथेष्ट पालन सुनिश्चित करेंगे।

प्रमाणित किया जाता है कि उपरोक्तानुसार संलग्न पूरक उत्तर पुस्तिकाओं की संख्या मूल्यांकन के समय सही पाई गई हैं। होलोक्राफ्ट स्टीकर यथा स्थिति में यथावत् रखते हुए ही उत्तरपुस्तिका का मूल्यांकन किया गया है। मैंने सभी प्रश्नों के उत्तरों का गहन मूल्यांकन किया है। उत्तर पुस्तिका के अन्दर के अंक एवं कव्हर पृष्ठ पर दर्शाये अंक एक समान है एवं योग पूर्णतः सही है।

हस्ताक्षर (परीक्षक) ---------

परीक्षक क्रमांक [ ]

हस्ताक्षर (उपमुख्य परीक्षक) ---------

दिनांक.....

हस्ताक्षर (मुख्य परीक्षक) ---------

दिनांक.....

परीक्षार्थी के लिए निर्देश

1. परीक्षार्थी को अपना अनुक्रमांक/विषय/माध्यम/दिनांक एवं प्रश्न–पत्र का कोड (समूह) मुख पृष्ठ पर अंकित करना अनिवार्य है। अन्यत्र कहीं भी नहीं लिखा जाएगा।
2. अनुक्रमांक नीचे दिये गए उदाहरण अनुसार लिखा जाए :–

1	8	2	4	3	9	5	6	8
एक	आठ	दो	चार	तीन	नौ	पाँच	छः	आठ

3. उत्तर पुस्तिका के दोनों ओर पृष्ठों में लिखें। बीच में रिक्त स्थान न छोडें। भूल से छूटा/रिक्त स्थान तथा शेष खाली पृष्ठों को क्रास' किया जाए।
4. परीक्षार्थी प्रश्न पत्र हल करते समय ही, कव्हर पृष्ठ पर दी गई तालिका में प्रश्न क्रमांक के सम्मुख़ वाले कालम में उत्तरपुस्तिका का वह पृष्ठ क्रमांक अनिवार्य रूप से अंकित करें जिस पर प्रश्न का उत्तर लिखा गया है। यदि पूरक उत्तरपुस्तिका का उपयोग किया गया हो, तो उस पर 25 से प्रारंभ करते हुए पृष्ठ क्रमांक परीक्षार्थी द्वारा स्वयं डाले जाएँ।

परीक्षक के लिए निर्देश

1. केवल उन्हीं उत्तरपुस्तिकाओं का मूल्यांकन करें जिन पर होलो क्राफ्ट स्टीकर चस्पा है।
2. उत्तरपुस्तिका का मूल्यांकन होलो क्राफ्ट स्टीकर को चस्पा स्थिति में यथावत् रखते हुए ही किया जाये।
3. बिना होलो क्राफ्ट स्टीकर वाली तथा फटे हुए होलो क्राफ्ट स्टीकर वाली सभी उत्तरपुस्तिकाऐं मूल्यांकन हेतु परीक्षा नियंत्रक, माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल को व्यक्तिशः रूप से भेजी जाये।

मूल्यांकन केन्द्र के लिए निर्देश

1. **O.M.R. SHEET** पर प्राप्तांक की प्रविष्टि करने हेतु केवल वही उत्तरपुस्तिकाएँ प्राप्त करें, जिनका मूल्यांकन होलो क्राफ्ट स्टीकर को चस्पा स्थिति में यथावत् रखते हुए ही किया गया है। यदि होलो क्राफ्ट स्टीकर फटा हुआ पाया जाता है तो ऐसी उत्तरपुस्तिकाऐं मूल्यांकन केन्द्र अधिकारी को पृथक से सौपी जाएँ। ऐसे प्रकरणों के प्राप्तांकों की प्रविष्टि **O.M.R. SHEET** में नहीं की जाए। मूल्यांकन केन्द्र अधिकारी ऐसी उत्तरपुस्तिकाऐं पुनः मूल्यांकन के लिये परीक्षा नियंत्रक, माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल को व्यक्तिशः रूप से सौपेंगे।
2. उत्तरपुस्तिका के मुख्य पृष्ठ में अंकों एवं शब्दों में अंकित प्राप्तांकों को मिलान कर **O.M.R. SHEET** में अंकों की सटीक प्रविष्टि करें।
3. **O.M.R. SHEET** पर प्रमाणीकरण् कर हस्ताक्षर करें।

योग पूर्व पृष्ठ

SEMP

Q.1]

(i) 6.25×10^{18} ✓

(ii) Electron ✗

(iii) Weber ✓

(iv) Ultra high frequency radio wave.

