Notice

Date: 01/10/2018

It is hereby informed to the students of M.Sc. – I and II, that First Term Internal Evaluation Examination is scheduled between 10th to 11th October 2018 in the Department of Physics.

Instructions:

1) Nature of question paper for M.Sc. – I: 05 MCQ's (05 Marks), 01 Short Answer Questions (05 Marks), 01 Long Answer Questions (10 Marks)
2) Nature of question paper for M.Sc. – II: 05 MCQ's (05 Marks), 01 Short Answer Questions (05 Marks), 01 Long Answer Questions (10 Marks)
3) Students should present before 15 minutes of the examination.
4) Answer sheets will be provided by the Department.
5) Strictly mention the Full Name and Roll number on Answer Sheet correctly.
6) All students should remain present for the Internal Examination as the examination will not be conducted afterwords in any case.

Sr. No.	Date	Class	Name of the Paper	Time
01	11/10/2018	M. Sc. – I	(01) Mathematical Physics	12noon – 01 Pm
			(02) Classical Mechanics	02pm – 03 Pm
02	11/10/2018	M. Sc. – II	(01) Nuclear and Particle Physics	12noon – 01 Pm
			(02) Thin Film Deposition and other Techniques	02pm – 03 Pm
03	12/10/2018	M. Sc. – I	(01) Quantum Mechanics I	12noon – 01 Pm
			(02) Solid State Physics – 01	02pm – 03 Pm
04	12/10/2018	M. Sc. – II	(01) Solid State Physics – 01	12noon – 01 Pm
			(02) Solid State Physics – 02	02pm – 03 Pm

Coordinator

HOD, Physics

Head of the Department of Physics Vivekanand College, Kolhapur

VIVEKANAND COLLEGE ESTD JUNE 1964 KOLHAPUR - 416003

Shri Swami Vivekanand Shiksham Sanstha, Kolhapur

Vivekanand College, Kolhapur

Department of Physics

M.Sc. Part-II Internal Examination (2018-2019)

NUCLEAR AND PATICLE PHYSICS (Paper No. IX)

Paper code CP-64101

Time - 12:00 - 01:00 pm

Total Marks: 20

Q1: choose the correct alternative (5)

1. The parity of deuteron is .....
   a) Zero b) not definite c) odd d) even
2. The spin of graviton is
   a) 1/2 b) 0 c) 2 d)1
3. The correct nuclear potential is of the form .....
   a)wood -Saxon b) Yukawa c) central d)conservative
4. For attractive potential the phase shift delta in N-N scattering is
   a) Zero b) positive c) negative d) undefined
5. The isospin and the strangeness of Ω^-
   a)1.-3 b)0.-3 c) 1.3 d)0.3

Q2: Attempt any one (10)

1. Write the detailed Fermi theory of beta-decay.
2. What is collective model? Explain collective vibrations and collective rotations.
3. Show that in beta decay (weak interaction) parity is not conserved

Q3: Attempt any one (5)

1. Write the Gellmann-nishijima formula, and explain term involved.
2. What are the empirical evidences for nuclear shell model?

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Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College (Autonomous) Kolhapur
Department of PhysicsM.Sc. II
2018-19
Attendance Sheet
Paper: Nuclear and particle physics
Date:11/10/2018

Roll. No.	Name of Candidate	Sign
1	Aswale Nikhil Mohan	Aswale
2	Bachate Prajakta Ramchandra	
3	Deshmukh Namita Prataproa	
4	Ghadage Sachin Subhash	Ghadage
5	Jadhav Anmol Narendra	
6	Jangid Saroj Nemichand	Jangid
7	Kamble Karan Mukund	
8	Khan Anjum Ibrahim	
9	Mane Rajalaxmi Sanjayrao	Mane
10	Mulla Shahanwaj Barkatali	
11	Nalawade Priyanka Mansing	Priyanka
12	Patnkar Shivrsaj Mansing	Patankar
13	Pathak Onkar Herambraj	
14	Patil Nirmala Vilas	N. V. Patil
15	Patil Rasika Chandrakant	
16	Pawar Pooja Gunvant	
17	Phadatare Pooja Sunil	PPS
18	Salunkhe Abhishek Chandrashekhar	
19	Shirage Pravin Ramchandra	
20	Sid Shraddha Arun	Sid

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 9/20

Roll No. : 1337

Class : M.Sc II

Subject : Nuclear & Particle Physics

Test / Tutorial No. : Internal Exam

Div. : -

Q. 1

1 → A) Hard

2 → B) Maximum

3 → C) Greater

4 → D) 2

5. → D) Electrons

4

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2

1.

Elementary particles are classified by their mass, charge, lifetime, spin & interaction.

1) Mass -

All elementary particles has some rest mass. The magnitude of rest mass serves as principal level identically to identify the Elementary particles uniquly. If two particles has different rest mass then they treat as two different elementary particles.

2) Charge -

All Elementary particles having charges e^-, e^+ & e°. They all charge conserved in process.

3) Lifetime -

All Elementary particles except proton, electron & neutrino are unstable & decay into lower mass particles. some of particle has long lives but some of particles has short lives.

4) Spin -

All elementary particles has spin motion analogy to that of earths on it's axis. They has spin of half integrab i.e $\left(\frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \ldots\right)$ obeys the fermi-dirac stat called as Fermions.

Also the particles has an spin of $(0, 1, 2, 3, \ldots)$.

5) Interaction -

To understand the interaction between the elementary particle we have to measure interaction property.

a) Gravitational Interaction -

It is a the weakest interaction. The value of Gravitational spin i.e Graviton has value. 2.

Particle & Antiparticle -

Dirac predicted theorotically the existance of antiparticle of electron. The antiparticle has same mass, same spin, same lifetime to that of the particle but having opposite charge.

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Signature of Supervisor	

Suppliment No. : 1

Roll No. : 1337

Class : M.Sc II (Physics)

Subject : Nuclear & particle Physics

Test / Tutorial No. : Internal Exam.

Div. : —

Q. 3

2.

The particle which is having same mass, spin, lifetime & having exactly opposite charge to that of particle is called anti particles.

Particle & Antiparticle :-

Dirac predicted theoretically the existance of antiparticle of electron. Which has same mass, spin, lifetime to that of electron but having exactly opposite charge. The interaction between particle & antiparticle produces new particles.

1) Electron & Positron -

The antiparticle of electron called as positron. It is the 1st antiparticle. Positron has '+ve' charge on it. It is denoted as 'e^+'. Positron has same mass, spin & lifetime to that of electron.

The interaction between the electron & positron produces γ-Photon. Two molecules of γ-photon.

i.e

$$e^- + e^+ \longrightarrow 2\gamma$$

2) Proton & Antiproton -

The antiparticle of proton is called as Antiproton. It is '-vely' charged particle. It denoted as 'p^-'. Antiproton also has same mass, lifetime & spin to that of proton. The antiparticle proton produces by bombarding proton i.e it produces due to proton-proton collision. It can represented as,

$$p + p \longrightarrow p^+ + p^+ + p^+ + \overline{p^-}$$
$$\longrightarrow 3p^+ + p^-$$

when proton & antiproton interact it produces,

$$p + \bar{p} \longrightarrow \pi^+ + \pi^- + \pi^+ + \pi^- + \pi^\circ$$

3) Neutron & Antineutron -

The antiparticle of neutron called as Antineutron. The antineutro is hard to detect. Because the neutron has no charge & also the antiparticle of neutron also does not have charge. Both neutron & Antineutron are neutral in nature. Antineutron has same spin & magnetic moment to that of neutron. The antineutron denoted as '$\bar{p}$'.

