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-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College (Autonomous), Kolhapur

Department of Physics

Notice (M.Sc.II) **Date : 10/01/2022**

All the students of M.Sc. II Physics are hereby informed that, their internal examination will be held through online mode from **19/01/2022 to 22/01/2022.** The time table is given below.

Sr. No.	Course Code	Name of the Course	Date	Time	Marks
1	CC-1112C	Nuclear and Particle Physics	19/01/2022	11am to 12.00 noon	20
2	CBC-1113C	Thin Film Deposition Technology	20/01/2022	11am to 12.00 noon	20
3	CC-1114C	SSP-I Thin Solid Films : Deposition and Properties	21/01/2022	11am to 12.00 noon	20
4	CC-1115C	SSP-II Semiconductor Physics	22/01/2022	11am to 12.00 noon	20

Shri. C. J. Kamble
Coordinator

Prof. Dr.M. M. Karanjkar
Head of the
Department of Physics
Vivekanand College, Kolhapur

Dr. C. J. Navathe
Controller of
Examination
Vivekanand Autonomous
College, Kolhapur.

Dr.R .R. Kumbhar
PRINCIPAL
Vivekanand College
Kolhapur

VIVEKANAND COLLEGE ESTD JUNE 1964 KOLHAPUR - 416003

Seat No.

Vivekanand College , Kolhapur (Autonomous).

M. Sc. Part-II(Semester-III) Internal Examination Oct/Nov.2021

Subject: Physics

Title: Nuclear and Particle Physics

Total Marks: 20

Time - 11:00 am - 12:00 pm

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Figures to the right indicate full marks.
4) Use of Scientific calculator or Log table is allowed.

Q. 1 Select most correct alternative (05)

i) Primary cosmic rays consist of ……..
a) Electron b) Neutron c) Proton d) Mesons

ii) Positron was discovered by ……
a) Carl D. Anderson b) J. J. Thomson
c) Ernest Rutherford d) James Chadwick

iii) Deuteron is combination of proton and ……
a) Electron b) Neutron c) α – particle d) Mesons

iv) Which of the following is not fundamental particle ……
a) Electron b) Neutron c) Proton d) α – particle

v) Cosmic rays are produced in ……
a) near moon b) near sun c) in volcanoes d) in outer space

Q.2) Attempt any One (10)

i) Elucidate in brief "Cosmic Rays".
ii) What is matter & antimatter? Explain with special reference to positron and antiproton.

Q.3) Attempt any One (5)

i) Write a note on cosmic rays showers.
ii) Define i) Primary cosmic rays
ii) Secondary cosmic rays
iii) Soft component of cosmic rays
iv) Hard component of cosmic rays

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Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College (Autonomous) Kolhapur
Department of PhysicsM.Sc. II
2021-22
Attendance Sheet
Paper: Nuclear and particle physics
Date:19/01/2022

Roll. No.	Name of Candidate	Sign
1	Komal Jotiram Bhosale	
2	Priyarani Ravindra Burud	
3	Pratiskha Pandit Chogale	
4	Sunil Ratnakar Chougae	
5	Rishikesh Tukaram Devtale	
6	Pranav Shankar Ghosalkar	
7	Gouri Govind Jadhav	
8	Manasi Khanderao Jagadale	
9	Prasad Vilas Kamble	
10	Snehal Narayan Mane	
11	Priyanka Sanjay Patil	
12	Shweta Shital .Patil	
13	Sujata Anandrao Patil	
14	Bhagyashri Mahadev Pednekar	
15	Prajyot Sunilkumar Pradnyasagar	
16	Manisha Shivram Sawant	
17	Sadiya Mustafa Shaikh	
18	Rutuja Subhash Shetti	
19	Swapnil Sakharam Shinde	
20	Neha Sunil Thorat	
21	Yogita Vishnu Zirange	
22	Girish Suresh Adake	

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 16/20

Roll No. : 1346

Class : M.Sc-II Sem-III

Subject : physics

Test / Tutorial No. :

Div. :

Paper-I * Nuclear and Particle physics *

Q.1

1) None of the above

2) Maximum

3) Greater

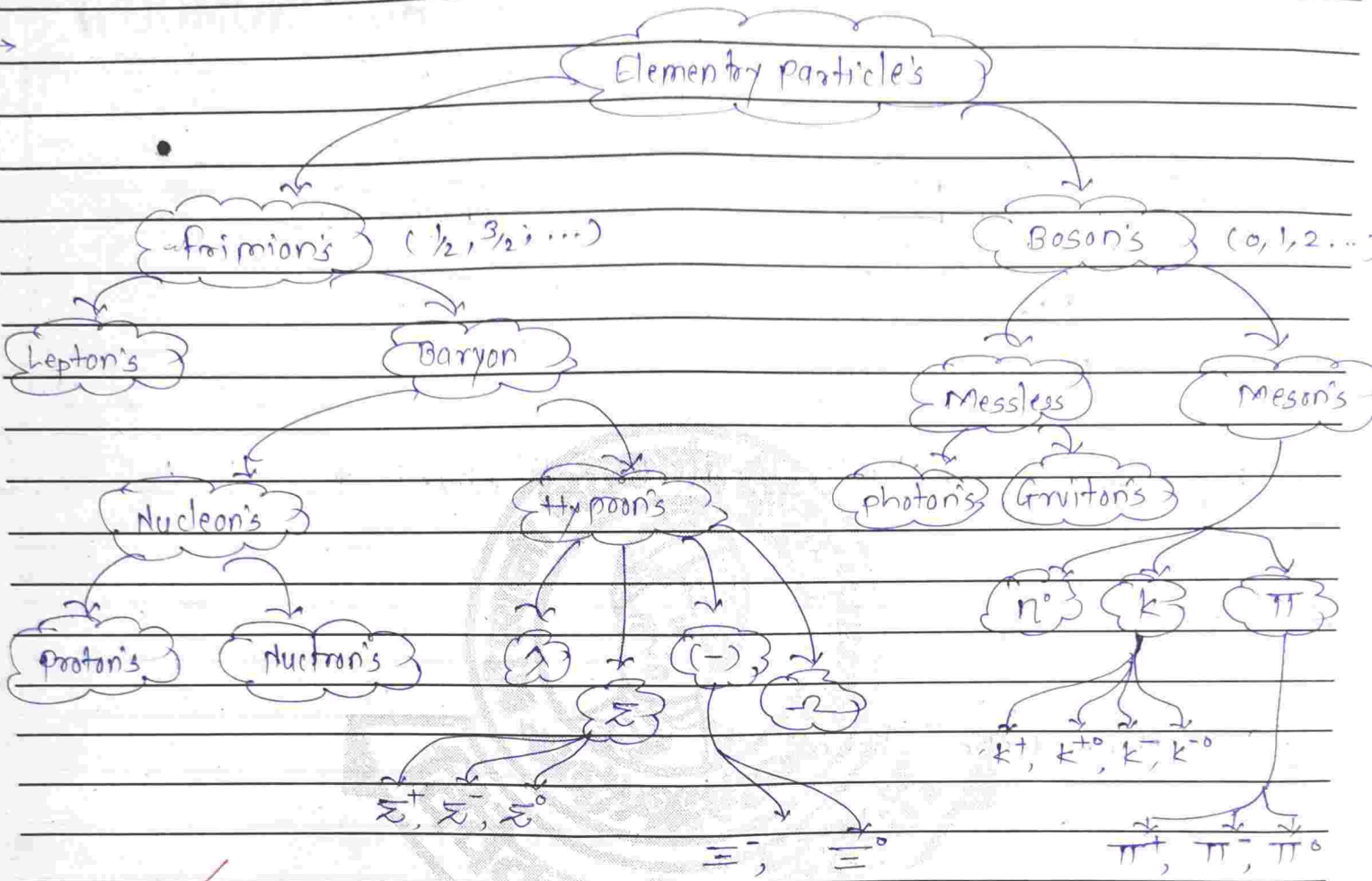
4) 2

5) Muons

4

The classification of Elementary particle's as given below.

→



The above the tree like shape digram are formation of is best structure of Elementary transformation of particle's & Anti- partical's

It's discovered by "Dired" in the by experimently proved.

These the formation are divided in two two parts is Baryon and Meson's is the most of the main part are formation of the particles & the Anti- particle.

* **Meson's** -

The intraction of the particle's in which the mass of mags & the speed & their of the spin of the electron's & the electro magnetic conservation but is elementary is the formation of zero spin is the meson's will be the formation.

π- Meson's -

- It is the meson's is dicovered by 1947 in the Anesen is best of meson's.
- It's are anti- partical are pasitive, negative and natural are the formation

e.g
- π^+ - positive
- π^- - Negative
- π^0 - Natural.

k- Meson's -

- It is the meson's is the mass & the spin is zero.
- Then the partical k' is the Anti- partical

e.g - k^+, k^{+0}, k^-, k^{-0}

η- Meson's -

- It is the partical are masses & the spin was 7×10^9 etc. is are formation
- η - Meson's are the traks in the formation of the "Bobel chember" is mostly colliding the partical are the formation.

The Brayon's is 'Hypron' itisb divded in two four groulp.

Brayon's -

In the formation of elementy partical is the $\frac{1}{2}$ level of spin of is called the fremion's

In the intracting of the conservation of the partical.

Nucleon's - It is Spin of the interaction in the partical & one of Anti- partical
The Nucleon's are dived by protons (p) & the nutron's

Hyperon's - Four type's

1) **λ - Hyperon** - • It is the partical & one of anti-partical is '2' part's
• λ^-, λ^0 is the negative or Anti-partical.

2) **Σ - hyperon** - • It is the partical is six. part are the follow's. Σ^+, Σ^-, Σ^0
• and the anti- partical
$\bar{\Sigma}^+$, $\bar{\Sigma}^-$, $\bar{\Sigma}^0$.

3) **Ξ - hyperon** -
• It is also name as Cascate hyperon in the Four type's formation partical,
• Ξ^- & Ξ^0 is the negative & naturle is will formation
• and the $\bar{\Xi}^-$ & $\bar{\Xi}^0$ is the also formation

4) **Ω - hyperon** -
• These type of hyperon is the formation of two part's
• Ω^- & $\bar{\Omega}$ are negative & positive formation

These are the all of the above formation is such called as Elementry partical : classification

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Suppliment No. : 1

Roll No. : 1346

Class : M.Sc-II Sem-III

Subject : Physics (Paper-I)

Test / Tutorial No. :

Div. :

The above classification is also parts the in electron's proton's, neutron & the neutrion's In the formation like the Antipartical's OR the phenomenon is formation like structural formation is as the basis of Dired exprimenal formation.