(v) $\beta = \frac{\alpha}{1-\alpha}$. ✓

Q.2]

i) ~~NA~~ NC^{-1} ✓

(ii) Specific conductivity ✓

(iii) 100 MHz to 200 MHz

iv) Inverter

1) Analog signal

Q.3]

i) Electric dipole moment → Coulomb x metre

1) Lorentz force → $qvB\sin\theta$

b) S.I. unit of self Induction → Henry

) Biot-Savart law → $dB = \frac{\mu_0}{4\pi} \frac{I\,dl\sin\theta}{r^2}$

Base of electromagnetic wave → Hertz

कुल अंक

Q.4)

(i) True ✓

(ii) False ✓

(iii) True. ✓

(iv) False ✓

(v) True. ✓

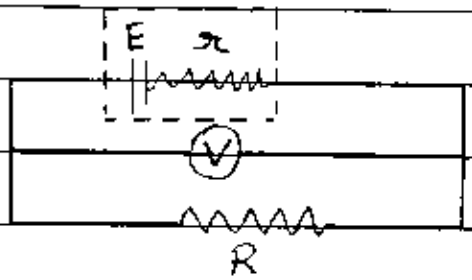
Ans-5)

In 1842, Scientist Kirchhoff's have proposed a law which is called as Kirchhoff's law

First law →

Ans - 5|

Internal resistance of a cell = The obstruction offered by the flow of current inside the electrolytes of the cell is called internal resistance of the cell. It is represented by small letter 'r'. It's unit is ohm (Ω).



Circuit diagram

Internal resistance of a cell depend upon the following factor :-

① Separation between the electrodes = If the separation between the electrodes increases, the internal resistance of the cell also increases.

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(c) On the concentration of electrolytes =
On increasing the concentration of electrodes (electrolytes) internal resistance of cell also increases.

On the area immersed inside the electrolytes =
On increasing the area immersed in the electrodes, the internal resistance of cell decreases.

(d) On the dependence of temperature =
Generally on increasing temperature, internal resistance of cell decreases.

Ans-6

Ammeter	Voltmeter
It is used to measure current flow in the circuit. It is measured in amperes.	It is used to measure potential difference in the circuit. It is measured in volt.
It is always connected in series in the circuit.	It is always connected in parallel in the circuit.
It is obtained from galvanometer by connecting them in parallel with low resistance wire called shunt.	It is obtained from galvanometer by connecting high resistance wire in parallel series within the circuit.
Resistance of ideal ammeter is zero.	Resistance of ideal voltmeter is infinite.
The resistance of low range ammeter is more as compared to high range ammeter.	The resistance of low range voltmeter is less as compared to high range voltmeter.

Ans-71

Step-up transformer	Step-Down transforma
The transformer used to convert low alternating voltage to high alternating voltage are called step-up transformer	The transformer used to convert high alternating voltage to low alternating voltage are called step-down transformer
The current value of output (i.e secondary coil) is less than in input (i.e primary coil)	The current value of output (i.e secondary coil) is more than in input (i.e primary coil)
The number of turn of wire is more in secondary coil as compared to primary coil i.e wire is thick in primary coil and thin in secondary coil	The number of turn of wire (copper wire is wounded) is more in primary coil as compared to secondary coil

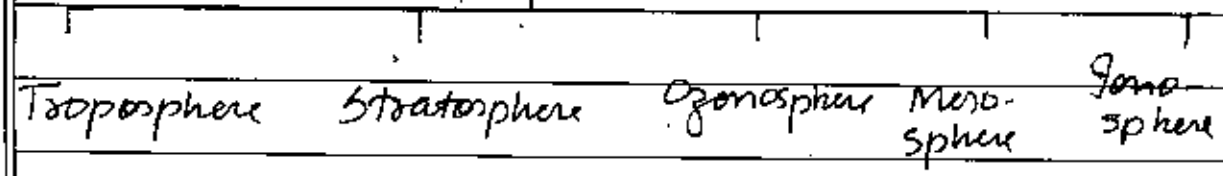
This decreases the strength of ~~a~~ current flowing in them i.e. current flowing in primary coil is more as compared to secondary coil. This transformer is used for transmission of power generating at generating station. It is also used in X-ray, Television sets and in wireless sets	This increases the strength of current flowing in them i.e. the current flowing in secondary coil is maximum. For this reason, this are used in making electric bell, night lamp and in various welding purposes.

