Notice

Date: Thursday, 06/04/2023

It is hereby informed to the students of M.Sc. – I and II, that Second Term Internal Evaluation Examination is scheduled between 20th to 21st April 2023 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	20/04/2023	M. Sc. – I	Quantum mechanics- II	11 – 12 AM
			Statistical mechanics	12 – 01 PM
02	20/04/2023	M. Sc. – II	Experimental techniques	11 – 12 AM
			Electronic devices and applications	12 – 01 PM
03	21/04/2023	M. Sc. – I	Electrodynamics	11 – 12 AM
			Atomic and Molecular Physics	12 – 01 PM
04	21/04/2023	M. Sc. – II	Solid State Physics- III	11 – 12 AM
			Solid State Physics- IV	12 – 01 PM

Coordinator

HOD, Physics
Head of the
Department of Physics
Vivekanand College, Kolhapur

VIVEKANAND COLLEGE ESTD JUNE 1964 KOLHAPUR - 416003

"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM III Internal Examination (2022-23)

Experimental techniques

Time - 11:00 am - 12:00 noon

Total Marks: 20

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

Q.1Choose the correct alternative and rewrite. **(05)**

1. In gases, the magnitude of ionization current depends on ..... of the gas.
   a) Pressure b) volume c) temperature d) kinetic energy

2. In ..... gauge, the resistance of wire with temperature and pressure is measured by Wheat stone bridge consequently.
   a) Pirani b)McLeod c) Penning d) all of these

3. Maximum power density can be calculated by.....
   a) maximum power per unit length b) maximum power per unit area
   c) maximum power per unit volume d)) none of these

4. Wind energy is the manifestation .....
   a) heat energy b) geothermal energy
   c) solar energy d) mechanical energy

5. India's potential for electrical power from wind power is.....
   a) negligible b) 50MW
   c) 20000 MW d) 100 MW

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

1. Describe principle, construction, working and characteristics of sputter ion pumps.

2. Write short note on thermal conductivity gauges and Describe construction, working and uses of Pirani gauge.

Q.3 Attempt any one. **(05)**

1. Briefly explain the concept of leak detection.

2. Explain the applications of vaccum technology.

VIVEKANAND COLLEGE KOLHAPUR ESTD JUNE 1964 (Autonomous)

Date: 13-04-23 T.Y.B.Sc. : Internal Examination, 2022-23 April

Paper-Experimental Techniques - Marks

Name	Roll No.		Sign.
Shraddha S. chougule	1332	11	
Aishwarya S. Gaikwad	1334	10	
Divya R. Gaikward	1335	16	
Sayali Shantaram Gawade	1336	12	
Rutuja Ravindra Gurav	1337	17	
Jadhav Pravin Prakash	1338	14	
Jadhav Nikhil Sandeep	1339	10	
Jamadar Wahida Sardar	1340	18	
Kakade Seema Vishnu	1341	18	
Khokhar Rafiq Rafiq	1343	10	
Khot Priyanka Balaso	1344	16	
koli Sayali Santosh	1345	17	
Kondaro Adinath Bhaskar	1346	14	
Kore Jyoti vinayak	1347	15	
Sanyogita sanjay patil	1356	13	
Kshirsagar Vijaya Suresh	1348	12	
Kumbhar Pooja Prakash	1349	16	
Kusade Shubhangi Shivaji	1350	14	
Jathbe sammed Rajendra	1351	14	
Nikam Meenali Tanaji	1352	11	
Aakansha Bhimrao patil	1353	17	
Anuja Dattajirao Patil	1354	17	
Siddhant Deepak Pirale	1358	18	
Rajguru Supriya Dhanaji	1359	20	
Rajput Prerana Pundlik	1360	13	
Sayyad Aisaba Javed	1362	15	

VIVEKANAND COLLEGE KOLHAPUR ESTD JUNE 1964 (Autonomous)

Avinash sanjay shelar	13~~6~~63	13	AV
Rohan Raju Sonkamble	1364	13	~~RR Sonkamble~~
Pooja vishwanath sutar	1365	14	Sutar
Pooja Khandekar	1342	18	P. Khandekar

Rajguru Sutariya Dhanaji

27854 (22/10)

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	
Suppliment No. : 01	Subject : experimental techniques
Roll No. : 1359	Test / Tutorial No. :
Class : M.Sc-II	Div. :

Q.1)

1) positive displacement

2) both (a) & (b)

3) 10^{-6}

4) perpendicular

5) IR

05

Q.2)