(8)

2. Antiparticle's -

In the formation of partical in Dired exprimentily it will be the formation of same of partica in opposition will the change the entracting the converge is the partical is called Anti-particle's

e.g → Σ^+ & $\bar{\Sigma}^+$, and $\bar{\Sigma}^-$, Σ^-, Σ^0, $\bar{\Sigma}^0$

In the Antiparcle's are clssfied by the basis of Elementry particle's

1) Electron's & Positron -

It in these partical are say's the electron are the denoted e^- is the negativily charged but the same as the Anti-partical's formation positron e^+ is the opposition formation in the elementy partical. The partical & Anti-partical is colliding the formation is e^- & e^+ is the ν-component formation By the eqn given below.

$$e^- + e^+ = 2\nu \quad \text{---} (*)$$

2) Proton - If the elementry partical is proton is one of the Anti. elementy formation of proton is denoted (p) In the entracting the the beloco the innilate & the nuclei is give below eqn

The proton.

$$p + p = \pi^+ + \pi^+ + \pi^- + \pi^0$$

In the formation of nuclei is,

$$p + n = \pi^{+} + \pi^{0} + \pi^{0} + \pi^{+} - \pi^{-} \quad \text{——} \ (1)$$

It is formation of neutrons in the partical & Anti-partical's

Neutron – If the Neutron are highly dark's in the formation of the particle's & the Anti-particle's is is zero charge partical in the elementry partical.

It will be the denoted by n.

In the partical & Anti-partical eqn form is

$$n = e + \nu \quad \text{——} \ (2)$$

Neutrino –

In the formation Neutrino is Basis of clock wise formation in spin & the given their masses will be also clock wise direction is formation

In the elementry particle's is inraction in the conservation of momentum.

If all of the above type's is is also part of Elementry partical classification bases.

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	15.11.21

Suppliment No. : 01

18/20

Roll No. : 1359

Class : M.SC-II

Subject : Nuclear & particle physics.

Test / Tutorial No. :

Div. :

Q.1)

1) ~~Soft~~ Hard

2) Maximum

3) Greater

4) 2

5) muons

8

Q.2)

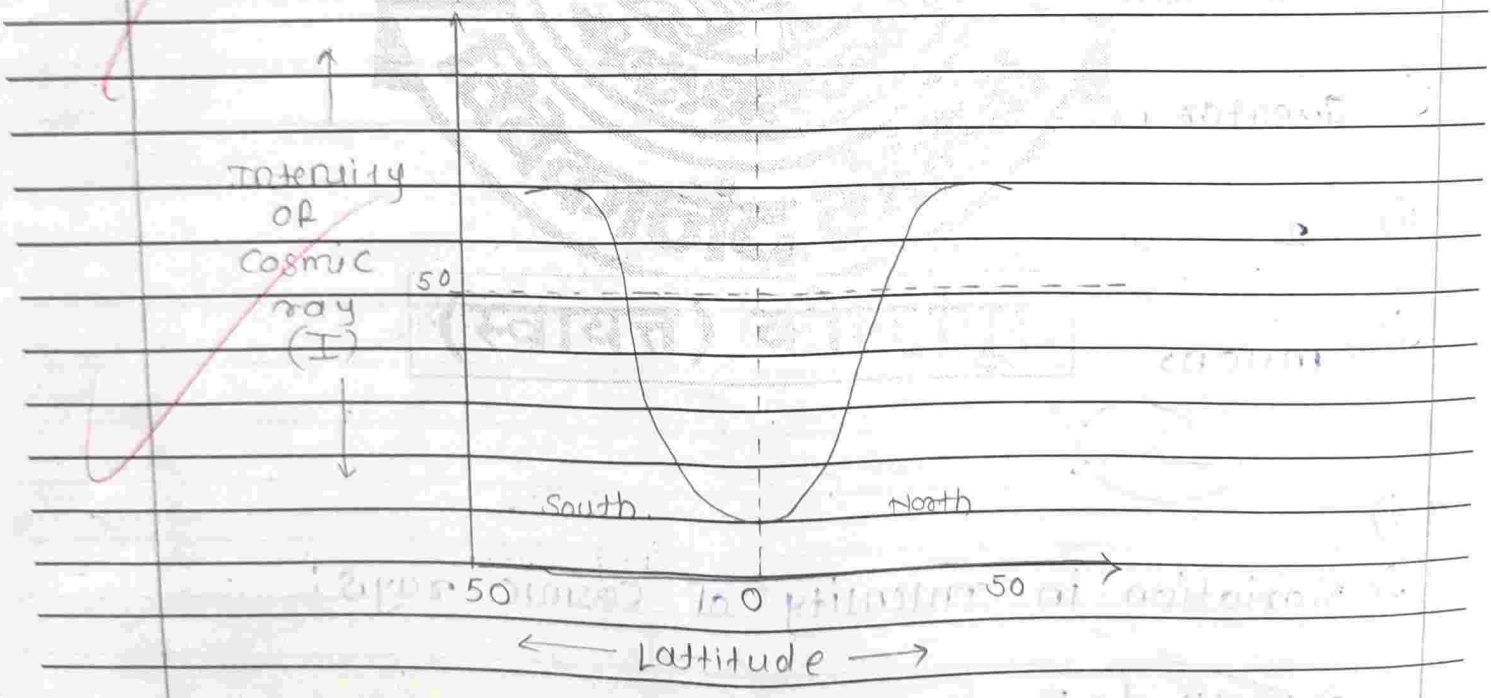
2) Variation in Intensity of Cosmic rays:

a) Lattitude:

• The variation in intensity of cosmic rays in a geomagnetic lattitude is called as lattitude effect: At earth's magnetic poles intensity of cosmic rays is maximum.

then the intensity of cosmic rays due to magnetic pole. The cosmic rays of intensity at equitor is intensity is minimum at the 10 % less than intensity terminal lattitude.

- since the variation of cosmic rays intensity is easily explane because the base of magnetic field of earth atomspheres.
- Hencel, the against we can de observed the cosmic ray particle is very high charge particle.
- The primary cosmic rays is reflected to the earth's atomsphere ~~they can easily~~ at verticaully deflection, they can easily reflected back to earth's of atomsphere.



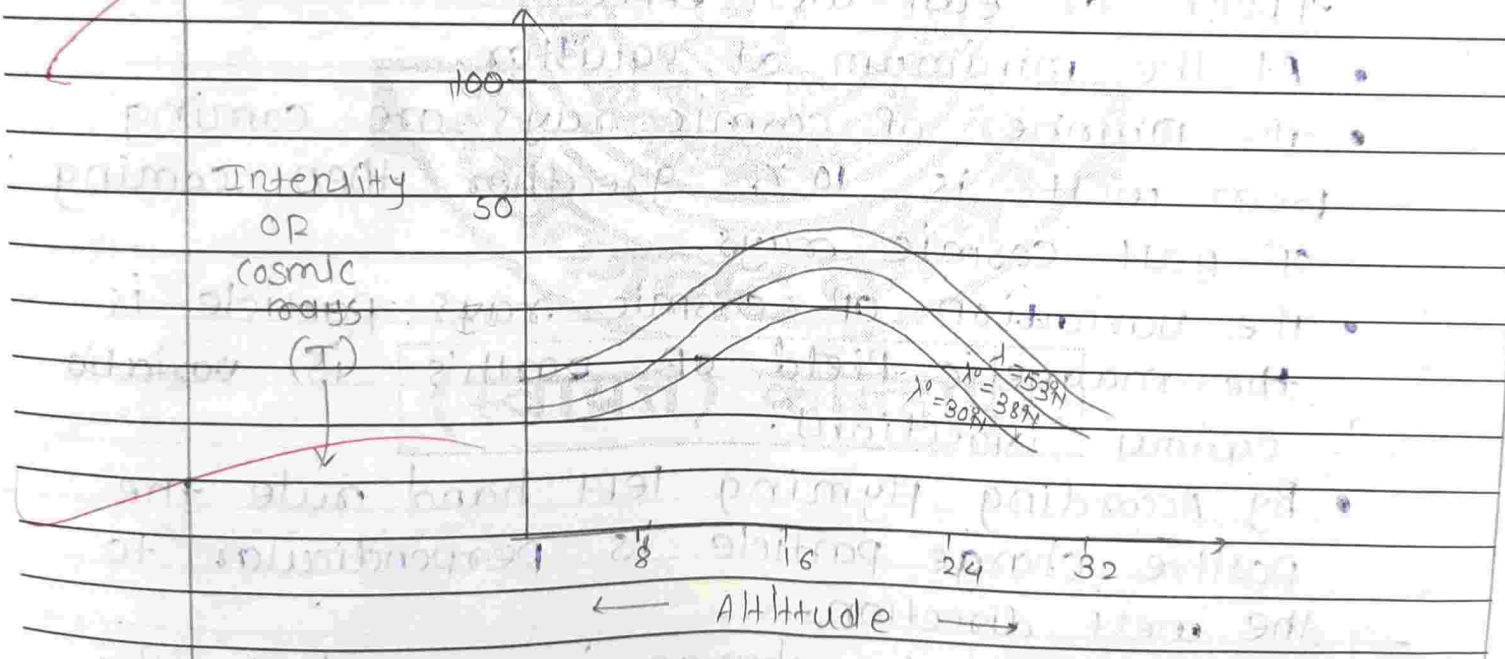
- The intensity of cosmic rays at equicator is perpendicular to magnetic field of earth therefore, the exerted of deflection is minimum they can also intensity of cosmic

ray dell suffer maximum depletion.

- The intensity of cosmic ray at equitor is parallel to the earth's atomsphere magnetic field. Therefore, the excreated the depletion of cosmic ray intensity maximum suffer the maximum depletion.

b) Altittude :

- It is variation in intensity of cosmic rays are increases at altittude but they are not on top off then the intensity of cosmic rays is against down.
- After increases altittude they are intensity of cosmic rays are false.



- The variation of intensity of cosmic rays are increases at increasing altittude at hight 20-25 km and then againt the intensity is false. As clear as fig.

- The variation cosmic rays intensity is increases with increasing at geomagnetic lattitude.
- The primary cosmic rays component are increases with increasing their alltitude.
- The cosmic ray intensity at various surface they are unstability.

c) East - West effect:

- The number of cosmic rays are coming from west is greather than coming of cosmic rays of east is called as Azimathal effect or east-west effect:
- At the minimum at equittor.
- The number of cosmic rays are coming from west is 10 %. greather then coming of east cosmic rays.
- The variation of cosmic rays particle is the magnetic field of earth's is ~~variatio~~ various directions.
- By According flyming left hand rule the positve change particle is perpendicular to the west direction.
- And the negative charge is parallel to the east direction.
- Her I_W & I_S is the cosmic rays of west & cosmic rays of west respectively.

SUPPLIMENT

Signature of Supervisor	
Suppliment No. : 02	Subject : Nuclear & particle Physics
Roll No. : 1359	Test / Tutorial No. :
Class : M.Sc-II	Div. :

- $\frac{I_W - I_E}{I_W + I_E}$
- At high energy altitude at high energy is 0.25.