The interaction of neutron & antineutron produces new particle having zero charge.

$$n + p \longrightarrow \pi^\circ + K^+ + \nu^\circ$$

4) neutrino & Antineutrino -

The antiparticle of neutrino is called antineutrino. All elementary particles except the proton, neutrino & electron are unstable. i.e The neutrino & are the stable particle

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SUPPLIMENT

14/20

Signature of Supervisor	

Suppliment No. :

Roll No. : 1336

Class : M.Sc-II

Subject : Nuclear and Particle physics

Test / Tutorial No. : Internal exam

Div. :

1. C. Both

2. A. minimum

3. C. Greater

4. D. 2

5. D. electrons

2

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Q2. 1. classification of elementary particle

(i). photon -

photon is quantum of electromagnetic radiation it is stable particle, having zero charge, and zero rest mass, it is Boson it energy given by the plank's eqn $E = h\nu$ and their rest mass given by the Einstein eqn $E = mc^2$

(ii) Leptons -

It is lighter weight elementary particle, having spin ½ called fermions, it is characterized by the spin momentum $\hbar/2\pi$

Eg. $e^-, \mu^-, \nu_e, \nu_\mu, \nu_\tau, \tau^-, \bar{\nu}_e, \bar{\nu}_\mu, \bar{\nu}_\tau$

iii electron and positron

electron is an elementary particle having mass 9.1×10^{-31} kg and charge 1.602×10^{-19} coulomb. Spin angular momentum is $\pm \frac{1}{2}$.

positron is a antiparticle of electron. it same mass, same spin as that of electron but opposite charge to that of electron

iv. Muons.

it is also called as μ-meson, discovered by Anderson in 1936, represented by both negative and positive charge μ^+, μ^- resp. they are unstable

v. Meson -

It is agent of interaction between the particles inside the nucleus. having intermediate mass between electron and proton

Q2. i. Their existence predicted by 'Yukawa'. They are all bosons having Spin zero.

(vi). π - Meson

It is discovered in 1947, represented by by π^+, π^0, π^-, π^+ and π^- are antiparticle of each other. π^0 is a neutral particle it has no charge. The average lifetime is 10^{-8} sec.

(vii) K - meson

It is heavier class of Meson. represented by K^+, K^0, $\bar{K}$, $\bar{K}^0$, it is produced due to strong interaction of pions and protons.

(viii) η - meson

The central - η meson having rest mass 1093 me. It is Boson.

(ix). Baryon - it is heavy weight elementary particle having rest mass greater than neutron and less than dueteron. having spin $\frac{1}{2}$ called fermions.

x. Nuclear particle

In this Both proton and neutron involved and their antiparticle. Antiproton and Antineutron also involves. having Spin $\frac{1}{2}$, so they are called fermions.

Q2 1. Hyprons

- Baryons possesses rest mass which is greater than nucleons is called Hyprons

Classification of Hyprons.

(i). λ - Hyprons

- There are 2 types of λ - Hyprons represented by λ^0 and $\bar{\lambda}^0$

(ii). Σ - Hyprons

- There are 6 types of Σ - Hyprons represented by Σ^+, Σ^0, Σ^-, $\bar{\Sigma}^+$, $\bar{\Sigma}^0$, $\bar{\Sigma}^-$

iii Ξ - Hyprons

- There are 4 - types of Ξ - Hyprons. represented by Ξ^0, Ξ^-, Ξ^+, Ξ^{+0}

iv. Ω - Hyprons

There are 2 types of Ω - Hyprons.

Eg. : Ω^-, $\bar{\Omega}^-$

8

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Signature of Supervisor	

Suppliment No. : 1

Roll No. : 1336

Class : MSc - II

Subject : Nuclear and particle physics

Test / Tutorial No. : Internal exam

Div. :

Q3 2.

Classification of Particle and Antiparticle

i electron and positron -

The first antiparticle which is positron, found in 1932, having same mass, same spin as that of electron, but opposite charge. therefore electron and positron come contact with each other they mutually annhilates each other, and 2-photon are produced.

$$e^+ + e^- \rightarrow 2\gamma$$

ii. Proton and Antiproton -

The antiparticle of Proton called Antiproton. having same mass, same spin as that of proton. but opposite charge represented by p^-

Antiproton strongly interact with matter and annhilates with proton

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

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

(iii) Neutron and Antineutron

It is hardest to discover Antineutron. neutron and Antineutron have a zero charge when Antineutron collide with neutron it produced track, such track observed in a bubble chamber.

iv. Neutrino and Antineutrino

The antiparticle of neutrino is called Antineutrino. Neutrino is counter colokwise and Antineutrino is clockwise.

v. Particle and antiparticle

Dirac predicted existence of Antiparticle of electron, which is positron, have same mass same spin as an electron but opposite in charge. Positron have positive charge.

A+

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Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc.Part-II (SEM III) Internal Examination (2018-19)

SSP-1 Thin film deposition and properties

Total Marks 20

Time - 2.00 pm to 2.45pm

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. Choose correct alternative (5)

1) 1 atm is equal to ..... pa

A) 1.013×10^5 B) 1.013×10^3 C) 1 D) None of above

2) All types of substrate is used in .....

A) CBD B) PVD C) SILAR D) Electrodeposition

3) CBD is ... phase method for thin film deposition

A) Liqud B) Solid C) Gases D) none of above

4) ..... Droplet size in SPT depends upon

A) Viscosity of carrier gas B) Viscosity of spraying solution C) Density of Carrier gas

D) None of above

5) ..... metal is used for fabrication of filament in resistive heating

A) Tungsten B) Copper C) Iron D) Steel

Q2.Attempt any one **(5)**

1) Write a note on resistive heating method for PVD
2) Describe DC magnetron sputtering
3) Explain advantages of PVD

Q2.Attempt any one **(10)**

1) a) Write a note on flash evaporation
2) a) Describe vacuum system

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Vivekanand College (Autonomous) Kolhapur

Department of PhysicsM.Sc. II

2018-19

Attendance Sheet

Paper: Thin Film Deposition and other Technique

Date:11/10/2018

Roll. No.	Name of Candidate	Sign
1	Aswale Nikhil Mohan	
2	Bachate Prajakta Ramchandra	
3	Deshmukh Namita Prataproa	
4	Ghadage Sachin Subhash	
5	Jadhav Anmol Narendra	
6	Jangid Saroj Nemichand	
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SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1332

Class : M.SC - ~~II~~

Subject : Thin solid film deposition and properties

Test / Tutorial No. : –

Div. : –

16/20

Q1

① $Ga(CH_3) + ~~B_3H_3~~ ASH_3$

② Completely filled.

③ Both (a) and (b)

④ Zirconium

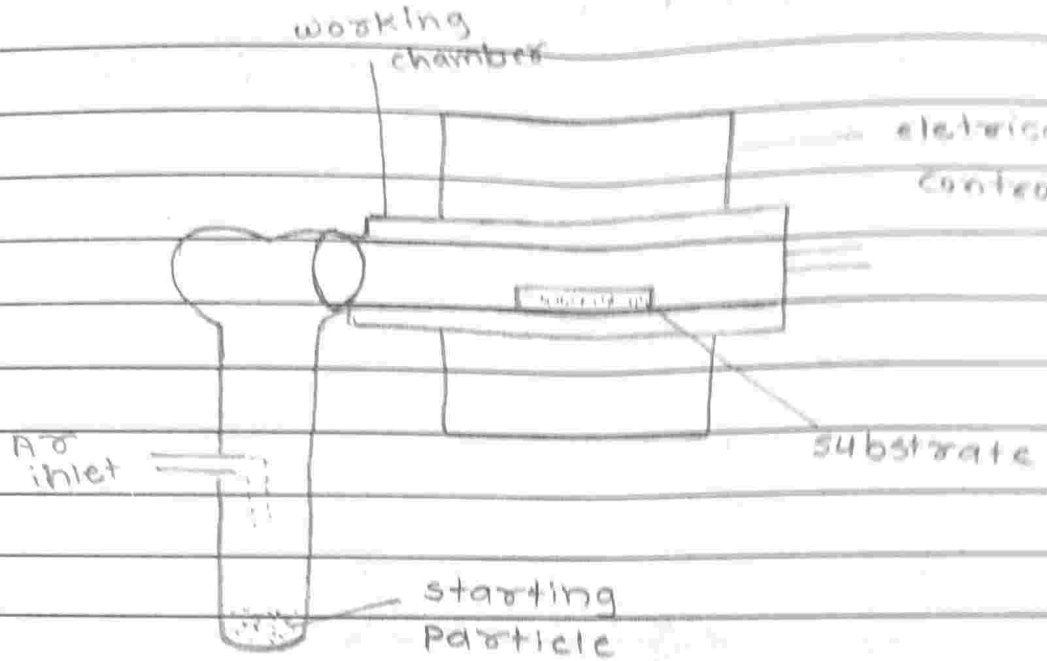
⑤ chemical reaⁿ

Q2 ① The deposition of flim prepration is following methods

1] Nakmurda CDV teqanies are used to preparation of amorphus born nitrit film. It has adjestable at two leak value one is NH_3 and $B_{10}H_{14}$. the deposition is take at Ti or Si substrate at temperat 300°C to 1150°C and time is 30 min to 300 min this method is use to x-ray diffraction.