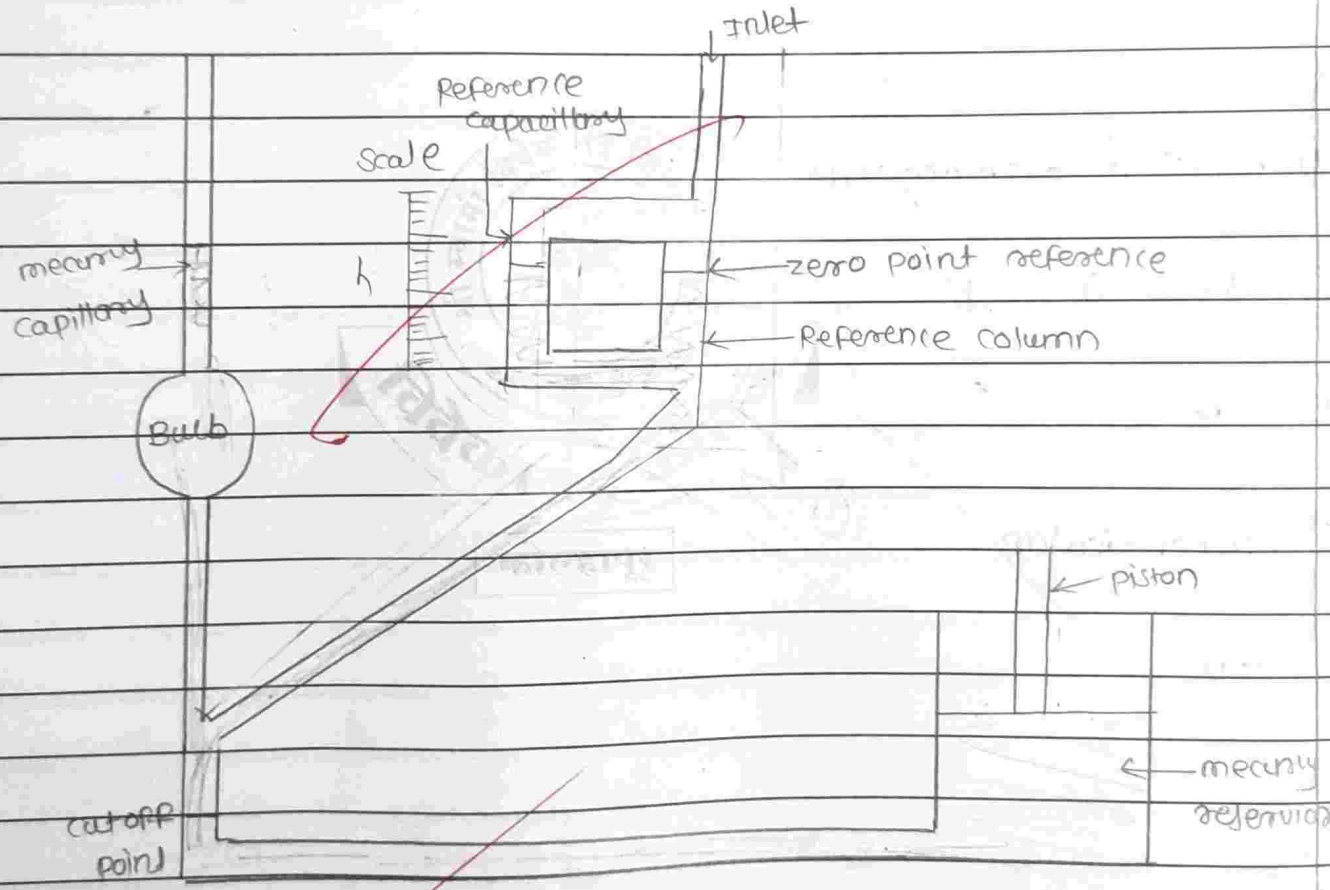
i) Mcleod Gauge:

- The mcleod Gauge is used to measure of very pressure the pressure range is 10^{-6} Torr.
- mcleod Gauge is also measured by mercu vaccuro pressuro.
- It is also known as compression gauge
- mcleod Gauge is similar to mercury manometer

- The mclead gauge due known volume at constant temperature & due to unknown pressure of volume gas.

- **principle:**
The mclead gauge is based of Boyle's low.

- **Diagram:**



Construction:

1) working fluid:
- Here mecury are used in working fluid. It
- It is consists of controlled by cutt off point initially.

2) Mecury Reservior:

- The mecury reservior is main rule to che to store the mercury.
- It is consists of piston the store the mercury when Piston is ~~down~~ upward direction to reference coulum to bulb to it's bulb.

3) Reference column:

- The Reference column placed as one ~~end~~ terminal connected cut off reference point and second terminal is connected at gas inlet.
- The reference column is greater the reference capillary.

4) Reference capillary:

- The reference capillary both ends one connected to the reference column.
- It is placed at very closed to the measuring capillary.
- The diameter of reference capillary & measuring capillary is equal.

5) Bulb:

- The bulb is one terminal connected at measuring ~~mercury~~ capillary and other one is connected at cut off point Reference.
- The bulb diameter is greater than measuring ~~mercury~~ capillary.

6) Measuring capillary:

- The one end of measuring capillary is sealed & other end is connected to the bulb.
- The main Rule of measuring capillary is measure the hight of mecury.