Q.3)

1)

a) primary cosmic Rays :-

- The primary cosmic rays are present in outer space of earth's atomsphere.
- The primary cosmic rays is beyond to the earth's atomsphere is called primary & primaries.
- This primaries or rays are hard constituent components.
- They are present by 90 % is hydrogen atom, 9 % is helium atom and only 1 % is steel heavier nuclei.
- It is mainly only Li & Ne particle obeyed.

- In prelent of primary cosmic rays electron, positrons, photons.

b) secondary cosmic rays:

- The secondary cosmic rays are perent in earth sea level at above 20km.
- The secondary cosmic rays are nearly by earth's of perimary cosmic ray their are affect at earth's atomspheric gases.
- The mesons in secondary cosmic rays, constitude in soft component.
- At consitude by π - mesons particles their are exist by electron, positron & photon.

$$\pi^0 \longrightarrow e^+ + e^-$$
$$\pi^+ \longrightarrow e^+ + \nu$$
$$\pi^- \longrightarrow e^- + \nu$$

- The nuclei is not interact with in sea level of mesons particle.
- there are μ - meson is 79 % in sea level of e^-.
- 19 % of nuclei in e^- of ν - mesons.
- and only one are heavier phone

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Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM III Internal Examination (2021-22)

Thin Film Deposition Technology

Paper code: CBC-1113C

Date: - 2001-2022 Time :- 2.00 pm-3.00 pm Total Marks: 20

Day: - Tuesday

Instructions:-

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table and calculator is allowed.

Q.1 Select Correct Alternative: **(5)**

i) In _____type of Raman scattering the wavelength of scattered photon increases than incident photon.

(a) stokes (b) anti-stokes

(c) Rayleigh (d) none of these

ii) Raman scattering from classical theory is based on _____ of molecule.

(a) polarization (b) interference

(c) diffraction (d) energy

iii) _____ spectroscopy plays a very important role in structure determination of molecule.

(a) vibrational (b) rotational

(c) ESR (d) none of these

iv) In ESR technique the splitting of magnetic energy level is done due to applied static _____.

(a) electric field (b) magnetic field

(c) both (a) &(b) (d) none of these

v) The energy level difference in ESR splitting is given by_____.

(a) $\Delta E = g\mu_B B_Z$ (b) $\Delta E = -g\mu_B B_Z$

(c) $\Delta E = \mu_B B_Z$ (d) $\Delta E = -\mu_B B_Z$

Q.2 Attempt any one **(10)**

i) What is Raman spectroscopy. Explain the classical theory of Raman scattering.

ii) What is ESR spectroscopy. Explain the construction and working of ESR spectrometer.

Q.3 Attempt any one **(5)**

i) Write a note on Fourier Transform Raman Spectrometer (FTRS).

ii) Give the transition spectra of iron and chromium.

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Vivekanand College (Autonomous) Kolhapur

Department of PhysicsM.Sc. II

2021-22

Attendance Sheet

Paper: Thin Film Deposition and other Technique

Date:20/01/2022

Roll. No.	Name of Candidate	Sign
1	Komal Jotiram Bhosale	
2	Priyarani Ravindra Burud	
3	Pratiskha Pandit Chogale	
4	Sunil Ratnakar Chougae	
5	Rishikesh Tukaram Devtale	
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13	Sujata Anandrao Patil	
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20	Neha Sunil Thorat	
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22	Girish Suresh Adake	

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ESTD JUNE 1964
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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

15/20

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1338

Class :

Subject : Thin film Deposition Tech.

Test / Tutorial No. : Internal.

Div. :

Q. 1

1] ~~anti~~ - stokes

2] Polarization.

3] Vibrational

4] Electric Field

5] $\Delta E = g \mu_B B_z$.

04

.2.

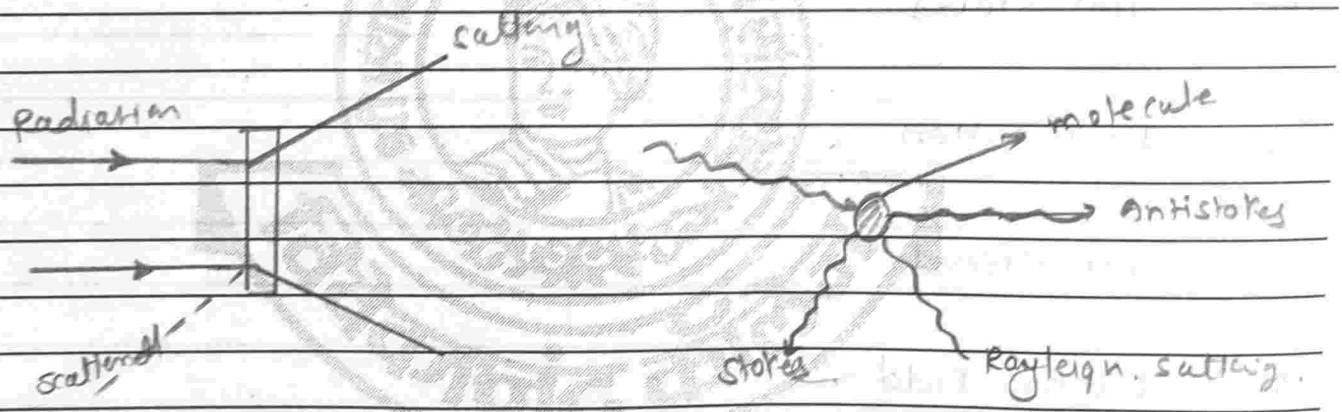
1] Raman Spectroscopy

① The Raman Spectroscopy is discovered by C.V. Raman and K.J. Krishnan in 1928.

2] Raman spectroscopy is a absorbtion spectroscopy.

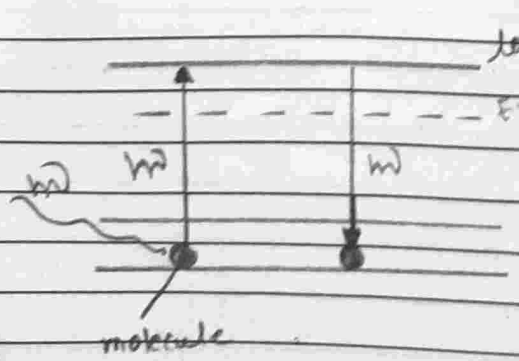
3]. In Raman Spectrocy. Study of molecular structural information of vibrational and Rotational Spectra.

4] In incide radiation on molecule get scattered. and form Three Types Rayleigh scattering, Stokes. and. antistokes.



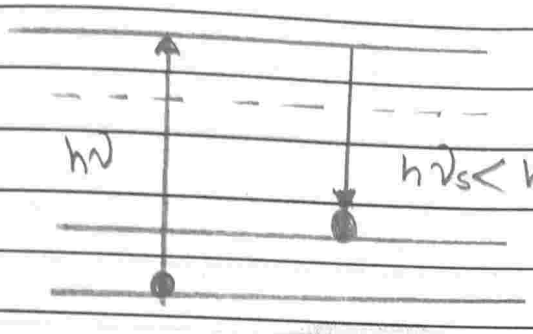
① Rayleigh scattering.
The incident light photon and scattered light are equal.

② It is known as Elastic scattering.



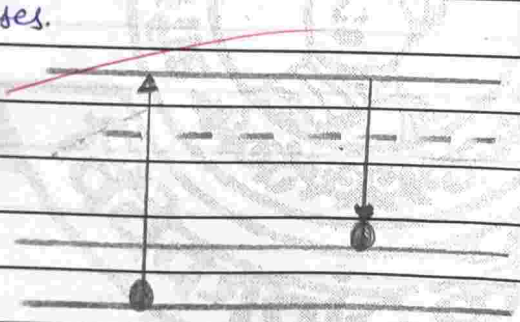
② Stokes scattering.

The molecule absorb the energy of radiation. The loss of the energy of photon wavelength will decreases.

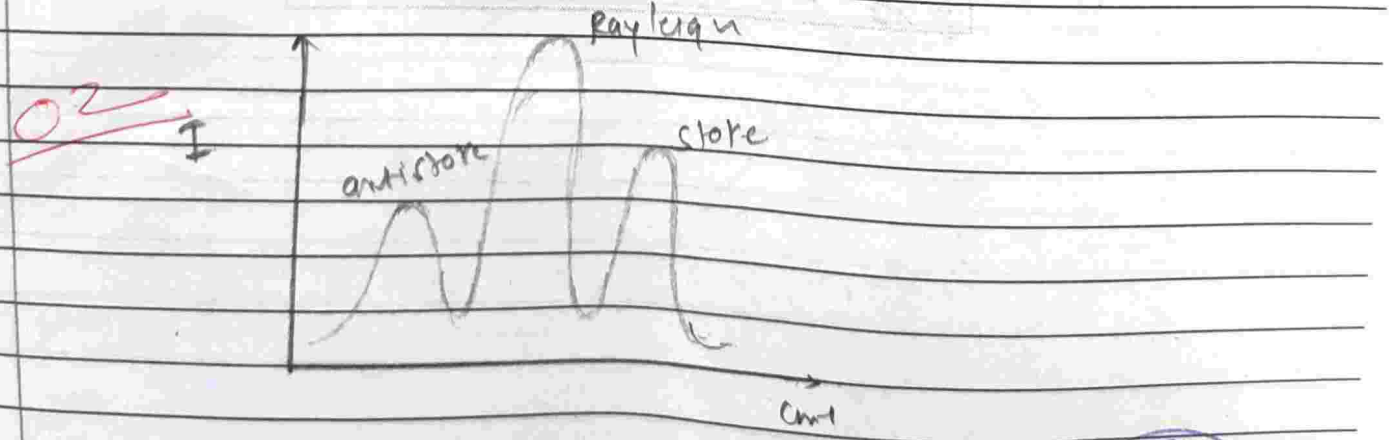


③ Antistokes

The molecules absorbed the energy from incident energy. The loss the energy of photon the wavelength will decreases.



The intensity of stokes are greater than antistoke.