2] The vartical cold valves low pressure is use to prepartion of WSi_2. the bell jar 24 cm diameter is used an chamber and graphite ~~she'shite~~ is cated with silicon the silicon is heated with the element WF_6 and SiH_4 at reactive gases at atmospheric presser and heated at 420°C

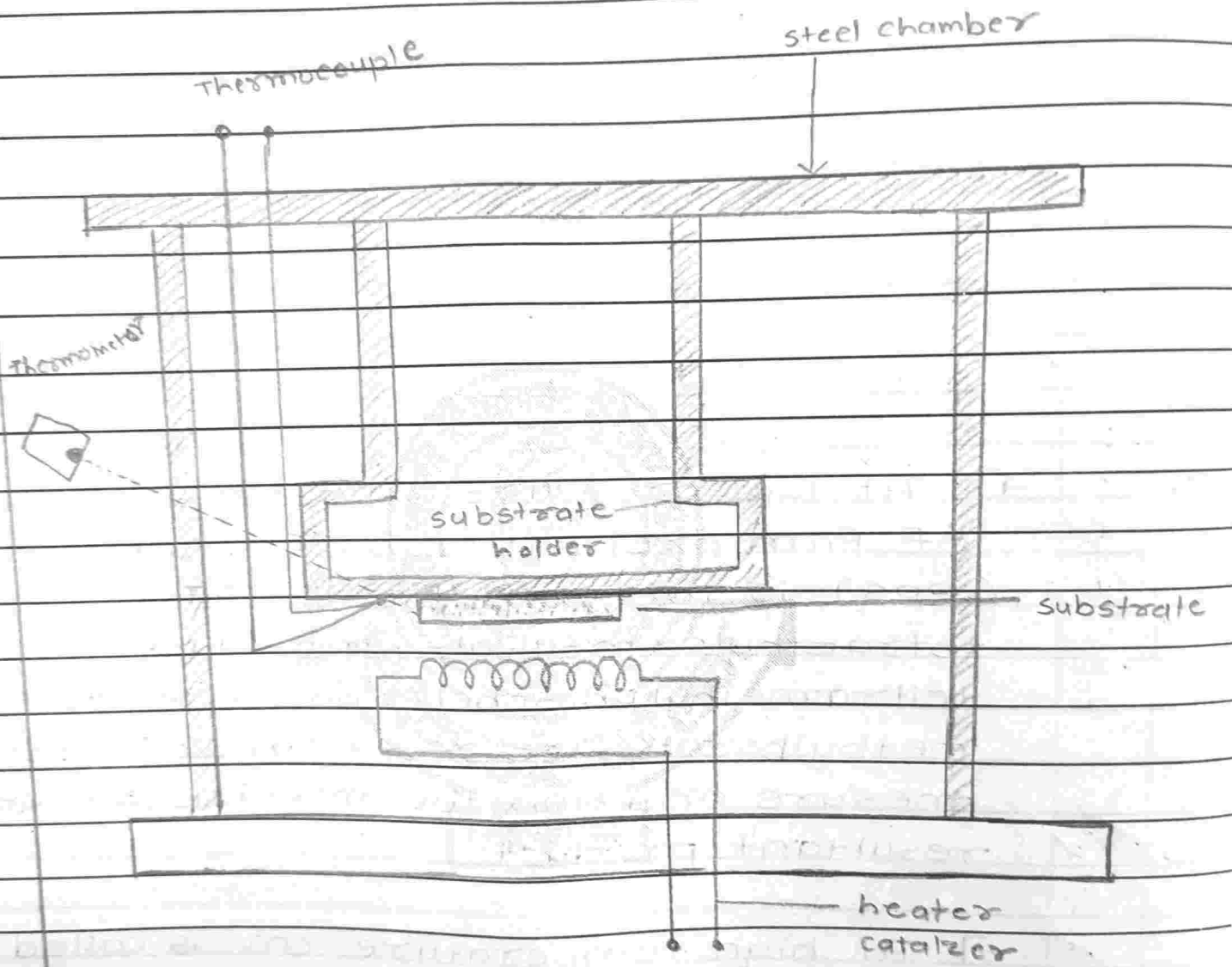
3] A metal oxide like Al_2O_3, CuO, In_2O_3, $CuOAl_2O_3$ are used to prepration of thin film. the starting material are used fine powder this starting material pass the Argon gas. the starting material and the ~~pr~~ starting particle are pass through the working chamber and the particles are set at the substrate. the substrate is keep hold at the center of chamber this process can electricaly controlled, in their film prepration.



4] At low pressure CDV the deposition of Film prepration by Bronphosphosilicate (BPS) is prepered by the (TEOS) tetraethylorthsilicate and (TMP) is teitramethylphosphet and (TMB) teitra-methylborate are mix with volumetricaly mesure and mix the mixture we get resultant product.

5] At low temperature CDV is called as caltalytic CDV or cat CVD. this is used to deposition of thin flim in amorphus semiconductor, The long jar chamber is consider it is made up with steel. the substrate is keep at the substrate holder the substrate is heated with the heat catalyzer and the cool with air get this is parllel to the substrate holder. and thermocouple is placed

at the behind the substrate holder it is used to mesure the temprater in the chamber.



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SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 1
Roll No. : 1332
Class : M.Sc - II

Subject : Thin Solid film deposition and prepration
Test / Tutorial No. :
Div. : -

3.

1. CVD is important and popular teganies use to film prepration. In CVD vapour or vapour mixture are inter in chamber and their contain substrate at the sutable temperature. In CVD chemical reaction is very important charateristices.
The ~~~~ common CVD reaction are following.

1] Thermal decomposition on metal film →
In this process silicon film prpration thermal decomposition of silicon gas at the sutable temperature at atmosphere.

$$SiH_{4(s)} \longrightarrow Si_{(s)} + 2H_{2(g)}$$

2] Reduction reaction →
The chloride have more commonely used halids it is ~~red~~ redily ~~pure~~ in

fractional distillation the hydrogen reduction is not sutable for used in deposition of film prepration. it is reacts with reactive gas at atmospheric pressure.

$$SiCl_{2(g)} + 2H_{2(g)} \longrightarrow Si_{(s)} + 4HCl_{(g)}$$

3] oxidation formation →

This type of deposition is used to oxide film prepration. the silicon dioxide film was prepared by oxidation of silican gas and oxygen with the inert gas, then we get the silicon dioxide film.

$$SiH_{4(g)} + O_{2(g)} \longrightarrow SiO_{2(g)} + 2H_{2(g)}$$

4] the formation of nitrite and chloride ~~film~~ film →

The deposition of nitrite and chloride we get the film. this deposition is depend upon the vapour and the condition of deposition i.e depend upon the ~~temper an~~ temperature and pe pressure.

$$BCl_3 + NH_3 \longrightarrow BN_{(s)} + 3HCl_{(g)}$$

the BCl_3 is reacted with amonia we get the boron nitrate.

5] compound formation →
This type of deposition of film prepration we get ~~a~~ two ~~or~~ more eg. element can combined ~~or~~

$$Ga(CH_3)_3 + ASH_3 \longrightarrow GaAS_{(s)} + 3H_{4(g)}$$
$$_{(g)}$$

3 CH_4

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SUPPLIMENT

Signature of Supervisor	
Suppliment No. :	Subject : Solid State Physics I.
Roll No. : 1334	Test / Tutorial No. : Internal No-1.
Class : M.Sc II	Div. : 05/20

Que.1)

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

2) completely Filled.