* working:

- First of all remove the gas on bulb & reference capillary.
- The gas inlet on the bulb & reference capillary.
- So the remove the gas then mecury of mecury reservion piston is upward direction.
- Now, connect the connection of gas inlet on bulb & references column. measure the vakcum pressure.
- the mercury filled on the bulb & cut off point references then the piston is downward direction move.
- the gas in coming for inlet to the reference column through cut off point reference. the gas is compressed and create the pressure.
- the fill on mercury on zero point reference to reference capillary.
- Almost the bulb & cut off point reference through cut mecury in mecury capillary.
- The different at hight of measuring capillary and references capillary.
- This height h is also known as final volume of gas.
- The mclead gauge is also differences calculated by initial & final volume of gas.

Rajguru Supriya Dhanaji

27872

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 02
Roll No. : 1359
Class : M.SC II

Subject : Experiment technique
Test / Tutorial No. :
Div. :

• The Boyle's law also find the initial volume of gas & final volume of gas.

* Melod derivation :

⁘ The initial volume of gas is equal final volume of gas
P_1V_1 & P_2V_2
According to Boyle's law
$P_1V_1 = P_2V_2$

Here,
• The V is volume of cut off point to bulb to measuring capillary.
• The area of cross section of meany capillary = πa
• And height of meany in measuring capillary = hc
• The initial volume of gas is trapped on measuring capillary we get,
$V_1 = V_1 + \pi ahc$
• And final volume of gas is given by
$V_2 = V_2 + \pi ah$
• Here, P_1 = initial pressure of volume gas.
P_2 = final volume gas.

$P_2 = P_1 + ah$

from the above eq^n

$P_1V_1 = P_2V_2$

put this value of P_2 & V_2 in above eq^n

$\therefore P_1V_1 = (P_1 + ah)(V_2 + ah)$

$= (P_1 + ah)V_2 + (P_1 + ah)ah$

$= (P_1 + ah)h$

$P_1V_1 = P_1h + ah^2$

$\therefore P_1V_1 - P_1h = ah^2$

$P_1(V_1 - h) = ah^2$

$\therefore P_1 = \frac{ah^2}{(V_1 - h)}$

Here, $V_1 \approx (V_1 - h)$; were $V_1 - h$ is very small

$\therefore \boxed{P_1 = \frac{ah^2}{V_1}}$ (6)

the above equation using and find the mecury ~~lev~~ ht difference.

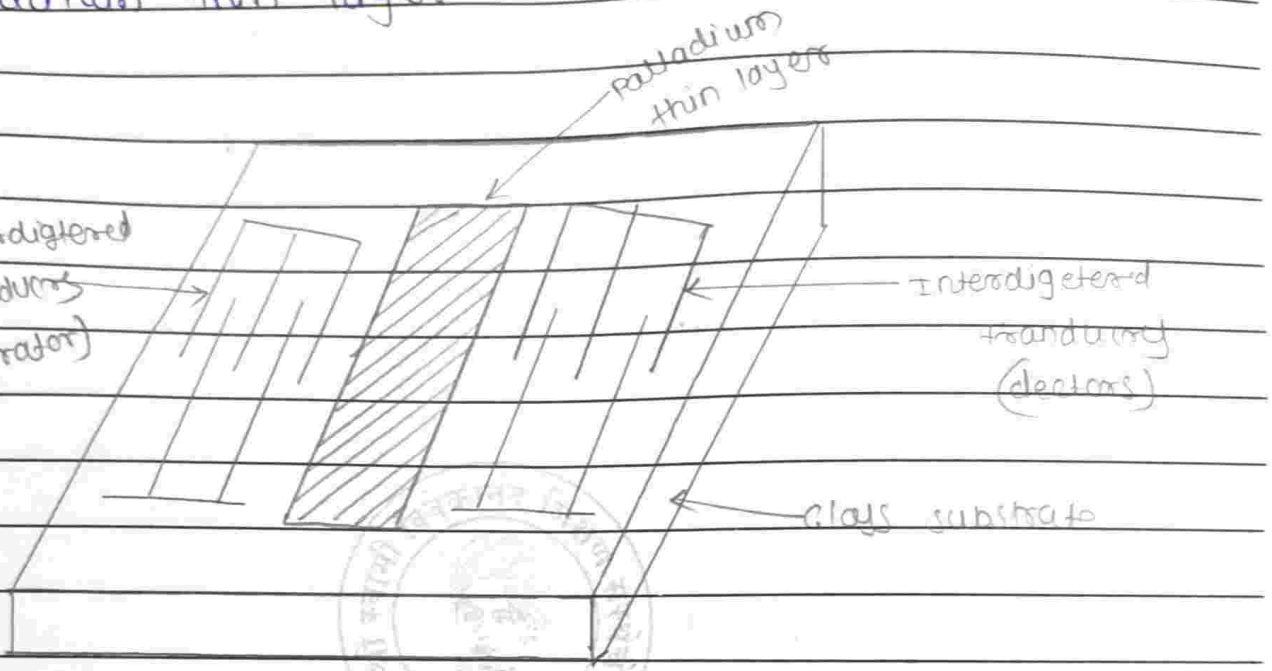
Q.3)

ii) Palladium barrier detector:

Construction:

- The glass substrate on construct the thin layer of palladium barrier detector. They are placed at the centre of substrate.
- The wing of interdigitted transducers are two ways.