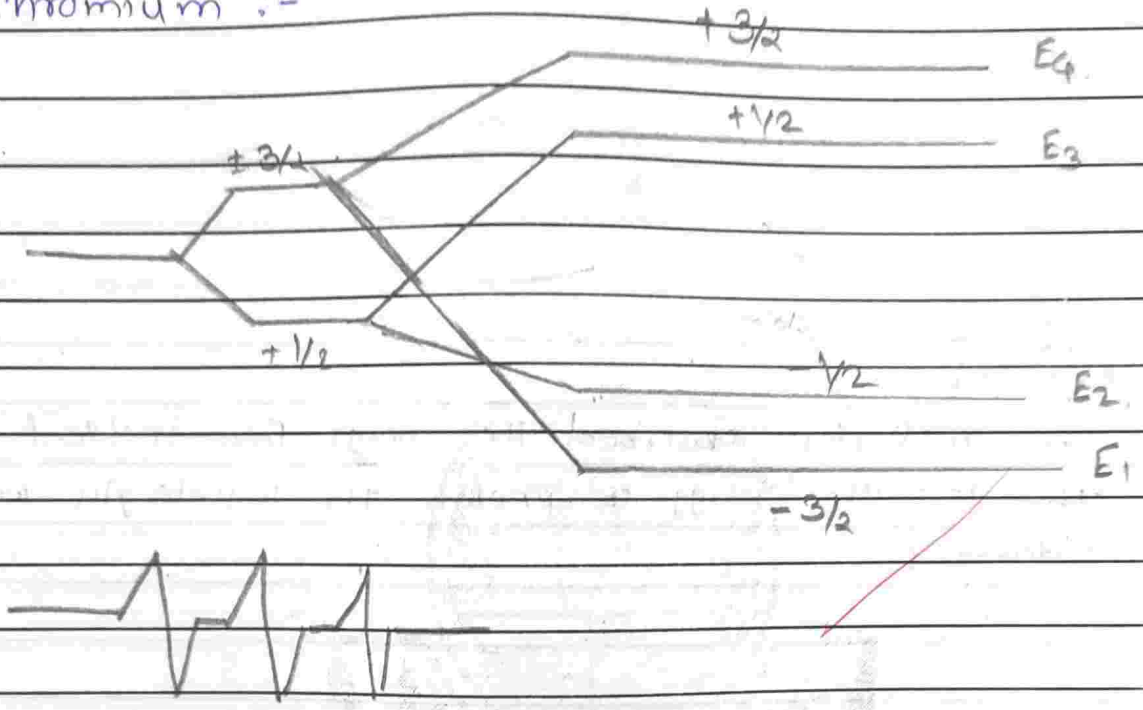


Q. 3.

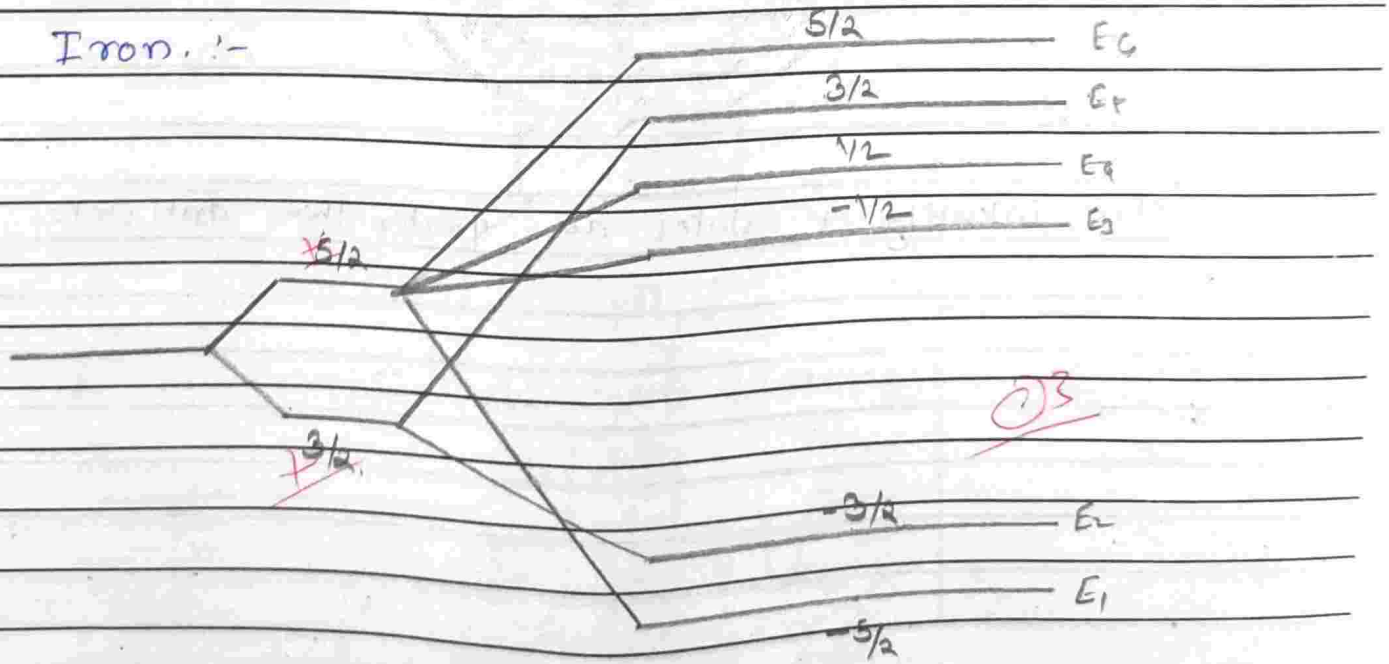
2] Transition spectra. Iron and chromium.

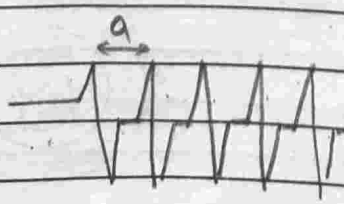
→

Chromium :-



Iron. :-





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SUPPLIMENT

Signature of Supervisor

Suppliment No. :

Roll No. :

Class :

Subject :

Test / Tutorial No. :

Div. :

Q. 2.

1]

→ Classical Theory of Raman.

The discovery Raman in 1928. In classical Theory based on Polarization. The molecule placed in electro statatic electric field. Then the charge are deformed Then ~~ind~~ we get induced Dipole moment μ_i

In magnitud μ_i is depence upon intensity of ~~electric~~ field (E) and porizibility (α)

$$\mu_i = \alpha E \quad -(1)$$

The molecule have a energy of molecule frequency in given time is

$$E = E_0 \sin 2\pi \nu_i t \quad -(2)$$

$$\mu_i = \alpha E_0 \sin 2\pi \nu_i t \quad -(3)$$

The polarizability changes so

$$\alpha = \alpha_0 + \beta \sin 2\pi \nu_0 t \quad \text{--- (1)}$$

$$\mu_i = (\alpha_0 + \beta \sin 2\pi \nu_0 t)(E_0 \sin 2\pi \nu_i t)$$

$$\mu_i = \alpha_0 E_0 \sin 2\pi \nu_i t + \beta E_0 \sin 2\pi \nu_i t \sin 2\pi \nu_0 t.$$

$$\sin A \cdot \sin B = \frac{1}{2}\left[\cos(A-B) - \cos(A+B)\right]$$

$$\mu_i = \alpha_0 E_0 \sin 2\pi \nu_i t + \frac{1}{2}\beta E_0 \cos(\nu_i - \nu_0) 2\pi t - \frac{1}{2}\beta E_0 \cos 2\pi(\nu_i + \nu_0) t.$$

$\alpha_0 E_0 \sin 2\pi \nu_i t$ = is Rayleigh scattering.

$\frac{1}{2}\beta E_0 \cos(\nu_i - \nu_0) 2\pi t$ is Stoke scattering.

$-\frac{1}{2}\beta E_0 \cos(\nu_i - \nu_0) 2\pi t$ = is Antistoke.

The Rayleigh have same energy, stokes has low energy an antistoke have high energy.

06

Vibrational Spectroscopy :-

→

Vibrational spectroscopy plays a very important roll in structur determination of molecule.

$$E = h\nu_e(1-2x_e) \text{ ergs}$$

$$E = h\nu_e\left(v+\tfrac{1}{2}\right) - h\nu_e x_e\left(v+\tfrac{1}{2}\right)^2$$

The absorbed the energy a molecule gives a Transition $V=0$ to $V=1$. $J = 0, \pm 1, \pm 2,$

$$E_0 = \frac{h\nu_e}{2} - \frac{h\nu_e x_e}{4}$$

$$E_1 = h\nu_e \frac{3}{2} - h\nu_e x_e \frac{9}{4}$$

$$\Delta E = h\nu_e\left(1-2x_e\right) \text{ erg.}$$

In Rotational Spectra.

In Rotational spectra having Diatomic mole.

The energy

$$E = Bh\,J(J+1)$$

$$B = \frac{h}{8\pi^2 I_e}$$

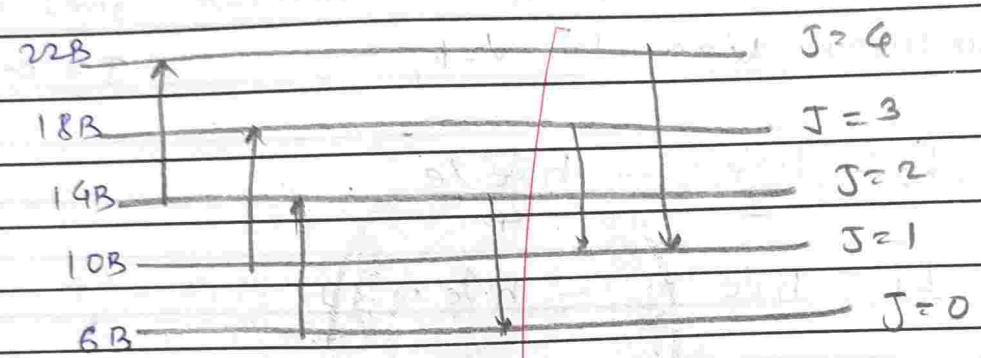
$J = 0, \pm 1, \pm 2,$

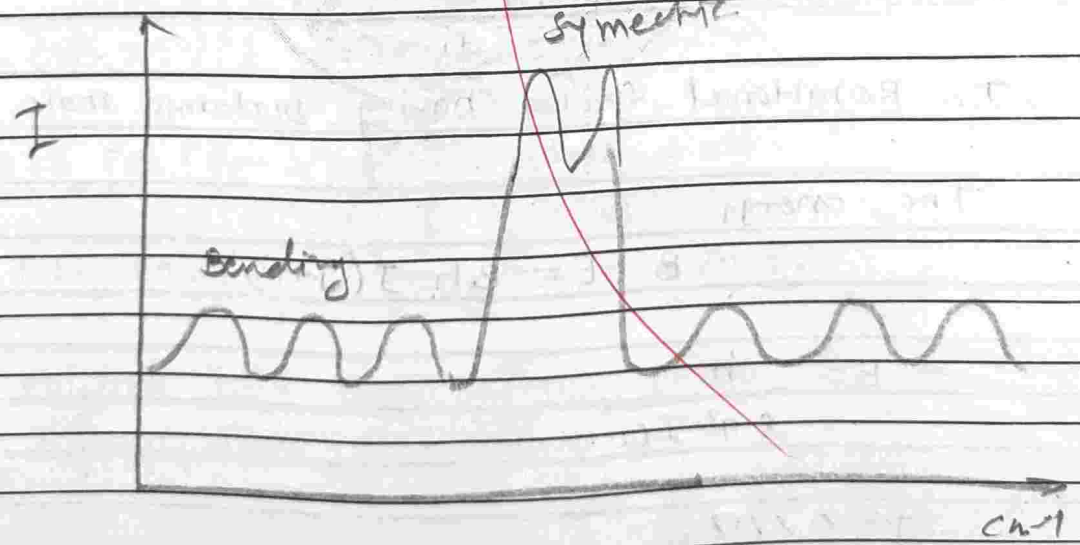
The Transition $\Delta J = J+2.$

$$\Delta E = \Delta E_{J \to J+2} - \Delta E_{J \to J}$$

$$= Bh(J+2)(J+3) - Bh(J+1)$$

$$\Delta E = Bh(4J+6)$$





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12/20

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Suppliment No. :