3) both (a) and (b).

4) Zirconium.

5) Chemical reaction.

Que. 2)

1) Methods of Film preparation →

Films are thin layer of metal on substrate deposition of ions by using various tech. in this tech. we used two componund mainly cathain and anaion. by using those we prepare solution and using some tech. by appling temp. and other process film will be froms. Thus tech. are explained below -

1) Chemical vapour deposition.
2) Chemical Bath deposition.
3) Spray pyrolysis.
4) SILAR.
5) Electrolysis.
6) Hydrothermal
7) Sol-gel
8) Photochemical vapour deposition.

1) Chemical vapour deposition →

- In chemical vapour deposition. film is fromed by using vapour pressure that is 30 - 300 K.
- In this process mostly halids are used. Si and H i.e. Silica halide and Hydrogen ions are used mostly.

$$Si_6 + 3H_2O \rightarrow 6SiH_2 + O$$

- In this process water heated and reaction is takes place under isolated system.

2) Chemical bath deposition →

- This process is used fror prepare thin film by using chemicals. the anaion and cathaion are present in samp beaker.
- That beaker is placed in chemical system and it heated at specific temp. in this process we used indirect heating.

- To prepare film some factors are affected that are. Temperature, concentrate, pH of solution, etc.

3) SILAR →

1) SILAR is stand for Sucessasive ~~ionic linear equous~~ Reaction.

2) In this process anoion and cathoion is present but we take separate beaker for each and have two more beakers for raiseing.

- In 1st beaker there is a anoion and 2nd ~~an~~ catoion between them we used double distilled water for raiseing in first deep extra particals or ions will loose. so catainic particle can be interact. in last raise extra particle loose so they can't contaminate anoin soln.

- factor like concentration and teamperature, as well as time of deposition and no. of cycle are affected. on this process.

Thus are tech. for thin film preparation.

1) Cleaning →

We used substrate for thin film deposition. thus are glass substrate and metal substrate. cleaning is very important process. without cleaning we can't able to create film.

- Clean substrate by using laboline under water. if we using metal substrate polish it by polish paper to get even surface. then clean with Laboline solution.

- then treat it under UV light for at least 1-2 hr. in UV chember.

- Now ~~also~~ by avoiding direct touch transfer them in acetone solution for one day. cover them by alumium Foil.

- Raise ~~o~~ substrate ~~o~~ from solution. and clean them with aceton by using cotton and pack them in tissue.

- Now, clean it by using acetone before use.

2) Concentration →

- For deposition use correct amount of concentration of catoin and anion solution.
- For that use formula which depend on molecular weight, percentage and ~~am~~ weight of substance.

3) PH →

- by using anneline or amonia maintain pH of solution pH can effect on solution and amount of hydrogen. reaction pH can effect on thin film.

4) Mixing →

Chemical will mix by using magnetic needle.

5) Time of deposition →

- Time is very important factor for deposition it can be 30 min to 2 hr.

6) Temperature →

Temperature is major impact on Film formation we having diff. temp. There are two types of temp.

- Direct temp.
- Indirect temp.

7) No. of cycles →

No. of cycles can vary a result.

8) Pressure →

Pressure is used in some conditions.

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SUPPLIMENT

Signature of Supervisor	
Suppliment No. :	Subject :
Roll No. :	Test / Tutorial No. :
Class :	Div. :

Que. 3)

1). CVD reactions →.

1) Reduction reaction →.

Reduction means H^+ will loose From reaction.

~~$Si \rightarrow$~~

~~$Si_s + 3H_2O \rightarrow SiO_2 + 6H_2$~~.

$SiH_4(s) \rightarrow Si \uparrow 2H_2$.

2) Oxidiation →

In oxidiation gain of oxigen will be happened. So we can get TiO_2, ZnO, SiO_2.

3) Halids are react in temp between 30-300 k.

$SiCl_2$ +

2) Chemical vapour deposition held under presence of Laser source called Laser CVD.
- In this process photon can effect on reaction
- Light source is used for reaction.

1) Thermal decom

Seat No. | O.P. Code

Vivekanand College, Kolhapur (Autonomous).

M. Sc. Part-II (Semester- III) Internal Examination Oct/Nov.2019

Subject: Physics

Title of the Paper: Solid State Physics-I (Thin film deposition techniques-Magnetic and electric properties)

Subject Code: CP-1114C

Time - 11 am - 12 pm **Total Marks: 20**

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

Q. 1 Select most correct alternative (5)

i. In general, material with ....surface energy will wet substrate.
A) low B) high C) medium D) zero

ii. The optical methods of thin film thickness measurement include ...
A) interferometry B) contact angle C) electrical resistivity D) magnetic sensitivity

iii. Sputtering yield is always .....
A) less than unity B) greater than unity C) infinity D) zero

iv For. ... ionic product must be greater than solubility product.
A) aggregation B) precipitation C) dissociation D) decomposition.

v. In laser photolytic photochemical deposition (LPD) .... of sufficient energy are used to dissociate the molecules.
A) photons B) neutrons C) hydrogen atoms D) electrons

Q. 2 Attempt any one (10)

i) What are the different types of the substrates used for the deposition of thin films? Explain the electrodeposition method to deposit the thin film.

ii) Discuss classification of physical and chemical methods of thin film deposition.

iii) Explain the chemical bath deposition for the preparation of semiconductor by giving the idea about ionic and solubility product.

Q.3 Attempt any one (5)

i. Discuss the merits and demerits of MOCVD method.

ii. Write note on Sol-gel technique

iii. Describe processes in hydrothermal deposition

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Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College (Autonomous) Kolhapur
Department of PhysicsM.Sc. II
2018-19
Attendance Sheet
Paper: Solid State Physics-1
Date:12/10/2018

Roll. No.	Name of Candidate	Sign
1	Aswale Nikhil Mohan	Aswale
2	Bachate Prajakta Ramchandra	
3	Deshmukh Namita Prataproa	
4	Ghadage Sachin Subhash	Ghadage
5	Jadhav Anmol Narendra	
6	Jangid Saroj Nemichand	Jangid
7	Kamble Karan Mukund	
8	Khan Anjum Ibrahim	
9	Mane Rajalaxmi Sanjayrao	Mane
10	Mulla Shahanwaj Barkatali	
11	Nalawade Priyanka Mansing	Priyanka
12	Patnkar Shivrsaj Mansing	
13	Pathak Onkar Herambraj	
14	Patil Nirmala Vilas	N. V. Patil
15	Patil Rasika Chandrakant	
16	Pawar Pooja Gunvant	
17	Phadatare Pooja Sunil	
18	Salunkhe Abhishek Chandrashekhar	
19	Shirage Pravin Ramchandra	
20	Sid Shraddha Arun	Sid

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Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

09/20

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1332

Class : M.SC-II (Physics)

Subject : Thin film deposition Technology

Test / Tutorial No. :