- The interdigitted tranducres one is surface acautic wave generater and another one is deteror.
- The interdigtered tranducres are placed at both sides of palladium thin layer.

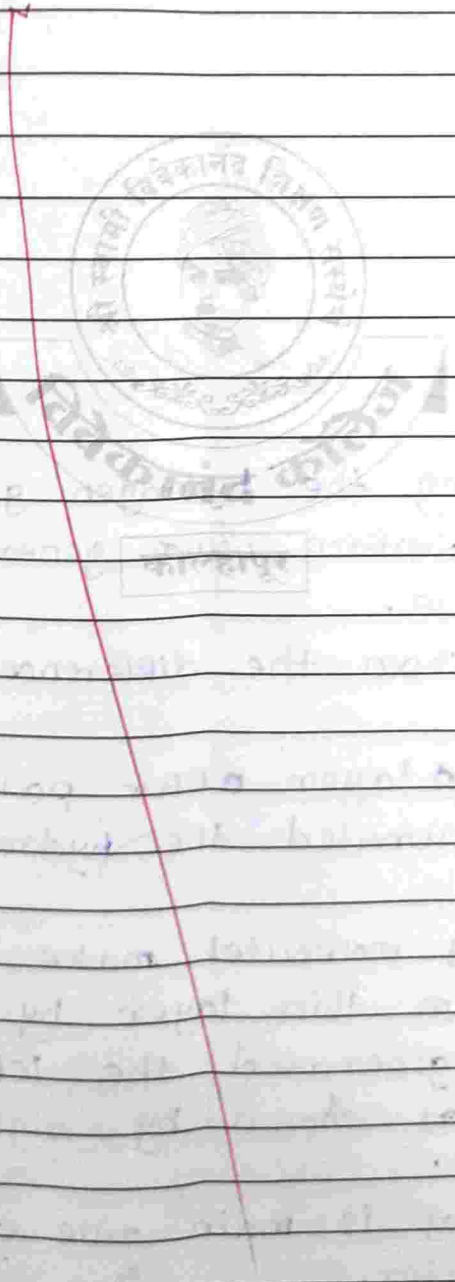


working;

- The Before passing the hydrogen gas the intedigtered ~~indt~~ tranducres ~~surface~~ wave generates is IDT is ~~as~~ a same phase.
- It ~~dose~~ doesn't shows the differences at right hand layer.
- The palladium ~~pl~~ layer after passing the hydrogen ~~ga~~ gas the generated the hydrogen hydrate gas molecules.
- this hydrate gas molecules make the thin layer of an palladium thin layer by hydrogen.
- Due to ~~SAW~~ generated the left hand tranducres surface wave as shown by right hand interdigtered tranducres.
- The H_2 molecules is main rule of the palladium thin layer. deteetor.

uses : 1) chemical industrial
2) power station
3) Fuel cell technology

05



Jamadar Wahida Sardar.

18/20

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

27839

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1340

Class :

Subject : Experimental techniques.

Test / Tutorial No. :

Div. :

Q. 1.

1) Positive displacement.

2) both a & b.

3) 10^{-6}.

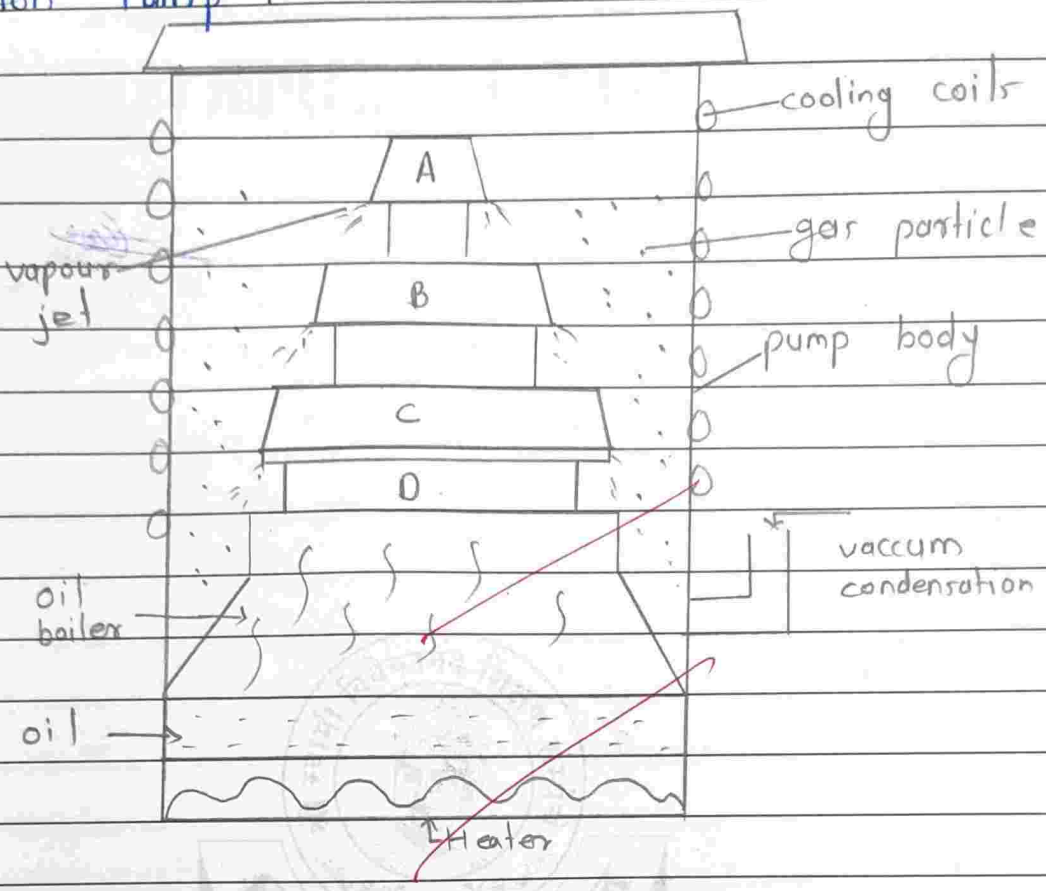
4) perpendicular.