Ans-8|

The atmosphere is about 300km above the earth's ~~at~~ surface. The air that surround us, is defined as atmosphere. The composition of atmosphere gradually changes when we go up and up above the earth's surface. The ~~atmosphere~~ consist of several gases like Nitrogen, Oxygen, Carbon-di-oxide and so many other gases.

Out of which, Nitrogen present in the maximum quantity on earth. The composition of Atmosphere is classified as below:-

Atmosphere



Out of which ozonesphere is the most important layer of atmosphere. This layer extend ranging from 30 km to 50 km above the earth surface.

This layer play an important role in the existence of life on earth.

This layer protects us from ultra violet ray, infra-red radiation reaching to the earth's surface which are very harmful for us.

This ray causes skin cancer and skin diseases and so

many diseases This layer is not allowing these ray to enter the earth's surface which are coming from sun

Thus ozone layer absorb these radiation and prevent us from these radiation.

Ans - 9|

Given =

Object distance from concave mirror (u) = 48cm

focal length of concave mirror (f) = 24cm.

By Sign Convection

u = 48cm (negative)

f = 24cm (negative)

Image distance (v) = ?

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By lens formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{-24} = \frac{1}{v} + \frac{1}{(-48)}$$

$$\Rightarrow \frac{1}{-24} = \frac{1}{v} - \frac{1}{48}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{48} - \frac{1}{24}.$$

$$\frac{1}{v} = \frac{1-2}{48}$$

$$\frac{1}{v} = \frac{-1}{48}$$

$$\boxed{v = -48 \text{ cm}.}$$

The position of image is ~~negative~~ real, ~~same side of object distance~~

The position of image is at centre of curvature as image distance = object distance.

Thus nature of image is negative real

Ans-10)

In 1924, louis De Broglie suggested that like light, matter also have dual character i.e. it exhibit wave as well as matter particles. According to him, wavelength of the wave associated with matter particles moving with velocity 'v' and having mass "m" is related as

$$\lambda = \frac{h}{mv}$$

Derivation = This can be explained on the basis of plank's quantum theory and Einstein's equation.

According to ~~plank~~ plank's quantam theory, the energy of the emitted photon is given ~~by~~ as.

$$E = h\nu \quad -(1)$$

where h = plank's constant

ν = frequency of photon

According to Einstein's theory

$$E = mc^2 \quad -(ii)$$

where c = velocity of light

from (i) and (ii)

$$h\nu = mc^2$$

$$\frac{hc}{\lambda} = mc^2$$

$$\frac{h}{\lambda} = mc$$

$$\boxed{\lambda = \frac{h}{mc}}$$

Special cases

(i) We know that momentum of particle

$$p = mc.$$

Therefore

$$\boxed{\lambda = \frac{h}{p}}$$

(2) Also we know that

$$p = \sqrt{2mK_E}$$

where K_E = Kinetic energy

$$\lambda = \frac{h}{\sqrt{2mK_E}}$$

Also $K_E = qV$

where q = charge on electron
V = Volt potential difference

$$\lambda = \frac{h}{\sqrt{2mqV}}$$

Ans - 11

Amplitude modulation	Frequency modulation
In amplitude modulation, modulated wave are super-imposed with the carrier wave such that the amplitude of modulated wave is the linear function of amplitude of modulating wave.	In Frequency modulation modulated wave are super-imposed with carrier wave such that the frequency of modulated wave is the linear function of amplitude of modulating wave.

In amplitude modulation, there is large noises are heard.	In frequency modulati there is negligibles noises are heard.
In amplitude modulation, the modulated wave have much lesser channel width (band width).	In frequency modulati the modulated wave have much larger channel width i.e. they have 20 channel width 20 times as amplitude modulation
In amplitude modulation there are three component i.e. carrier wave, upper side band, (lower side band) irrespective of modulating index (m_a)	In frequency modulat there are several component depending upon side band of frequency and also dependence on modulating index (m_f)
These don't require complex and perfect electronic equipment	These require complex and perfect electronic equipment

BSEM

Ans-12|

Statement

According to Gauss theorem, "the total number of electric lines of force passing normally through closed surface in an electric field is equal to the $1/\varepsilon_0$ times the total charged present within the surface".