Roll No. : 1357

Class : msc - II

Subject : Thin film deposition

Test / Tutorial No. :

Div. :

1) ⇒ (a) ✓

2) ⇒ (a) ✓

3) ⇒ (d) ✗

4) ⇒ (b) ✓

5) ⇒ (a) ✓

04

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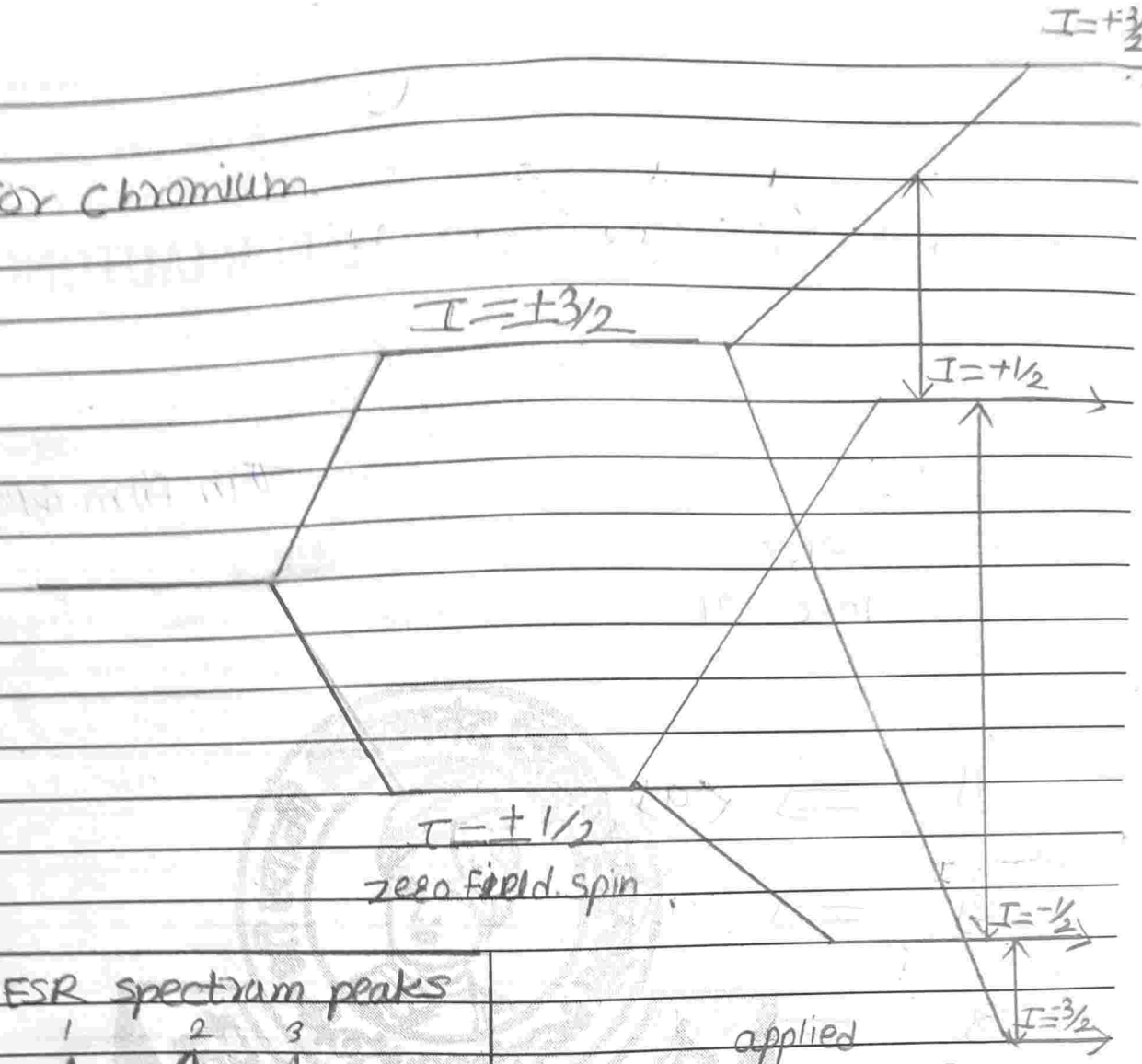
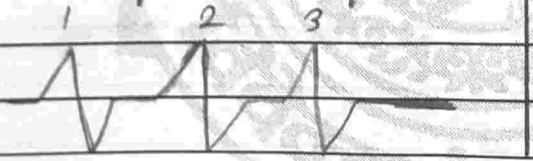
93)

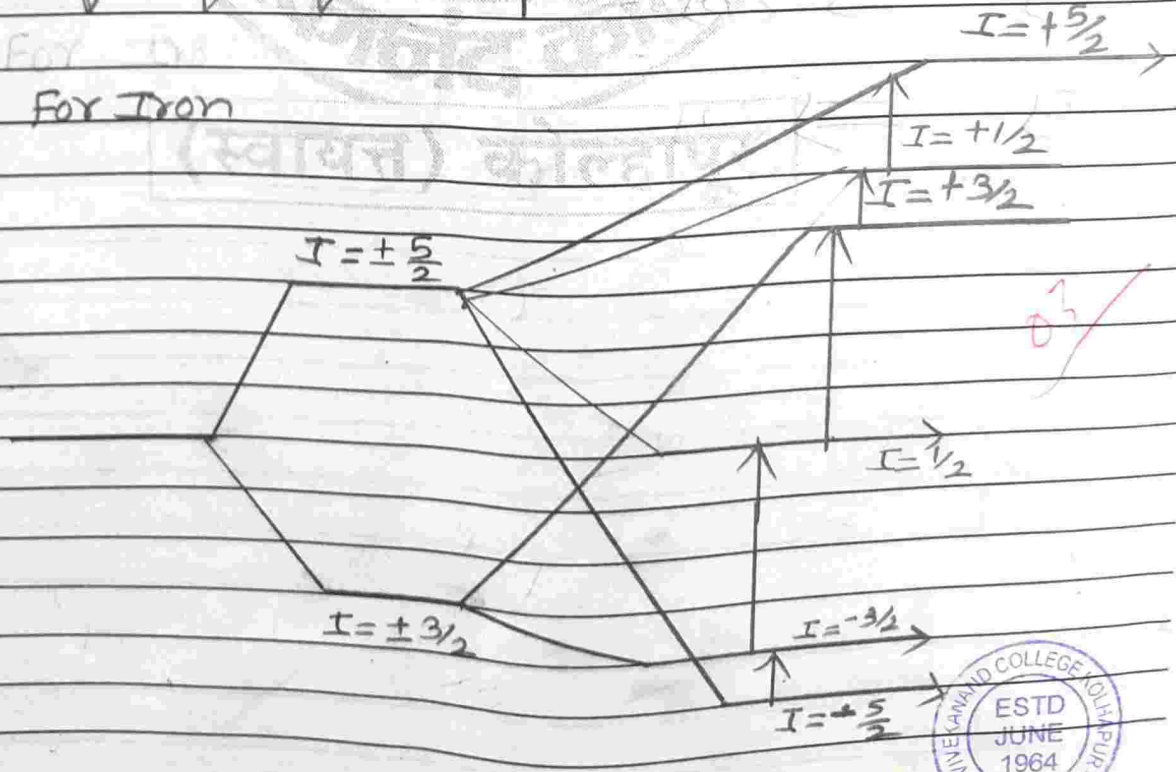
ii) For Chromium



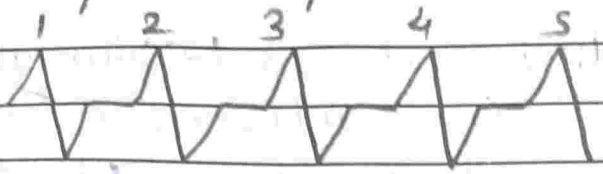
ESR spectrum peaks



For Iron



ESR spectrum peacks



Q2)

ESR Spectroscopy ⇒

1) Esr spectroscopy is also called as electron paramagnetic resonace (EPR) or electron magnetic Resonance. (EmR)

2) It is discovered by Zoviski in 1944

3) It is non-destricutive technique. It used to identify the propesty of unpaired electrons.

ESR Techniques

It is the branch of absorption spectroscopy in which radiation having Frequency in microwave region is absorbed by paramagnetic. meterial to intuced For transition beth magnetic energy level of electron with unpaired spin.

The spliting of magnetic energy level of electron is done by applying static magnetic Field.

ESR Phenomenon is shown by Following material

1) Atom having odd No. of electron.
e.g NO_2, ClO_2, Cl, N, P, K

2) Ions having partely Filled inner electron shell

3) Free radicals having unpaired electrons
e.g O_3, methely-ethely group

4) molecules having paired electron and zero magnetic Field.

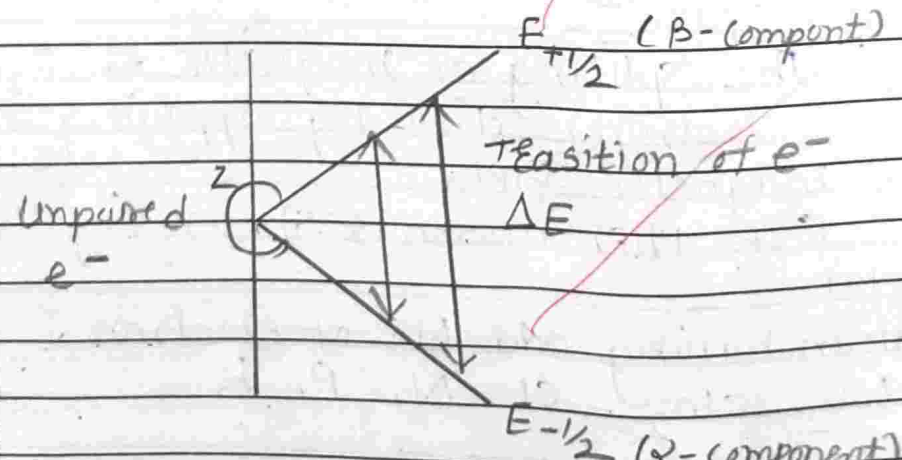
5) Raze earth metal → Neodynium (Nd), lanthanium (La) Yettrium (Y,) Yeterbium (Yb)

6) pueamagnetic material → Al, Cr, Sc, Silver, gold, Ti, V.