Div. : —

Q1

① stokes

② ~~Interference~~ diffraction

③ ~~ESR~~ Vibrational

④ electric field

⑤ $\Delta E = g\mu_B BZ$

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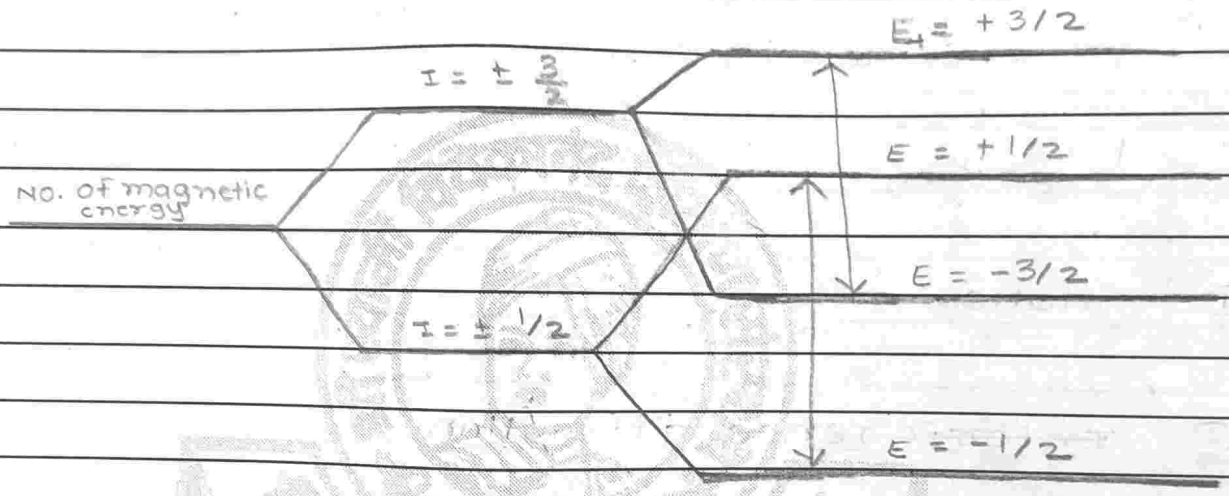
Q3

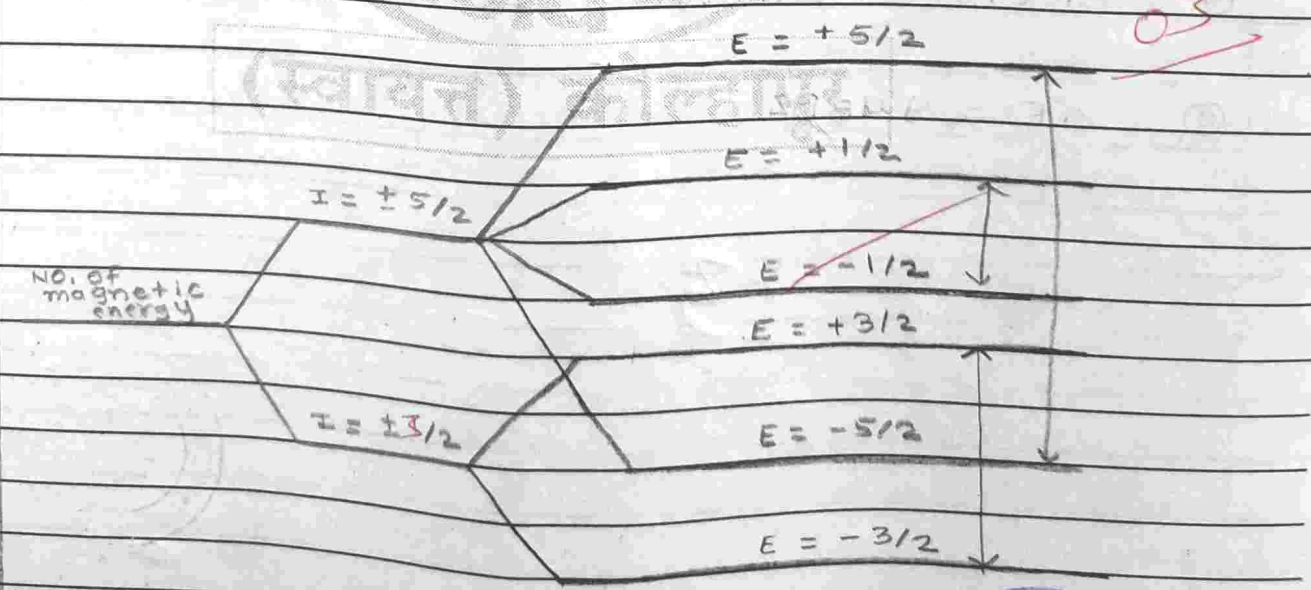
2] The transition of spectra of iron and chromium.

① ~~Iron~~ chromium –

$\pm \frac{1}{2}, \pm \frac{3}{2}$ are the transition of spectra



② ~~Chromium~~ Iron – $\pm \frac{3}{2} \rightarrow \pm \frac{5}{2}$ are the transition of spectra



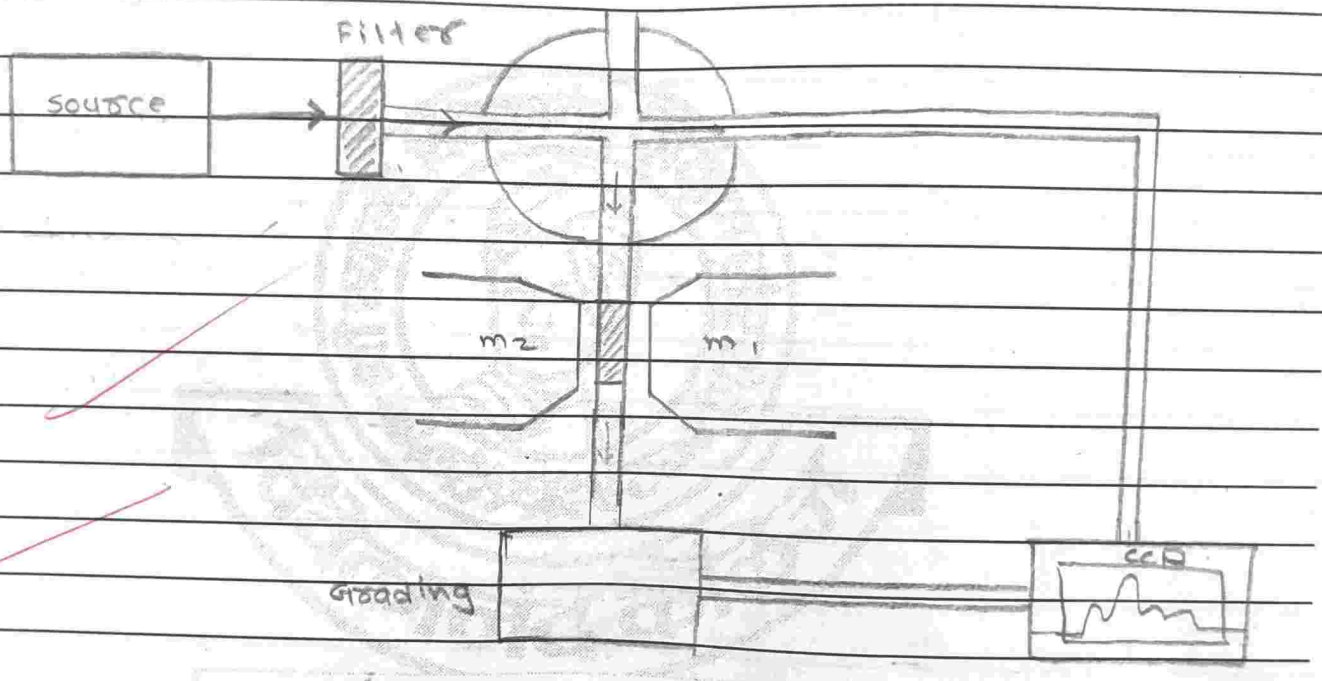
03

Q2.

2) ~~Raman~~ ESR spectroscopy →

ESR spectroscopy play a very important role in structure determination of molecule. The ESR techique the splitting of magnetic energy level is due to applied static electric or magnetic field.

construction -



working -

1] source - In ESR LASR is monochromatic sources is used

2] Filter - Their is a filter to control the unnessary waves

3] Magnet. - Here used two magnet m1 and m2 to spin of electron

4] Grading - The grading is used to grading the light

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SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1334

Class : M.Sc II.

Subject : Thin Film deposition Tech.

Test / Tutorial No. : Internal No-1.

Div. :

Que-1)

1) Stokes.

2) diffraction

3) Vibrational

4) electric field.