Mathematically

$$\phi = \iint_S E \cdot ds = \frac{1}{\varepsilon_0} \varepsilon q$$

$$\boxed{\phi = \frac{1}{\varepsilon_0} Q}$$

[$\because \varepsilon q = Q$ represent total charged present within surface]

where ϕ = Electric flux of a closed surface.

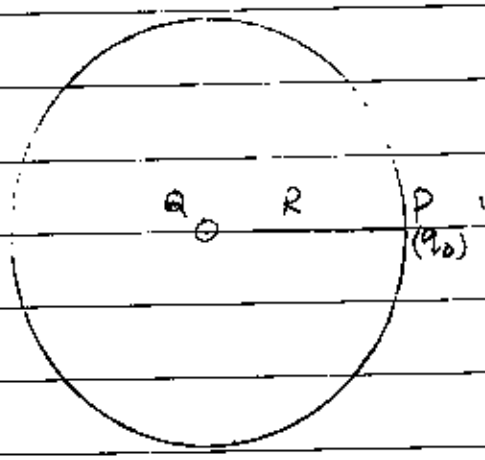
If $q_1, q_2, q_3 \ldots q_n$ are the number of charges then,
according to this law

$$\phi = \frac{1}{\varepsilon_0}(q_1 + q_2 + q_3 \ldots q_n)$$

$$\phi = \frac{1 \Sigma q}{\varepsilon_0}$$

$$\boxed{\phi = \frac{Q}{\varepsilon_0}}$$

Derivation =



Consider a point positive charge (+Q) placed at centre 'O' of sphere of radius 'R'

पृष्ठ 20 के अंक

To derive =

We are to find the Coulomb's inverse square using this law

Expression →

We know that, Intensity of electric field at any point is

$$\vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{Q}{R^2}$$

where $\frac{1}{4\pi\varepsilon_0} = K$ (constant)

Since the sphere is conducting, therefore total charge resides only on the outer sphere and no charge reside inside the surface.

Therefore

electric flux linked with the sphere

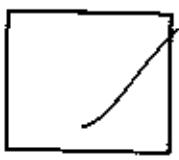
$$\phi = \iint_S E\,ds$$

$$\phi = E \times \iint_S ds$$

$$\phi = E \times 4\pi r^2$$

where

$\iint_S$ = Total surface area



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of sphere $= 4\pi r^2$]

$$\phi = E \times 4\pi r^2 \quad -(1)$$

But from this law

$$\phi = \frac{Q}{\varepsilon_0} \quad -(2)$$

from (i) and (ii)