Principal → ESR Sepectroscopy is based on absorption of microwave radiation by an unpaired electron which is exposed in strong magnetic Field.

The magnetic energy level are split into different energy level. The magnitude of spliting of energy level is depends on strength of magnetic Field.

The transition of electron from lower state to exited state is happen when wavelength of or (Frequency) of incident radiation is equal to the energy difference of that energy level.



Seat No.		Ques. Paper code	

Vivekanand College, Kolhapur (Autonomous)

M.Sc. Part- II (Sem-III) Internal Examination (2021-2022)

Course Code: CC-1114C

SOLID STATE PHYSICS- I

Thin film deposition techniques &

Other Properties

Time - 11:00 am - 12:00 pm Marks: 20

Instructions: 1) All the questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat labeled diagrams wherever necessary.
4) Use of log table/calculator is allowed.

Q. 1) Select most correct alternative. **(5)**

i) If relative permeability is denoted by μr, which of the following is correct about diamagnetic material?
A) Relative permeability is equal to zero
B) Relative permeability is less than zero
C) Relative permeability is greater than zero
D) Relative permeability is equal to infinity

ii) Paramagnetic Curie temperature in Kelvin for iron is equal to .....
A) 2195 B) 495 C) 895 D) 1095

iii) The ratio of the intensity of magnetization to the magnetizing field H is called as magnetic .....
A) permeability B) susceptibility C) induction D) moment

iv) The intensity of magnetization is given by .....
A) M/A 3) m/V C) m/A D) mA

v) Hall voltage is directly proportional to.....
A) current B) electric field C) magnetic flux D) temperature

Q.2 Attempt any One **(10)**

i) Explain the cathode sputtering. Discuss the factors affecting glow discharge.

ii) Explain process variables in CVD method. Explain preparation of a Si by photo-CVD method.

Q3. Attempt any One (5)

i) What are the applications of plasma enhanced CVD

ii) Explain electron beam evaporation for obtaining high quality films.

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Vivekanand College (Autonomous) Kolhapur
Department of PhysicsM.Sc. II
2021-22
Attendance Sheet
Paper: Solid State Physics-I
Date:21/01/2022

Roll. No.	Name of Candidate	Sign
1	Komal Jotiram Bhosale	
2	Priyarani Ravindra Burud	
3	Pratiskha Pandit Chogale	
4	Sunil Ratnakar Chougae	
5	Rishikesh Tukaram Devtale	
6	Pranav Shankar Ghosalkar	
7	Gouri Govind Jadhav	
8	Manasi Khanderao Jagadale	
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11	Priyanka Sanjay Patil	
12	Shweta Shital .Patil	
13	Sujata Anandrao Patil	
14	Bhagyashri Mahadev Pednekar	
15	Prajyot Sunilkumar Pradnyasagar	
16	Manisha Shivram Sawant	
17	Sadiya Mustafa Shaikh	
18	Rutuja Subhash Shetti	
19	Swapnil Sakharam Shinde	
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SUPPLIMENT

Signature of Supervisor

Suppliment No. :

Roll No. : 1336

Class : M.Sc - II

Subject : Thin Solid films Deposition and properties

Test / Tutorial No. : Internal Exam

Div. : 16/20

Q1. 1. b. $Ga(CH_3)_3 + AsH_3$

2. d. Completely filled

3. b. Gains

5

4. c. Zirconium

5. a. chemical reaction

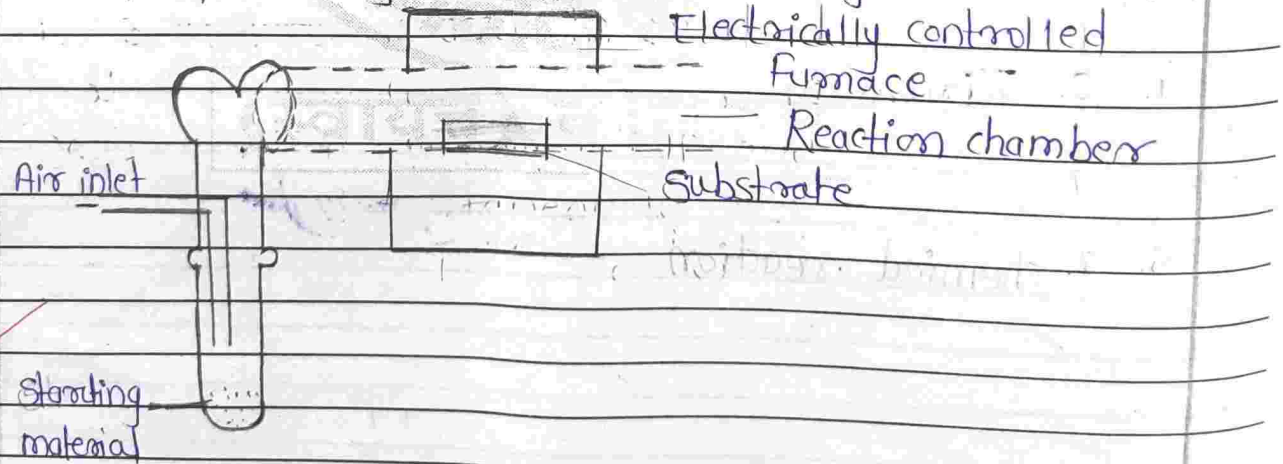
Q2. 1. Method of film preparation

i 'Nakamura' detected CVD technique that has been used for prepation of Boron nitride film, it consists of two adjustable leak valves one is for NH_3 and other is for $B_{10}H_{12}$

Film Deposited on Si substrate, with Substrate temprature 1000°C. Crystal structure of deposited film can be studied by the X-ray diffraction.

ii The vertical cold wall low pressure that has been used for preparation of WSi_2 film a quartz bell with jar in 24 diameter an which used as reaction chamber. and graphite Sheet coated with Silica is called heater element.

iii Oxides of metal like as CUO & Al_2O_3 can be prepared by decomposition of glass substrate

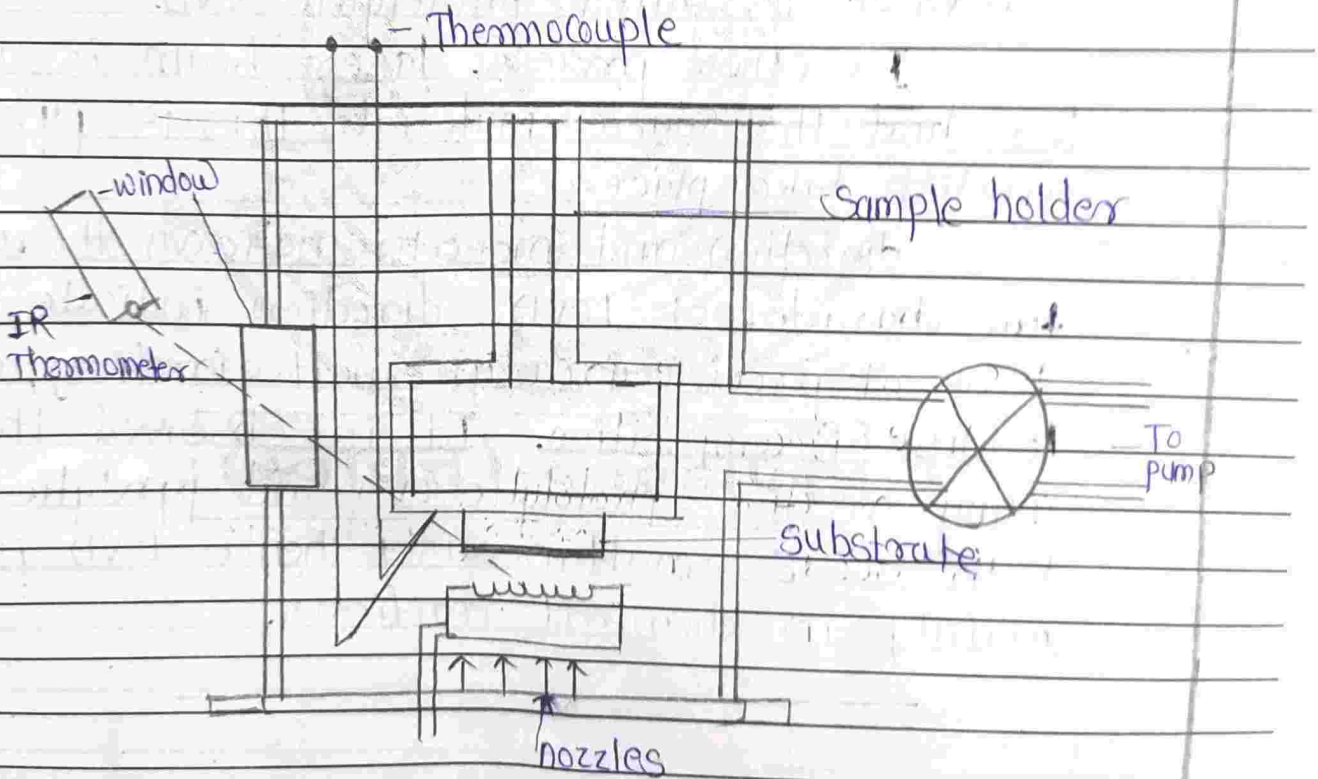


iv. The AR flowrate was adjustable too fine. the Ar particles come into the Starting material and starting material come into the reaction chamber.

2. i. Some of the particles deposited on the substrate holder kept at center of reaction chamber.
iv and substrate, tempreture can be controlled by electrically controlled furnace.

v. The low pressure CVD technique used for preparation of Borophosposilicate by the material Trimethyborate and Tetraethyorthosilicate which measures volumetrically.

vi The low tempreture CVD technique is called as Catalytic CVD. is used to prepare for Amorphous Semiconductor.



The reaction chamber is made up of still and substrate. The substrate hold by the Sample holder, and heated by heater element and Thermocouple is present there.

Q3. 2. Laser CVD

The Laser CVD technique is uses Laser Source for Decomposition. The two mechanism by which laser beam used for chemical reaction there are two process in which laser sources are uses

① photolysis ② pyrolysis

In photolysis process the photon of sufficient energy is used to dissociate the molecule to form chemical reaction.