5) TR.

85

Q. 2

II) Diffusion Pump :-



i) Diffusion pump are most commonly used mechanism creating a high vaccume in industrial vaccume processing.

ii) It is commonly used in mass spectroscopy and research and devolopment.

* Working :-

i) It is produced high vaccum nearby 10^{-12} mbar even in the poor condition when their are reactive gases are present.

ii) Diffusion pump is madeup of stainless steel

chamber which ~~on~~ we can vary its size by based on its applications.

iii) The diffusion of the pump of the size is consist of three varying sized.

iv) Cone shape pressure jet stacked vertically.

v) lower cone is largest and decrease in size as gas move upward.

vi) The excited gas travells in upward direction and exist through pressure jet that are pointed downward direction.

vii) The very bottom chamber is heated ~~when~~ a where a oil is heated.

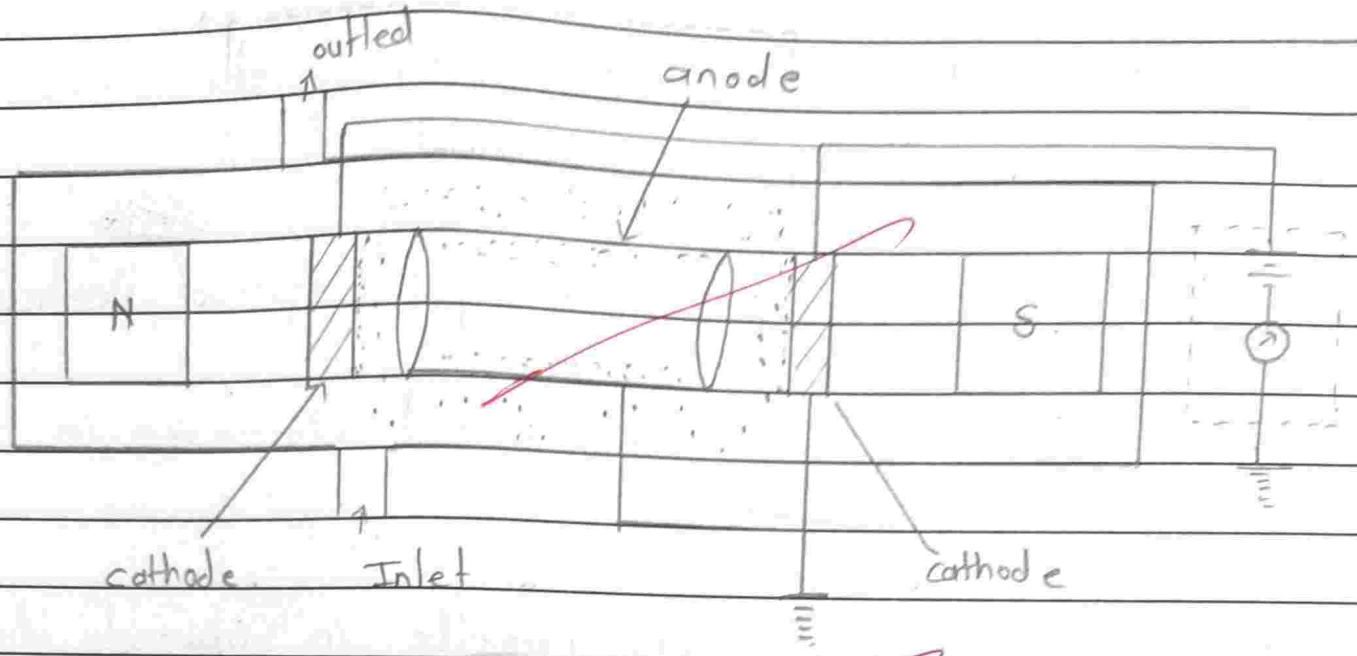
viii) The downward shooting vapour travels at an incredible speed.

ix) The gas travels ~~through~~ towards the wall of the chamber it traps the air through diffusion.

x) The chamber is always water cooled.

xi) When the gas reached the chambers wall it imidiatly return in liquid form.