$$E \times 4\pi r^2 = \frac{Q}{\varepsilon_0}$$

$$\boxed{E = \frac{Q}{4\pi\varepsilon_0 r^2}}$$

If charge q_0 be placed at point P
therefore

$$F = q_0 E$$

$$\boxed{F = \frac{1}{4\pi\varepsilon_0}\frac{q_0 Q}{r^2}}$$

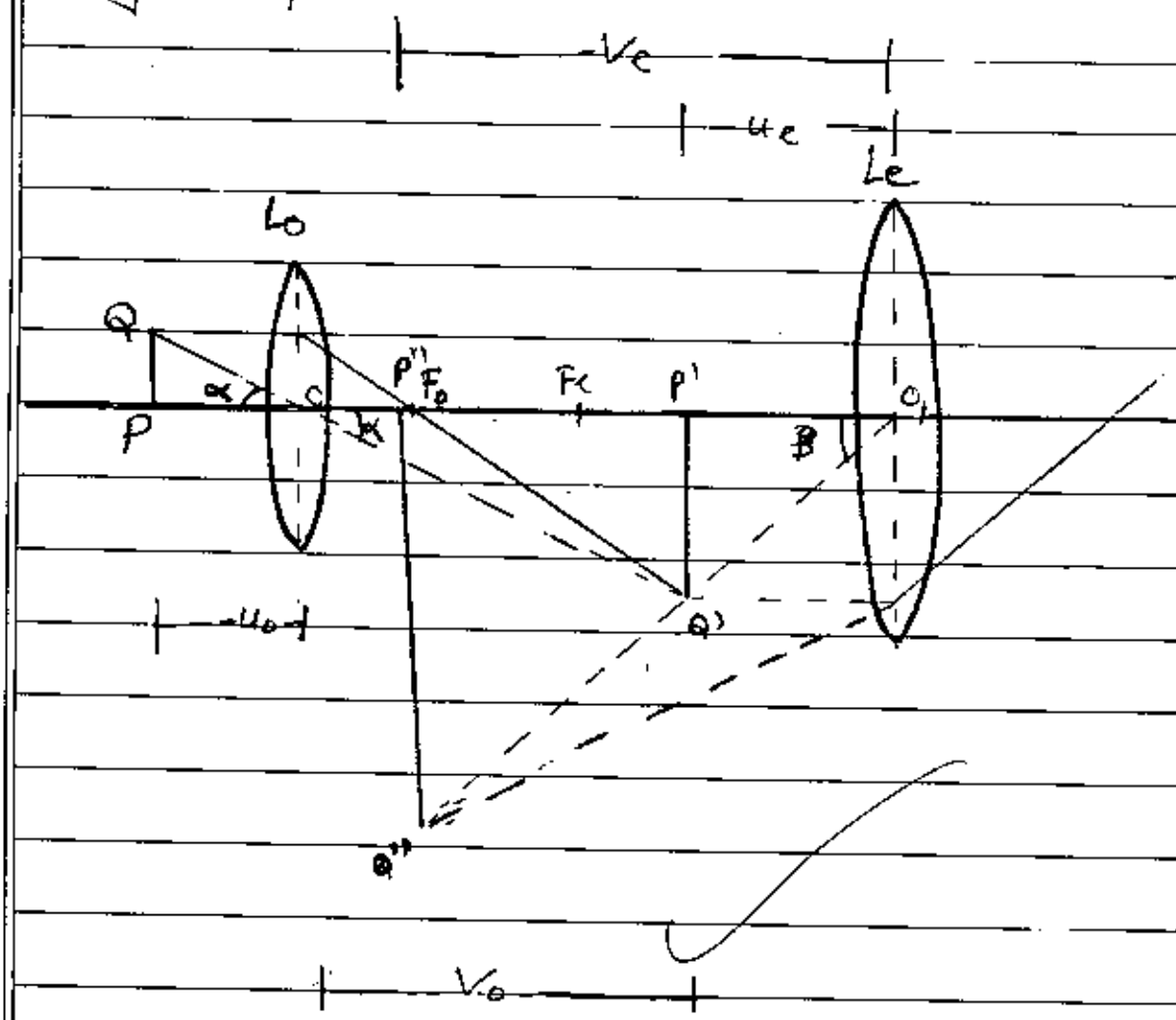
This is called Coulomb's inverse square law

Hence proved.

Ans-13)

⊙ Compound Microscope =

Ray Diagram =



Construction :->

Consider an object PQ placed in front of convex len of focal length f_o i.e. objective len and image of which is formed at P'Q' which again act as object for other convex len (i.e. eye lens) and final image is formed at P''Q''. This image

is real, magnified and inverted. In this microscope, the objective lens is kept smaller as compared to eye lens.

Expression for magnifying power =

We know that

m = Visual angle subtend at eye by image / Visual angle subtend at eye by object if it is at least distance of distinct vision

In $\triangle POQ$,

$$\tan\alpha = \frac{PQ}{D} \quad \text{... (1)}$$

where object PQ is assumed to be placed at least distance of the distinct vision.

Similarly final image is also assumed to be placed at least distance of distinct vision

In $\Delta P''O_0O''$,

$$\tan\beta = \frac{P''\Theta''}{D} \quad -(2)$$

If α and β are very small then

$\alpha = \tan\alpha$

$\beta = \tan\beta$.

$$\therefore m = \frac{\beta}{\alpha} = \frac{\tan\beta}{\tan\alpha}.$$

$$m = \frac{P''\Theta'' \times D}{\Theta \times P\Theta}$$

$$m = \frac{P''\Theta''}{P\Theta}$$

$$m = \frac{P''\Theta''}{P'\Theta'} \times \frac{P'\Theta'}{P\Theta}. \quad -(3)$$