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

05

Que. 2)

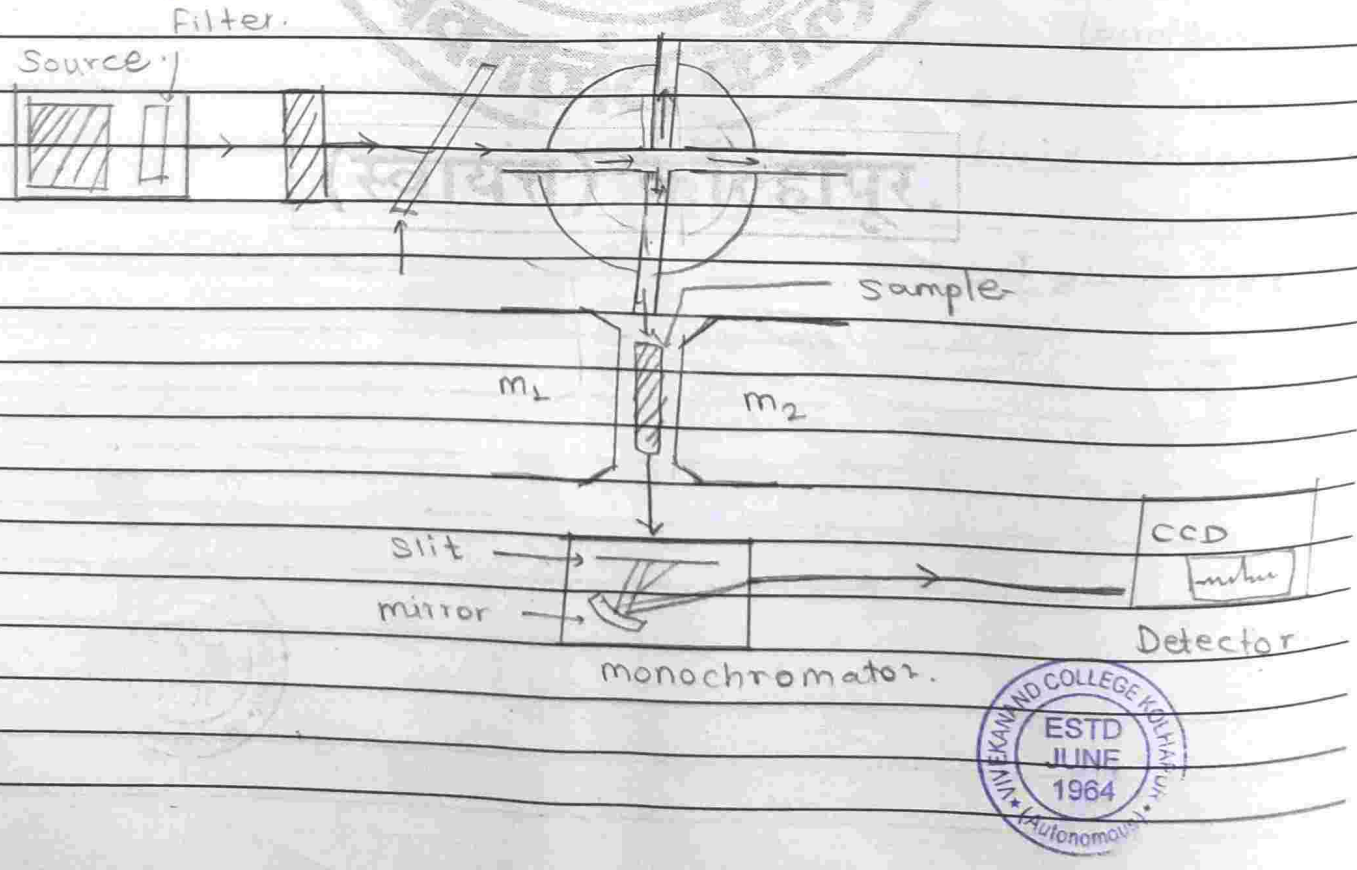
1) Raman Spectroscopy →

Raman spectroscopy dicoscovered by C.V. Raman and Krishanan. Raman spectroscopy in lies in quantum theory cause it helps ~~in~~ depends upon photon. ~~and energy emission.~~

2) ESR Spectroscopy →

- ESR stands for electron spin resonance. it is mainly based on spin of electron.
- In ESR techingue the splitting of magnetic energy level is done due to applied static electrical ~~as well as magnetic~~ field.
- In ESR techingue energy is splitting in diff. energy levels.

ii) ESR spectrometer →.



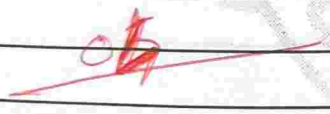
1) Source → There is LESAR source of monochromatic light used for ESR spectra.

2) Filter → There is a filter for reduce unnecessary waves.

3) Magnets → Here we used two magnet to change or detect spin of electrons.

4) Grading → An optical device is used for grading of light which contains slit as well as prism or mirror in it.

5) CCD → well known as detector. dectector is used for. deetect or notice intensity of electron. we show last result neare.
They record provided data.



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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

15/20

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1335

Class : MSC II

Subject : Thin film Deposition Technology.

Test / Tutorial No. :

Div. :

Q 1

1) stokes type of Raman scattering the wavelength of scattered photon increases then incident photon.

2) Raman scattering from classical theory is based on diffraction of molecule.

3) Vibrational spectroscopy plays a very important role in structure determination of molecule.

4) In ESR technique the splitting of magnetic energy level is done due to applied static electric field

5) The energy level difference in ESR splitting is given by. $\Delta E = g\mu_B B_z$

03

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Shri Swami Vivekanand ShikshanSanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc.Part-II (SEM III) Internal Examination (2018-19)

SSP- II

Total Marks: 20

Time: - 2.00 pm to 2.45pm

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. for pure intrinsic material, E_F lies ..... the middle of band gap (at T= 200K)

A) At B) Above C) Below

2. The approximate temperature dependence of are ..... for lattice scattering.

A) $T^{2/3}$ B) $T^{-3/2}$ C) $T^{-3/4}$

3. Carrier concentration at some temp. T K is depend on

A) Exponential of T K B) $T^{2/3}$ C) $T^{3/2}$

4. The process of introducing impurities in intrinsic type of semiconductor is .....

A) Quantum confinement B) doping C) recombination

5. The intrinsic concentration of electron in Si at room temperature is ..... per cm^{-3}

A) 2×10^{6} B) 2.5×10^{13} C) 1.5×10^{4}

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

1. Discuss intrinsic and extrinsic materials. Also discuss the Fermi level in semiconductor.
2. Explain variation of Energy bands with alloy composition in the ternary compound $Al_xGa_{1-x}As$?
3. Draw the band diagram and Fermi-Dirac distribution for both types of Semiconductors.

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

1. Explain carrier concentration at equilibrium and their temperature dependence.
2. Discuss effective mass of electron (KE=0) in semiconductor.
2. Derive the equations for mobility, conductivity and total current density of semiconductor under the influence of applied electric field.

ALL THE BEST

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Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College (Autonomous) Kolhapur

Department of PhysicsM.Sc. II

2018-19

Attendance Sheet

Paper: Solid State Physics-2

Date:12/10/2018

Roll. No.	Name of Candidate	Sign
1	Aswale Nikhil Mohan	
2	Bachate Prajakta Ramchandra	
3	Deshmukh Namita Prataproa	
4	Ghadage Sachin Subhash	
5	Jadhav Anmol Narendra	
6	Jangid Saroj Nemichand	
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Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : -

Roll No. : 1332

Class : M.Sc - II

Subject : semiconductor physics

Test / Tutorial No. : -

Div. : -

15/20

Q1 ① 10^{23}

② Insulator

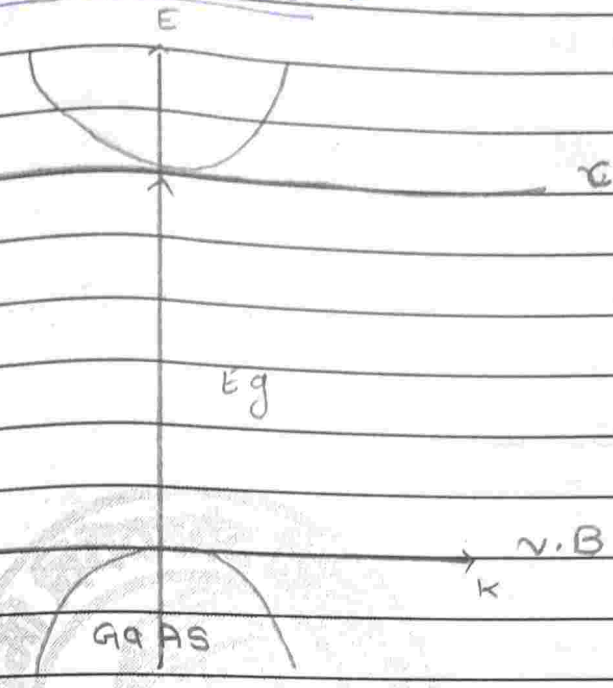
③ decrease

④ 2.16 ev

⑤ $\frac{1}{1+e^{(E-E_F)/KT}}$

Q2.