* Sputter Ion Pump :-



i) Sputter ion pump gas captured type vaccum pump that junctions without pump fluid.

ii) It mainly combines electric and magnetic field of ionize gas and then trap them creates the vaccum.

* Working :-

i) Sputter ion pump is basically consist of two electrode i.e. anode and cathode and magnet anode is usually cyclindrical in shape and it is madeup of stainless steel

ii) Cathode are placed on both side of anode and

it is madeup of titanium.

iii) Magnetic field is oriented along the axis of anode

iv) As we apply the electric field across the cathode it emitts electron and due to presence of magnetic field they move which improves there chanses to collides to the gas molecule.

v) After the collision of gas they create positive and negative ions.

vi) Positive ions moves towards the cathode

vii) Negative ions moves towards the anode.

viii) These sepration of charge gives the seprate (+)ve and (-)ve ~~ions~~ current on cathode and anode.

ix) We get the vaccum inside the cell because of charge sepration

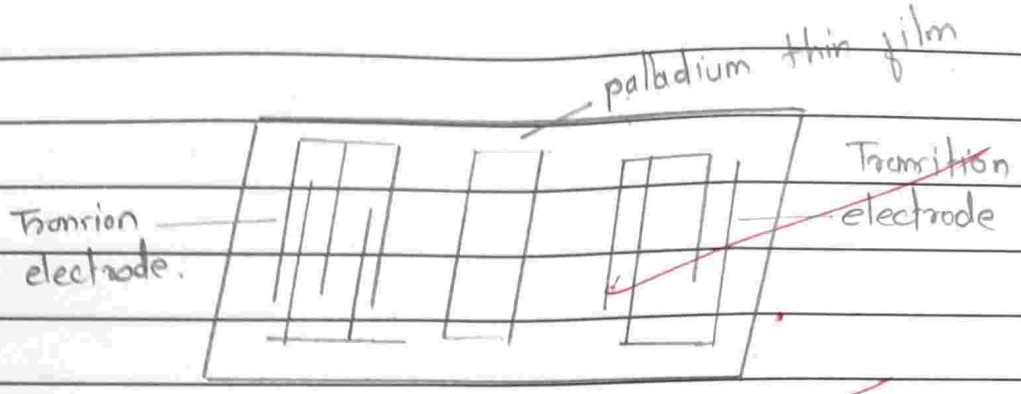
* It create the ultra high vaccume pressure nearby

* Applications :-

i) Semiconductor manufacturing company
ii) Ionization.

Q. 3.

ii) Palladium barrier detector :-



i) The thin film of palladium is deposited on the glass substrate.

03

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Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM IV Internal Examination (2022- 2023)

Electronic devices

Time - 12:00 noon - 01:00 pm Total Marks: 20

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)**

i) In case of n-p-n transistor, base transport factor (α_T) is .....

a) measure of the injected hole current compared with the total emitter current
b) ratio of the hole current reaching the collector to the hole current injected from the emitter
c) leakage current between the collector and the base with the emitter base junction open
d) common base current gain

ii) The collector current for the common-base configuration in p-n-p transistor is given by

a) $I_C = \alpha_0 I_E + I_{CBO}$ b) $I_C = \alpha_0 I_B + I_{CEO}$ c) $I_C = \gamma + I_{CEO}$ d) $I_C = \alpha_0 I_B + \gamma$

iii) To derive the current-voltage expression for an ideal transistor, which of the following condition is wrong ?

a) The device has uniform doping in each region
b) The hole drift current in the base region as well as the collector saturation current is negligible
c) There is high-level injection
d) There are no series resistances in the device

iv) In p-n-p transistor , to improve the frequency response, the transit time of minority carriers across the base must be....., therefore, high-frequency transistors are designed with a ..... base width.

a) Short, short b) High, high c)Short, high d)High, short

v) MESFET stands for .....

a) metal-semiconductor field-effect transistor
b) metal electron semiconductor field-effect transistor
c) metal elemental semiconductor field-effect transistor
d) metal based electrical semiconductor field-effect transistor

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

i) Explain modes of operation of BJT depending of polarities of EB and CB junction
ii) Write a note on frequency response of BJT and hence obtain equation for transit time of minorities carriers

Q3.Attempt any one **(10)**

i) Write a note on construction and working of BJT. Hence obtain the relation of collector current for n-p-n transistor
ii) Elucidate MESFET device structure and its application

Section	Q. No.													02
	Marks													

प्र. क्र.
Q. No.