In ΔPOQ and $P'OQ'$ are similar

$$\frac{P'Q'}{PQ} = \frac{OP'}{OP}.$$

$$\frac{P'Q'}{PQ} = \frac{V_0}{-u_0} \quad -(4)$$

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पृष्ठ के अंकों का योग

2009

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उ.पु. 4 पृष्ठ

माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल

1. केन्द्र की सील

परीक्षक के लिये

2 पर्यवेक्षक के हस्ताक्षर एवं दिनांक

3. केन्द्राध्यक्ष के हस्ताक्षर एवं सील

4 केन्द्र क्रमांक

6. परीक्षा का नाम

7. विषय 8 माध्यम

8. दिनांक

पृष्ठ

In $\Delta P'O, \theta''$ and $P'O, \theta'$

$$\frac{P''\theta''}{P'\theta'} = \frac{OP''}{OP'}$$

$$\frac{P''\theta''}{P'\theta'} = \frac{-v_e}{-u_e}$$

$$= \frac{+D}{+u_e} \quad -(5)$$

On putting value of (4) and (5) eq in (ii) eq

$$m = -\frac{v_o}{u_o}\left(\frac{D}{u_e}\right)$$

If image is at infinity $u_e = f_e$

$$m = \left(\frac{-v_o}{u_o}\right)\frac{D}{f_e}$$

If image is at least distance of distant vision

$$m = \frac{-v_o}{u_o}\frac{D}{u_e} \quad \text{— (4)}$$

$$\frac{1}{-f_e} = \frac{1}{-v_e} - \frac{1}{(-u_e)}$$

$$\frac{1}{+f_e} = \frac{1}{-v_e} + \frac{1}{u_e}$$

$$\frac{1}{u_e} = \frac{1}{f_e} + \frac{1}{v_e}$$

$$\frac{D}{u_e} = \frac{D}{f_e} + \frac{D}{D} \qquad [\because v_e = D]$$

$$\frac{D}{u_e} = \left(\frac{D}{f_e} + 1\right)$$

So,

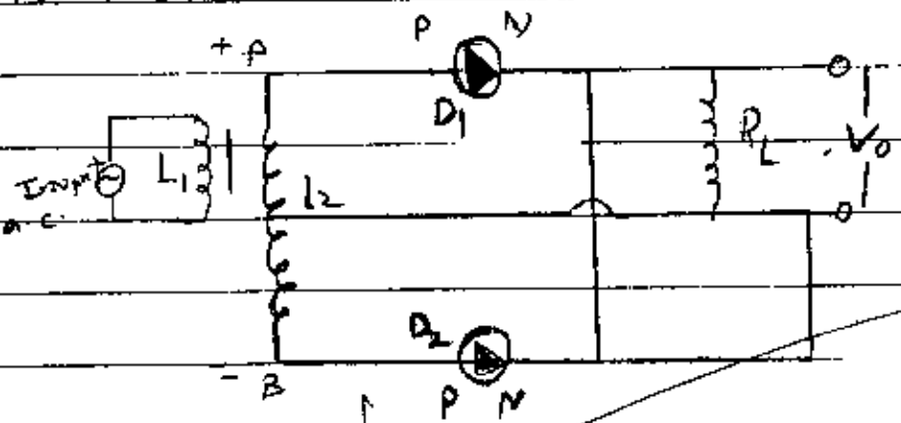
$$m = \frac{-v_o}{u_o}\left(1 + \frac{D}{f_e}\right)$$

Ans-14)

Labelled diagram and working :->

Consider an p-N junction diode as full wave rectifier

An input a.c. circuit is applied across the end of inductance L_1 in primary coil and there is secondary coil of inductance L_2 is also attached and there is R_L load resistance where output potential can be obtained from them. There are two diods D_1 and D_2 are attached to them. First diode D_1 is kept at positive terminal and D_2 is kept at negative terminal at point A and B.