1] Direct semiconductors →



1] In this semiconductors electron are transition from ~~valence band~~ minimum conduction band to the maximum valence band at same K value.

2] The transition of electron are ~~re~~radioactive recombination and they are use in LED and ~~LA~~ LESR.

3] The transition of electron are momentum and energy is conserved.

4] e.g - GaAs, InP, ZnS.

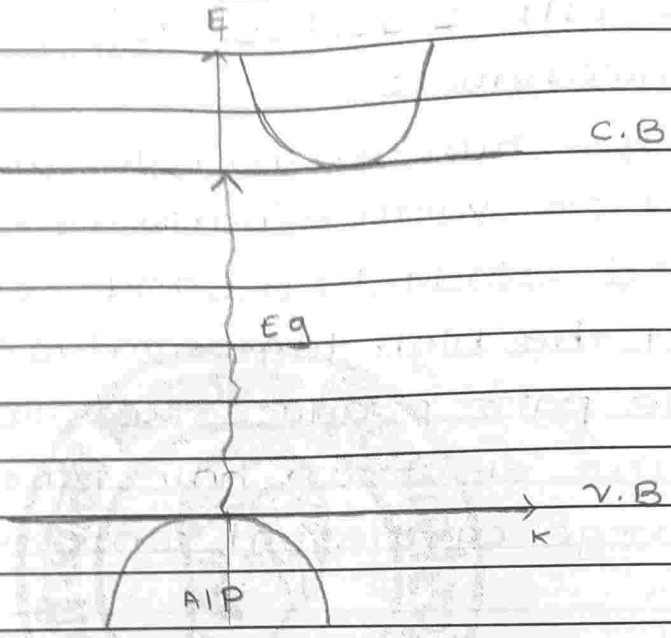
Indirect semiconductors →

1] ~~The~~ In this semiconductor electron are transition from minimum conduction band ~~an~~ to the maximum of valence band at different K value.

2] The transition of electron are non radioactive recombination and this type of SC is used to heat generated

3] The transition of electron either ~~nor~~ momentum or nor energy is conserved.

4] e.g - Si, Ge, Zn, & AlP



SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1332

Class : M.SC - II

Subject : Semiconductor Physics

Test / Tutorial No. : -

Div. : -

The temperature is increase γ_i increase the g_i is also increase equibibrium conc. of hole.

$\gamma_i \propto n_o p_o$

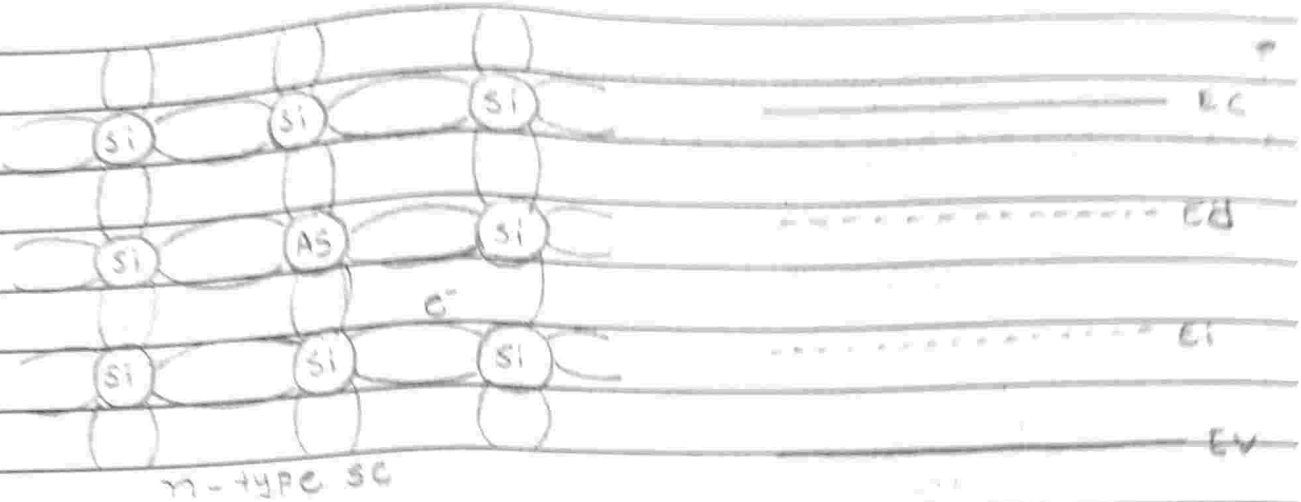
$\gamma_i \propto = g_i^2$

- Extrinsic semiconductor →

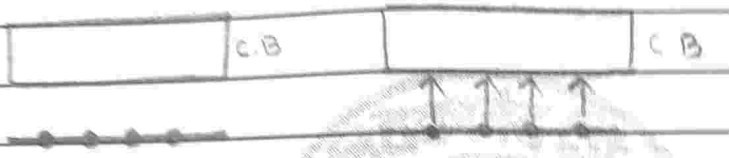
A process adding the impurity of semiconductor as to improve it's condctivity is called dopping

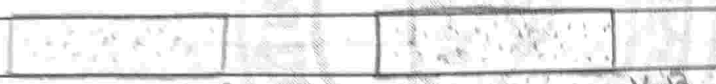
The electron impurity dopped with the pentvalent impurity the Introduce of energy level is near to the conduction band in pure semiconductor and at the 0 K the energy level of is field with the electron. In that level electron are the donetes electron is called donor this resultant impurity is called as n-type of semiconductor. the resultant relation of n-type of semiconductor is $n_o >> p_o$ n_i

e.g - P, Sb, As etc.



n-type SC





at 0K At 50K

The bonding of energy of hydrgen atom is :

$$E = \frac{m^* a^4}{2K^2 h^2}$$

$$K = 4\pi\varepsilon_0\varepsilon_r$$

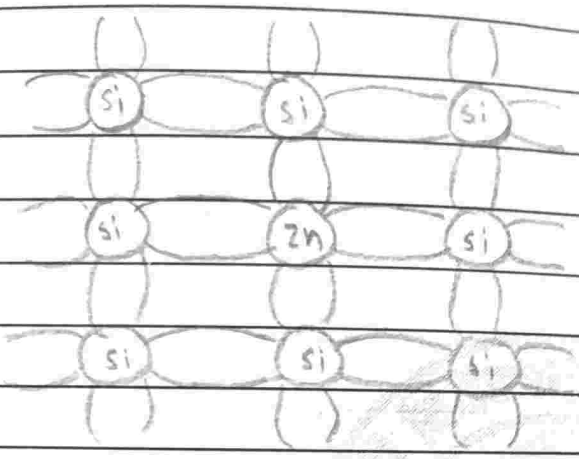
P-type semiconductor →

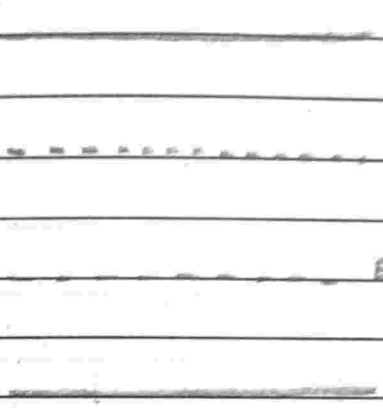
The electron impurity dopped with trivalent impurity. The ~~ind~~ introduces energy level near to the valence band in pure semiconductor. at 0 K the energy level is empty with electron. In that level electron are accepts. this level is called

acceptor level. the resultant impurity is called as p-type of semiconducter.