Attendance (Internal Exam) 20-04-2023

Paper- Electronic Devices & Applications

	Name	Roll No	Marks	Sign
1)	Shraddha S. Chougule	1332	09	
2)	Aishwarya S. Gaikwad	1334	10	
3)	Divya Ramesh Gaikwad	1335	14	
4)	Gawade S. Shantaram	1336	17	
5)	Gavar R. Ravindra.	1337	13	
6)	Pravin P. Hivare	1338	15	
7)	Nikhil S. Jadhav	1339	09	
8)	Jamadar Wahida S.	1340	12	
9)	Kalvade Seema Vishnu	1341	16	
10)	Khandekar Pooja Sanjay	1342	15	
11)	Kohaklar Raees R.	1343	14	
12)	Kokil Priyanka Balaso	1344	13	
13)	Kondave Adinath J.	1346	12	
14)	Kore Jyoti Vinayak	1347	17	
15)	Kshirsagar Vijaya Suresh	1348	18	
16)	Kumbhar Pooja P.	1349	11	
17)	Kavade Shabhargi Shivaji	1350	17	
18)	Sammed R. Latthe	1351	09	
19)	Nilam Anuradha Tanaji	1352	09	
20)	Alankesha Bhimrao Patil	1353	11	
21)	Anuja Dattatray Patil	1354	14	
22)	Patil Sanyogita Sanjay	1356	15	
23)	Shrutika J. Patil	1357	16	
24)	Pivale Siddhath Deepak	1358	17	

ction	Q. No.													03
	Marks													

क्र. No.				
25)	Rajguru Sofiya P.	1359	19	
26)	Rajput Prerna P.	1360	03	
27)	Sayyad Aleeba J.	1362	08	
28)	Shelar Avinash S.	1363	10	A.V. Shelar
29)	Pooja Vishwanath Sutar	1365	09	

• Name: Rajgure supriya bhanaji

26847

Signature of Jr. Super.

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, Internal Examination - Electronic Devices & Applications

at the Physics Examination

उमेदवाराचा आसन क्रमांक (Candidate's Seat No.) 1359 विभाग (Section)

19/20

null

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्या नंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे शक्य तितक्या सुवाच्यपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there be anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

प्र. क्र. Q. No.

Q I)

Answers

a) 400 MeV

b) 90°

c) Electromagnetic

d) λT_{max} = Constant

e) An ideal

05

VIVEKANAND COLLEGE KOLHAPUR ESTD JUNE 1964 (Autonomous)

प्र. क्र.
Q. No.

· Fresnel Equation :

Q.2) Fresnel eq? is also known as Fresnel Coefficient which is nothing but ration of electric field of reflected & transmitted wave to incident wave.

This equation gives relative amplitude as well as phase shift bet? waves

· It gives reflection & transmission of light at interface of medium

· It Proved that light is transverse wave.

· We see Fresnel effect on water surface
· It depends upon angle of incidence

· In this case plane of incidence play a important role

· Polarization of light :

a) S - Polarization

b) P - Polarization

a) S- Polarization - when plane of incidence is ⊥ or to the incident polarization of light

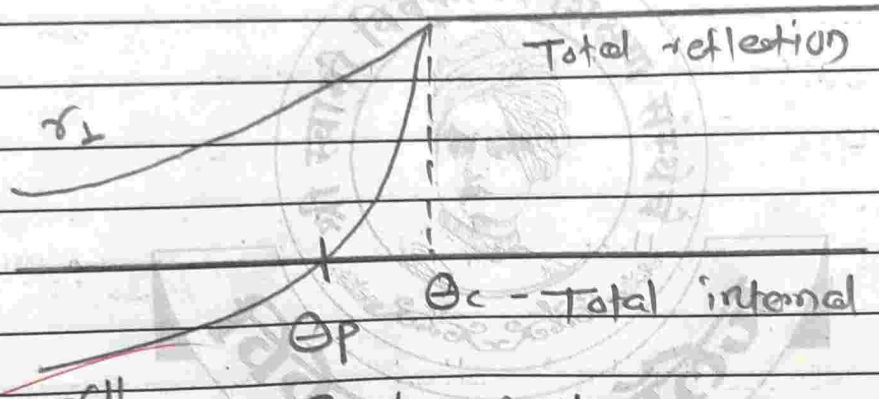
प्र. क्र.
Q. No.

b) P- Polarization

— when Polarization of light Parallel to the plane of incidence

· Freshnel Equation :-

It Considers magnitude & phase both.