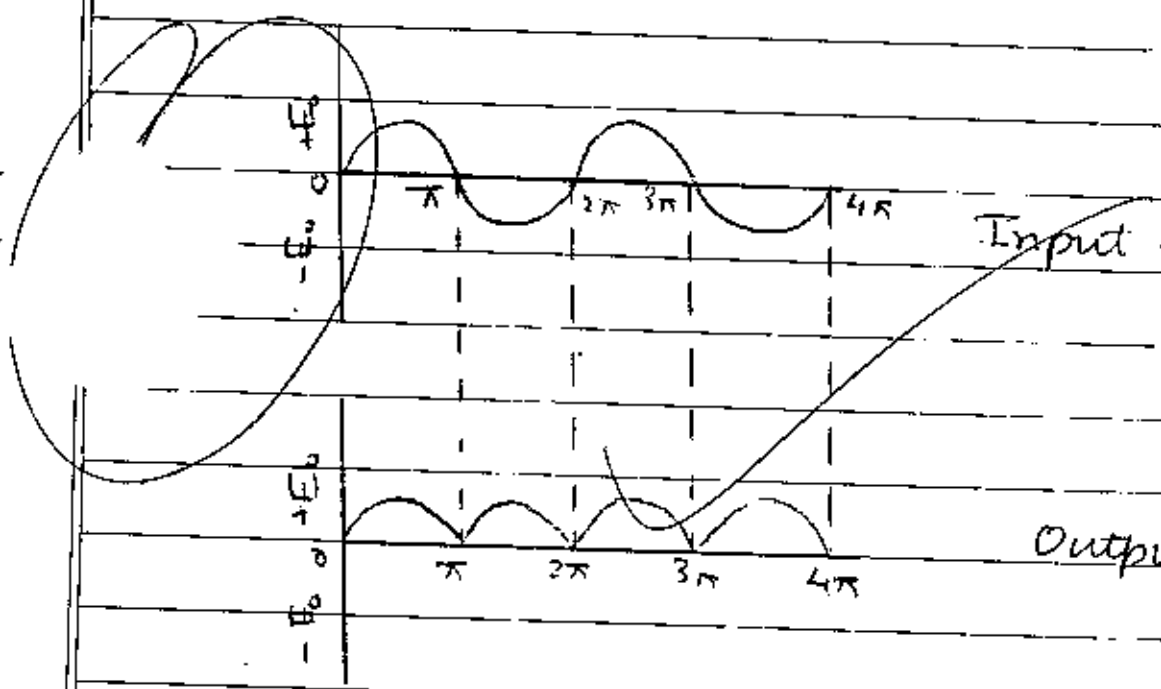
Full-wave rectifier

In the first half cycle, P-N junction of Diode D_1 is at positive of terminal and D_2 is at negative terminal so current flow through Diode D_1 as it is forward bias and output voltage can be obtained

through load resistance R_L.

In remaining half cycle, when D_1 is at negative terminal and D_2 is at positive terminal so current flow through Diode as it forward bias ~~current~~ Diode and in this way output voltage can be obtained by them.

Input and Output potential curve



Since the current obtained in both times so it is full wave-rectifies ~~I~~ 1st manner

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2009

माध्यमिक शिक्षा मण्डल, मध्यप्रदेश, भोपाल

1. केन्द्र की सील

2. पर्यवेक्षक के हस्ताक्षर व दिनांक

3 केन्द्राध्यक्ष के हस्ताक्षर को सील

511048

4 केन्द्र क्रमांक

6. परीक्षा का नाम H.S.S.C. Exam

7. विषय 8. माध्यम

8. दिनांक

पृष्ठ

परीक्षक के लिये
स्टीकर तीर के निशान से मिलाकर लगायें

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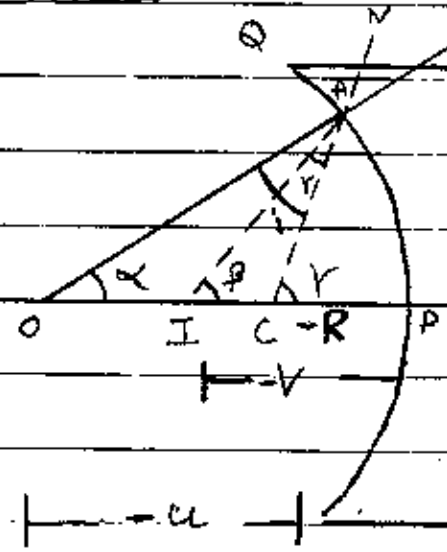
Ans-15)

Concave spherical surface



Consider QPR is a concave spherical surface and radius R. P is pole, O is point object placed on principal axis when ray OA from point O is made incident on concave spherical surface and it enters into another medium

पृष्ठ के अंकों का योग

कुल अंक

bending toward the normal CAN when produced backward, follows the path AB

But when AB produced backward they meet at a point I.

Thus I is the image of an object O.