Due to this compound of film of required chemical composition is deposited on adjecent substrate is called photolytic CVD.

In other process. laser beam is used for heat the source material. this is pyrolytic reaction take place.

direction and monochromatic CVD there are two character of LCVD. direction indicate the focus at precise area in small direction, and localise Decomposition. It is observed that in many reaction photolytic CVD and pyrolytic process both occur simultaneously hence LCVD is used mainly in chemical reactions.

3

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SUPPLIMENT

Signature of Supervisor	

Suppliment No. : -

Roll No. : 1337

Class : M.Sc II (Physics)

Subject : SSP1 - Thin film deposition

Test / Tutorial No. : Internal Exam

Div. : -

15/20.

Q. 1

1.

→ b) $Ga(CH_3)_3 + AsH_3$

2.

→ d) completely filled

3.

→ b) Gains

4.

→ d) Tennessine

5.

→ a) chemical reaction.

Q. 2

1

Methods of film preparation -

In CVD, the reator produces films are following,

(1) Nakamora reported that deposition of film has been applied to formation of Boronitrite film.
(2) The setup contains two adjustable leak walls; one is of NH_3 & other is of $B_{10}H_{14}$ i.e Deca Boron.
(3) For film deposition Ta or Si substrates are used.
(4) For film deposition on Ta or Si substrate temperature is about 300 - 1150 °C used.
(5) For film deposition in CVD technique, time taken is 30 - 300 minutes.
(6) The crystal structure deposition is measured by x-ray diffraction.

Methods of film preparation by using CVD are as follows,

1st preparation –

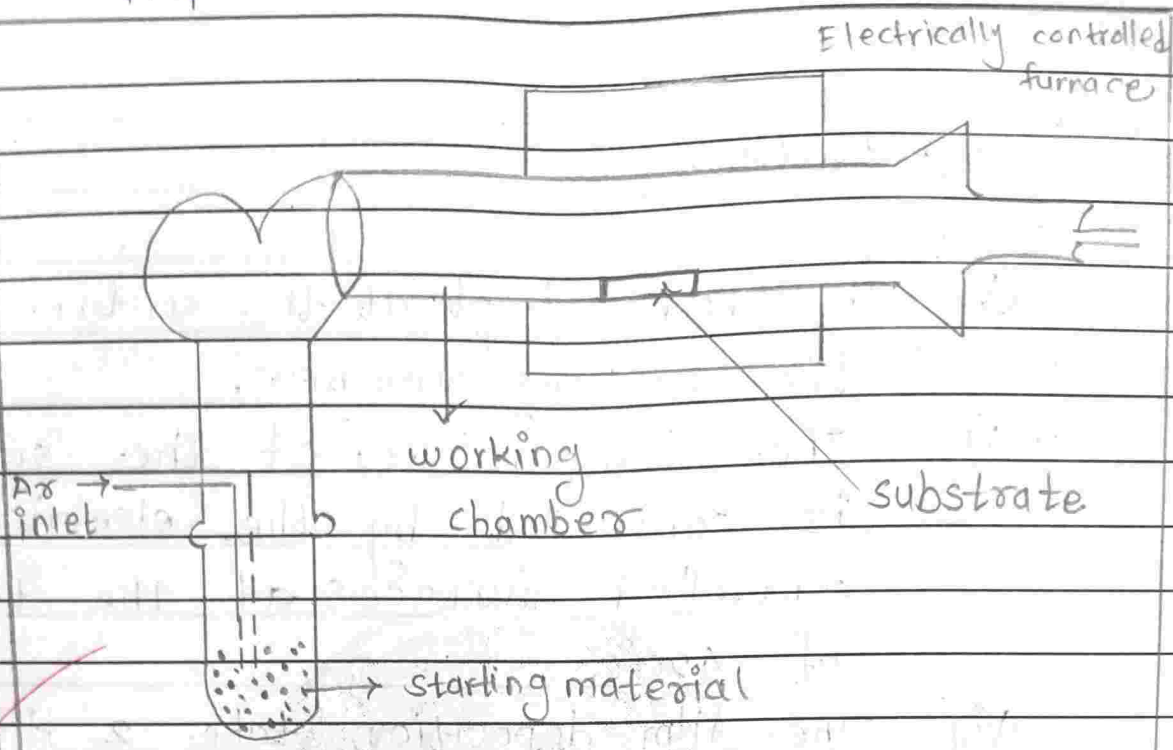

fig (a)

(i) The vertical cold wall chamber of low pressure, is used to formation of thin film deposition of the WSi_2 (Tangustan-di-silicate).

(ii) The mixture of oxides i.e Al_2O_3 are used.

(iii) The Ar-furnace enters into the starting material.

(iv) The particles of Ar entering starting material, starting material enters into working chamber

(v) The few particles of starting material is setteld on the

substrate.

(vi) The holder kept at the centre of the working chamber.

(vii) The temperature of the substrate is controlled by the electrically controlled furnaces at the temperature of 420°C.

(viii) The film deposition take 2 Hours to deposition on substrate.

(ix) The thickness of film on the substrate surface is 10 - 20 nm.

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Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM III Internal Examination

SSP 2 : Semiconductor Physics

Paper code:CC-1115C

Date: - 21-01-2022 Total Marks: 20

Day: - Wednesday Time :- 2 pm- 3 pm

Instructions:-

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table and calculator is allowed.

Q1. Fill in the Blanks (1 mark for each) **(5)**

1. In a 1 cm^3 piece of metal, we can have nearly ..... electrons/cm^3

a) 10^{22} b) 10^{10} c) 10^{23} d) 10^{11}

2. NaCl is an .....

a) Conductor b) Insulator c) Semiconductor d) None of above

3. As the interatomic spacing ....., energy levels turns into continuous bands

a) decrease b) increase c) remain unchanged d) None of above

4. AlAs is an indirect semiconductor with band gap .... eV

a) 1.16 b) 3.16 c) 0.16 d) 2.16

5. The Fermi dirac distribution law for probability of finding electron in energy level E is given by .....

a) $\frac{1}{1+e^{(E-Ef)/kT}}$ b) $\frac{1}{1-e^{(E-Ef)/kT}}$ c) $\frac{1}{1-e^{(E+Ef)/kT}}$ d) $\frac{1}{1+e^{(E+Ef)/kT}}$

Q2. Answer the following (Any one) **(5)**

1. Write a note on direct and indirect semiconductors.
2. Explain electrons and holes in quantum wells

Q3. Answer the following (Any one) **(10)**

1. Explain extrinsic and intrinsic semiconductor materials.
2. Write note on bonding forces and energy band in solids.

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Vivekanand College (Autonomous) Kolhapur

Department of PhysicsM.Sc. II

2021-22

Attendance Sheet

Paper: Solid State Physics-II

Date:21/01/2022

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5	Rishikesh Tukaram Devtale	
6	Pranav Shankar Ghosalkar	
7	Gouri Govind Jadhav	
8	Manasi Khanderao Jagadale	
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Suppliment No. :

Roll No. : 1354

Class : MSC - II

Subject : SSP-2

Test / Tutorial No. :

Div. :

16/20

Q.1.

1) a) 10^{22}

b) b) insulator

c) a) decrease

d) d) 2.16

e) a) $\frac{1}{1+e^{(E-E_F)/kT}}$

Q.2 a) Direct Semiconductor :-

Semiconductor in which transition of electron takes place from min of conduction band to maximum of valence band at same k values ($k=0$) is called direct Semiconductors.

This type of semiconductor have radioactive combination. which is used in LASER's & LED's.

In this transition, the energy & momentum during the process is conserved.

For example :- GaAs, InP, InAs, etc.

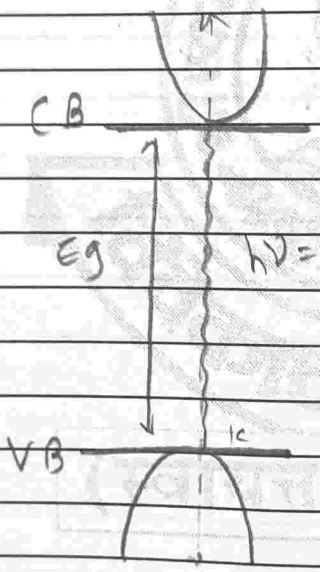

fig. transition of electron in photon emission.

b) In direct Semiconductors :-

Semiconductors in which transition of electron takes place from min. of conduction band to maximum of valence Band at different k values is called indirect semiconductor.

This type of semiconductor have non-radioactive combination which generates heat.
In this semiconductor, transition of e⁻ neither the energy nor momentum is conserved.
For eg:- Si, Ge, AlP, AlAs, GaP, etc.

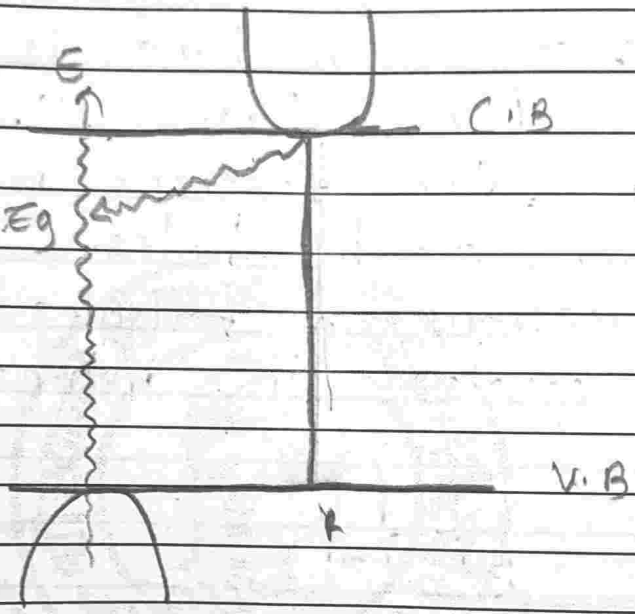

fig:- intrensic semiconductor via defect level.

2.3 a) Intrinsic Semiconductors.

The intrinsic semiconductors are perfect semiconductors, which has no impurity or lattice defects.

for eg: Pure Si & Pure Ge.

At 0°K, conduction band is completely filled & valence band has e⁻, when in transition, the electrons excite to conduction band which create holes.

The electrons & holes are the only charge carries in intrinsic semiconductor.