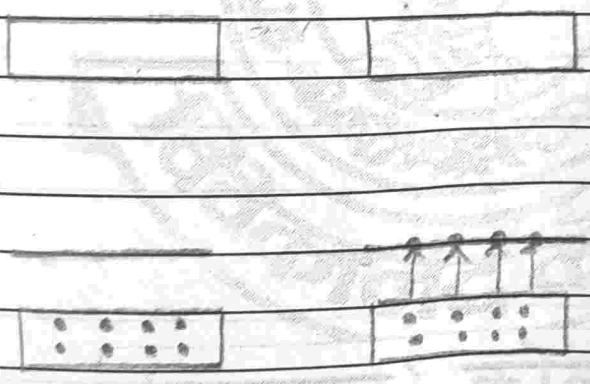
$P_0 \gg n_0$; $P_0 \gg n_i$

e.g - Al, Ga, Zn.





P-type semiconductor



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Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1334

Class : M.Sc II

Subject : Solid State physics II.

Test / Tutorial No. : Internal No-1.

Div. :

18/20

Que.1

1) 10^{23}

2) Insulator.

3) decrease

4) 2.16.

5) $\frac{1}{1+e^{(E-E_F)/KT}}$

Que. 2)

Direct and indirect semiconductors →

There are two types of semiconductor. they are present in cartesion co-ordinate system in quantum mech. so we can used Schrödinger eqⁿ for this.-

$$\left(\frac{-\hbar^2}{2m}\nabla^2 + V(r)\right)\Psi(r) = E\,\Psi_k(r).$$

But if its lies in same plane, then we have.

$$\Psi_k(r) = U_k(r)\, e^{ikr}.$$

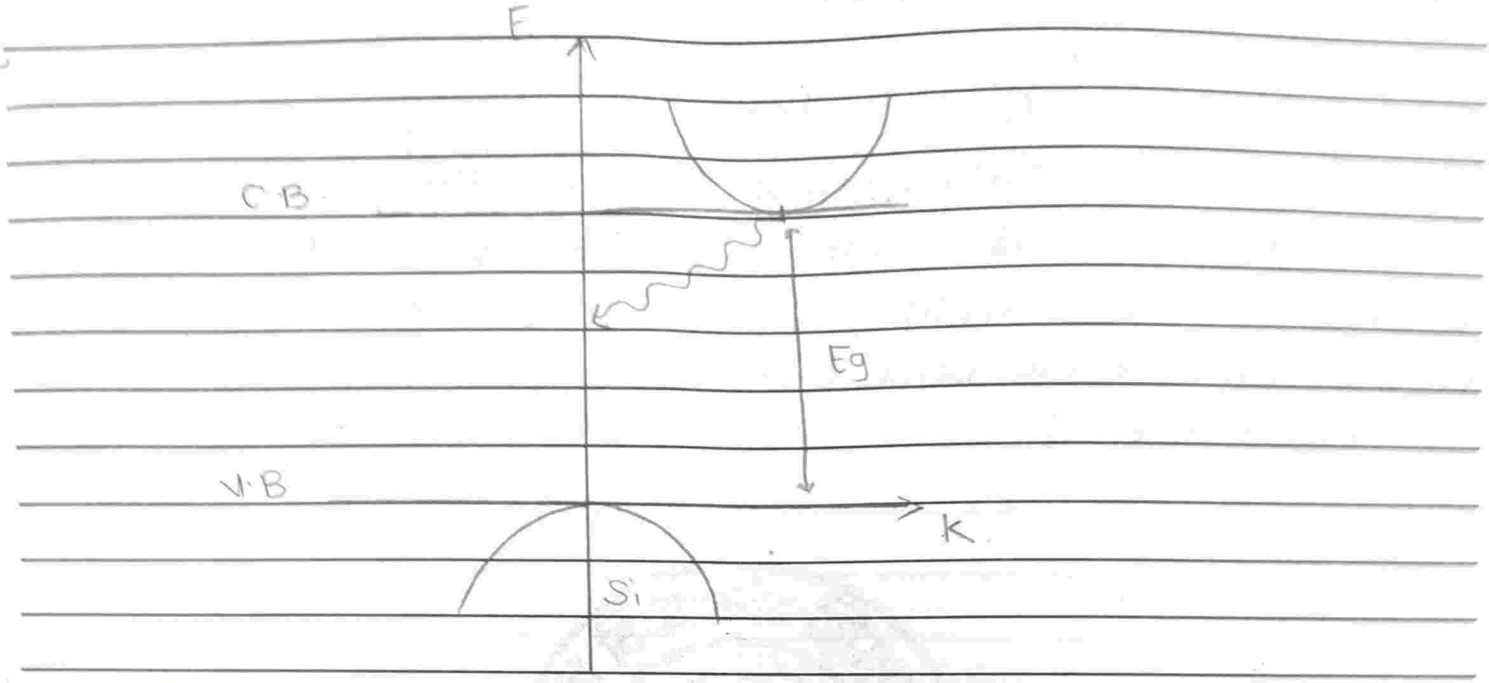
By using this we can assume [E-k] system were we have conduction band and valance band distance between conduction band minima and valance band maxima is Eg. or energy in semiconductor. in [E-k] system at 0K.

1) Direct Semiconductor →

In direct semiconductor ~~energy is~~ conduction band minima and valance band maxima is at same K value

1) direct semiconductors are used in LED'S as well as in Laser.
2) It is changes on energy and momentum of e⁻
3) For eg → GaAs, AlAs.

2) Indirect Semicounductor →



In indirect semiconductor conduction band minima and valance band maxima is initially not at same K. for form semicounductor it must be come at equal k value.

1) Indirect semicounduct produce heat during process.

2) There in no exchange of energy nor momentum in indirect semiconductor.

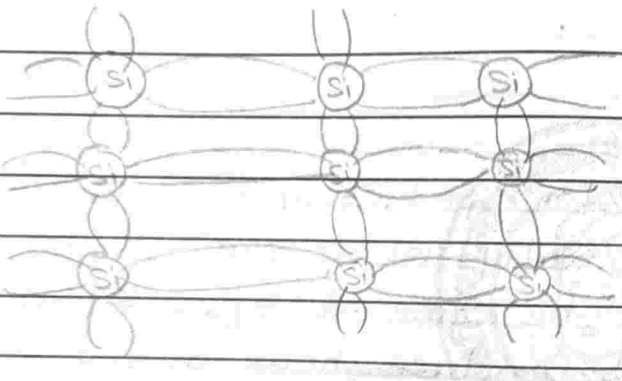
3) For eg) → Pure Si, Pure Ga.

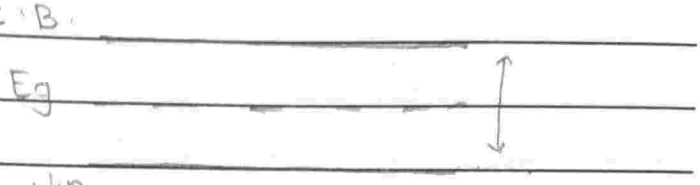
Que.3) Extrinsic and intrinsic semiconductor →.

1) Intrinsic Semiconductor →.

Intrinsic semiconductors are semiconductors which act as insulator at room temperature but behaves as conductor after applying heat. they form bond with it self. with loosely bond pair.

Eg - Pure Si.





2) Extrinsic Semiconductor →

Doping → adding impurity to from holes and electrons.

There are two types of extrinsic semiconductor -
- n-type semiconductor.
- p-type semiconductor.

In extrinsic semiconductor we add external impurity in elementet cause of that it behaves like semiconductor.

1) n-type semiconductor →.

In n-type semiconductor we add pentavalant impurity in ~~with~~ which we are adding ē Free electron in semiconductor that Free electrons can produce energy.

for eg → photovoltic cell.