We know that, from Snell law

$$_aM_g = \frac{\sin i}{\sin r} = \mu \text{ (let)}$$

If sin i and r are very small, then

$\sin i = i$

$\sin r = r$.

$$\mu = \frac{i}{r}$$

$$\boxed{i = \mu r} \quad -(2)$$

Let $\angle OAC = i$

$\angle IAC = r$

Let incident ray OP, refracted ray and normal ray makes an angle of α, β, γ respectively

In ΔDAC,

$\angle OCA = \angle OAC + \angle ADC$

$\gamma = i + \alpha$

[The sum of two interior angle is equal to exterior angle]

$i = \gamma - \alpha$ — (3)

Similarly

In ΔIAC,

$\angle ICA = \angle IAC + \angle AIC$

$\gamma = \gamma + \beta$

$\gamma = \gamma - \beta$ — (4)

Put in (2) eq.

$i = \mu\gamma$

$\gamma - \alpha = \mu(\gamma - \beta)$

$\gamma - \alpha = \mu\gamma - \mu\beta$

$\mu\beta - \alpha = (\mu - 1)\gamma$ — (5)

But Angle = Arc / Radius

Therefore

$$\alpha = \frac{AP}{OP} \quad \beta = \frac{AP}{PI} \quad \gamma = \frac{AP}{CP}$$

By sign convection

$OP = -u$ {distance of object}

$PI = -v$ {distance of image}

$PC = -R$ {Radius of curvature}

Therefore put these value in (5) eq. we get

$$\frac{\mu}{-v}\frac{AP}{} - \frac{AP}{-u} = \frac{(\mu-1)}{-R}\frac{AP}{}$$

$$\frac{\mu}{-v} - \frac{1}{(-u)} = \frac{\mu-1}{-R}$$

$$\boxed{\frac{\mu}{v} - \frac{1}{u} = \frac{\mu-1}{R}}$$

2009

माध्यमिक शिक्षा मण

पूरक उ.पु. 4 पृष्ठ

देश, भोपाल

1. केन्द्र की सील Asaul

2. पर्यवेक्षक के हस्ताक्षर व दिनांक

3. केन्द्राध्यक्ष के हस्ताक्षर की सील

4. केन्द्र क्रमांक 511 MSSC Exam

6. परीक्षा का नाम

7. विषय 8. माध्यम

8. दिनांक

परीक्षक के लिये
स्टीकर तीर के निशान से मिलाकर लगायें

उत्तर पुस्तिका का सरल क्रमांक 134077

1. परीक्षार्थी का अनुक्रमांक (अंग्रेजी अंकों में)

2. नीचे दिये प्रत्येक कालम में ऊपर दिये गये अनुक्रमांक के अंकों को उसी क्रम में शब्दों में लिखा जाए :-

पृष्ठ

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Ans - 16)

Expression for long solenoid by mutual inductance

Consides two long solenoid P and S which are placed co-axially each other. If N_1 be the number of turn of primary coil 'P' and N_2 be the number of turns of secondary coil 'S' Let the length of solenoid be 'l' A be the area of cross section of long solenoid. If I_p is the primary current in ~~it~~ flowing in primary coil therefore

Magnetic field intensity inside a long

... solenoid will be

$$B = \frac{\mu_0 N_1 I_p}{\ell} \quad -(1)$$

But magnetic flux linked with secondary coil will be ϕ ; therefore

$$\phi = BAN_2$$

where A = area of coil

N_2 = number of turn in secondary coil.

$$\phi = \frac{\mu_0 N_1 \times A N_2 I_p}{\ell}$$

$$\phi = \frac{\mu_0 N_1 N_2 A I_p}{\ell} \quad -(2)$$

But Mutual inductance

$$M = \frac{\phi}{I_p}$$

i.e. [If I_p current flow in circuit then magnetic flux linked

with coil is directly proportional to I_p current flow in it

$$\phi \propto I_p$$

$$\phi = M I_p$$

where M is a constant called mutual inductance.

$$\boxed{M = \frac{\phi}{I_p}}$$

$$M = \frac{\mu_0 N_1 N_2 A I_p}{l I_p}$$

$$\boxed{M = \frac{\mu_0 N_1 N_2 A}{l} \text{ Henry}}$$

This is an expression for mutual inductance of long solenoid

■ It depend upon following factors:-

① On the number of turn = If the number of turn in primary and secondary coil increases, the mutual inductance also increases.

② On absolute permability = Mutual inductance generally increasing

with increase in absolute permability

① On length of solenoid :- On increasing length of solenoid, mutual inductance between two long solenoid decreases

② On area of solenoid = On increasing the area of solenoid in secondary coil, the mutual inductance increases