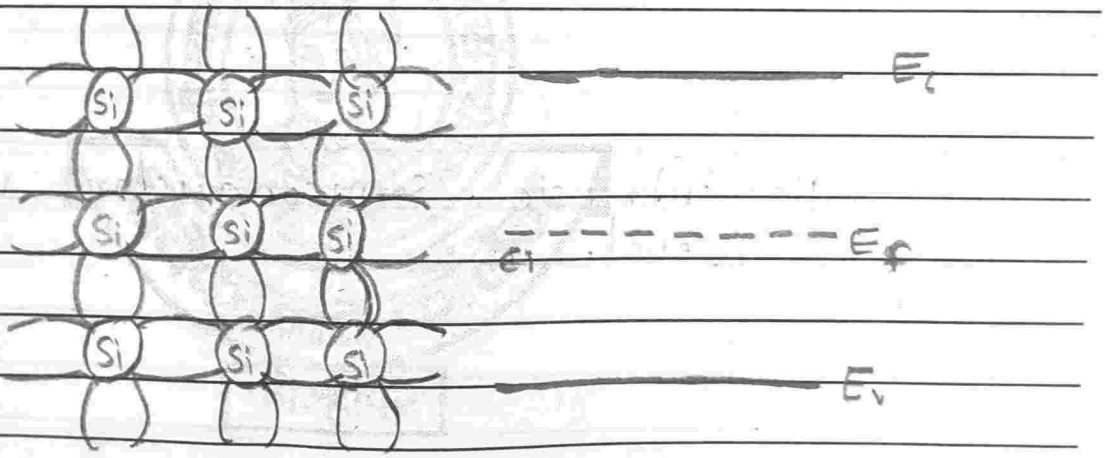

fig. lattice structure of silicon pure with no impurity

Here silicon is the pure metal which is attached to each other for bonding if the charge carriers pass through then the covalent bond is broken between them.

Same can be done for pure germ when at 0k the electron exite to conduction band, it creates holes &

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Signature of Supervisor

Suppliment No. :

Roll No. : 1354

Class : M S C II

Subject : S S P - II

Test / Tutorial No. :

Div. :

~~Extrinsic semiconductor~~ unstable, the holes should be given charge & mass.

b) Extrinsic semiconductor:-

doping:- The addition of impurities to a metal is called doping.

There are 2 types of extrinsic semiconductors
1) n-type semiconductor
2) P- type semiconductor

* n-type :- Semiconductor:-
The addition of pentavalent impurity to the semiconductor is called n-type semiconductor.
for eg:- P, ~~As~~, ~~An~~ Arsenic, Anatomy Phosphorus.

At 0°k the conduction band & valence band are empty.
There are no charge carries in this type of semiconductor.

★ p- type semiconductor:-
The addition of trivalent impurity to the semiconductor is called p- type of semiconductor.
For eg:- Boron, Aluminium, Germanium, etc.
At 0°k the conduction band and valence band are filled with electrons.
The transition of etechon takes place which causes holes & electrons as charge carriers.

★ For extrinsic semiconductor, the lattic structure of silicon with Arsenic impurity is given as:-

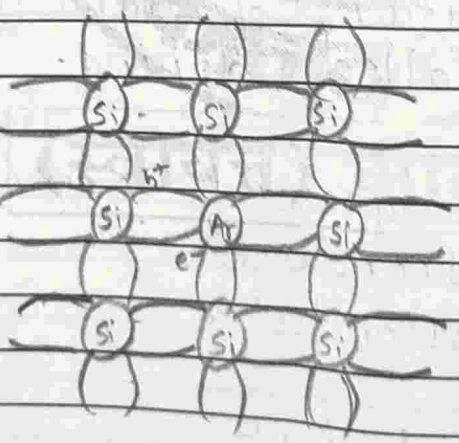

fig:- for n-type semiconductor.

★ for extrinsic semiconductor, the lattice structure of silicon with Germanium impurity is given as:-

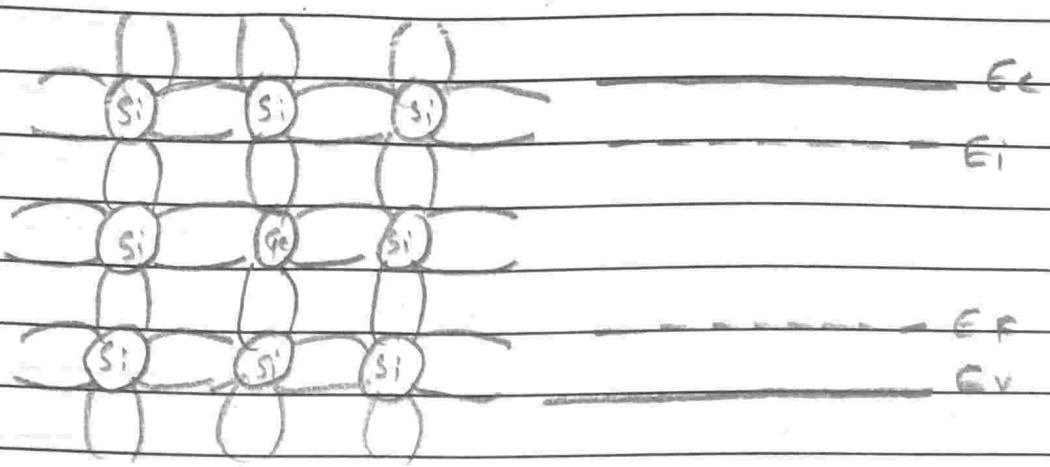

fig :- for - p - type semiconductor.

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SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1341

Class : MSc-II (Physics)

Subject : Semiconductor physics.

Test / Tutorial No. : Terminal exam.

Div. : -

15/20

Q.1

1. → c] 10^{23}

2. → b] Insulator.

3. → a] decrease

4. → d] 2.16.

5. → a] $\frac{1}{1+e^{(E-E_f)/KT}}$

2

1. Direct and Indirect Semiconductor.

When, quantitative calculations are formed of band structure. Condside a electron moved through perfect periodicity of lattice for, e.g moves in x- direction with perdurisation constant K. and act as like plane wave therefore.

→ Modified schroding plane wave eqn is.

$$\psi_k(x) = U_k(x) e^{ikx}$$

where

U_k - modutes the wave function according to periodicity of lattice.

5 E-k diagram -

A plot of electron energy E Vs polarisation constant k is called as E-k diagram. Periodicity differ of crystal or electron is different in different direction. therefore, we study the. We draw E-k diagram with using 3D (E-k) diagrams. of semiconductors.

Their are two types of semiconductor

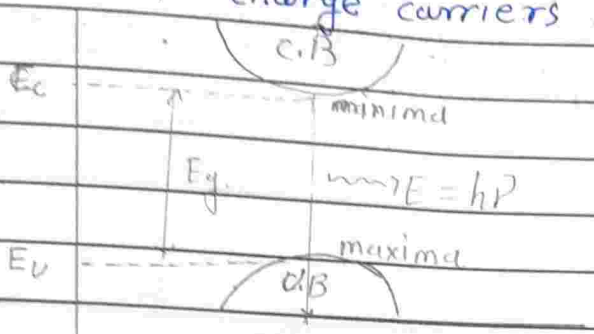
1] Direct semiconductor.
2] Indirect semiconductor.

1] Direct semiconductor:

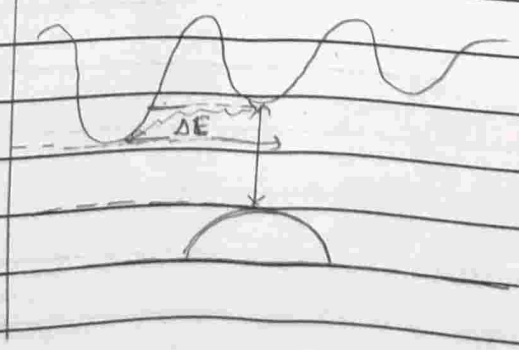
The semiconductor in which electron moves from minimum minimum of conduction band to maximum of valance band at same k value. is called Direct semiconductor.

1] GaAs. GaAsP are some e.g example of direct semiconductor.

2] Direct semiconductors are ~~impure~~ Intrinsic, ~~extrinsic~~ & ~~compound~~ semiconducter.
3] This semiconductors are used in LED's, LASER's.
4] In this recombination takes placed & enegy produced.
5] life time of charge carriers is less



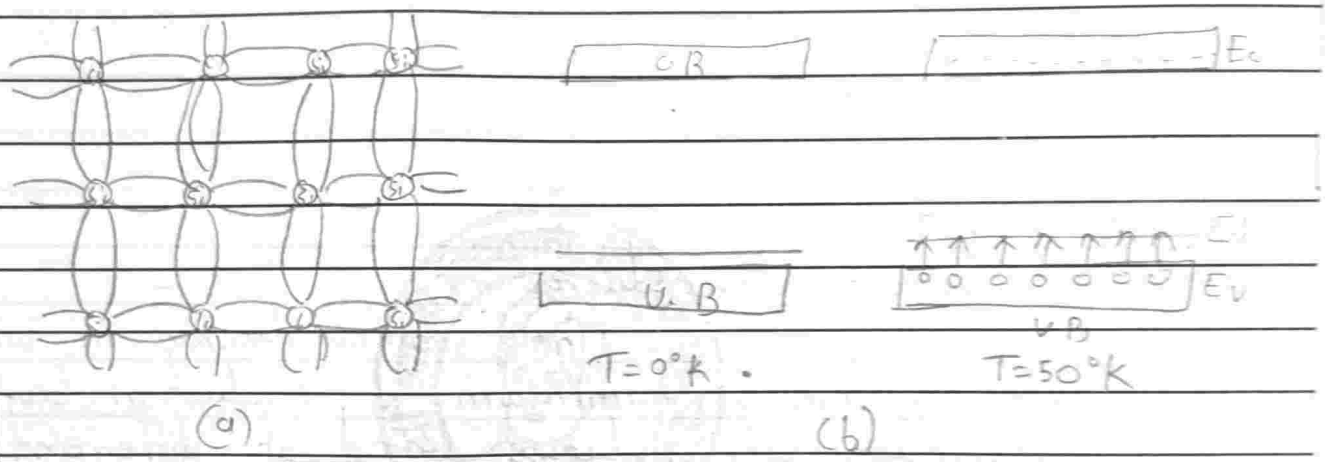
2] Indirect semiconducter -
The semiconducter in which electron moves minimum of conduction band to maximum of valance band at different k value.
1] Si, Ge. are some e.g of direct semiconducter.
2] Indirectect semiconducters ~~pure~~ ~~intrinsic~~ ~~and extrinsic~~ elemented.
3] This ~~semi~~ type semiconducters are used as amplifier. to ~~amit~~ amplify the signals in electronic devices. e.g transistor.



4) life life time of charge careerries is more.

Q.3. 1] Intrinsic & extrinsic semiconducter material.

1] Intrinsic Semiconducter are pure semiconducter.
2] ~~At 0°k Energy At~~
2] In this energy level is formed ~~at~~ near the ~~conduction band valance band~~. Conduction band.
~~3] T~~



In this ~~formation of~~ electron & hole ~~paire~~ pairs ~~are~~ are produced simultaneously.
∴ Therefore concentration of electron is equal to concentration of hole.

$$n_i = p_i = n_i$$