· Freshnel eq^n for S- Polarization -

$$E_i + E_r = E_t$$

But $B = \frac{nE}{c_0}$

so $\theta_i = \theta_r$

$$\text{so } t_s = \frac{E_t}{E_i} = \frac{2n_i \cos\theta_i}{n_i \cos(\theta_i) + n_t \cos\theta_t}$$

· for P- Polarization : $\frac{E_t}{E_i} = \frac{2n_i \cos(\theta_i)}{n_t \cos(\theta_i) + n_i \cos(\theta_t)}$

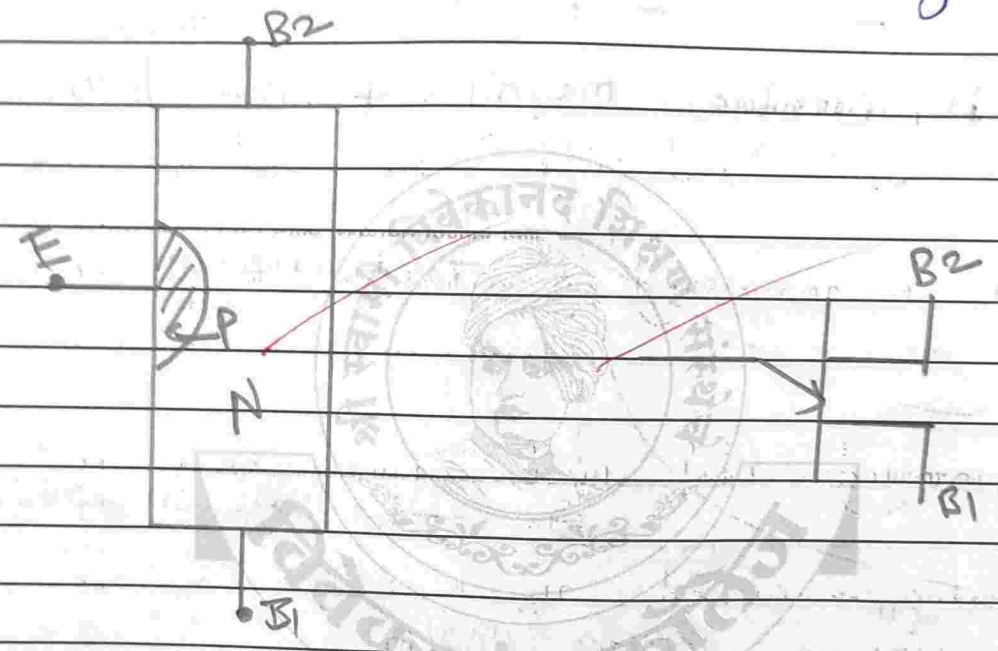
Q. No.

Marks

·Q.3·

·Explain Construction & Working of UJT·

· It is a double base diode
· 3 Terminal Solid state switching device.

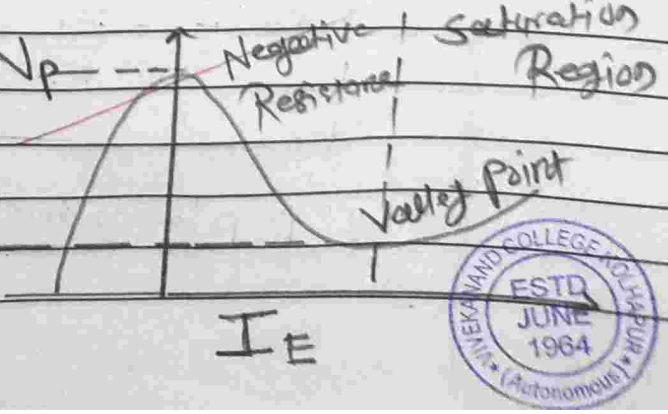


·Construction:-

· It consists of lightly doped N-type Si bar with heavily doped P type material & forms P-N junction.
· Base have two ohmic contact
· emitter junction closer to Base junction
· structure is similar to JFET.

·Operation·

· Ev voltage changes characteristically as we change emitter current.



Name: Kurade Shubhangi Shivaji

26845

Signature of Jr. Super.

विवेकानंद कॉलेज, कोल्हापूर (स्वायत्त)

परीक्षेच्या _____ या विषयाच्या प्रयोग परीक्षा

Practical Examination in, M.Sc-II Internal exam - 2023

at the Physics Examination

17/20

उमेदवाराचा आसन क्रमांक (Candidate's Seat No.) 1352

विभाग (Section) Mmt

उमेदवारांना सूचना

१. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
२. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
३. कोणताही विद्युतप्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्या नंतर पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
४. सर्व निरीक्षणे कोटकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे शक्य तितक्या सुवाच्चपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
५. प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेघ ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

1. Read the question carefully and perform the experiment as required.
2. If there be anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you
3. Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection and obtain the examiner's permission to proceed.
4. Express all observations in a tabular form. It is also desirable that all intermediate calculations and results should be entered as neatly and clearly as possible
5. No numerical figures should be written over either in the preliminary or final observations. If any figure is shought to be discarded it should be run through and the desired figure written near to it.
6. Please see that your table is in good order before you leave the laboratory.

(येथून लेखनास सुरवात करा.) (Begin writing here.)

प्र. क्र. Q. No.

Q-1)

i) 400 meV

ii) 90°

iii) electromagnetic

iv) ΔT_{max} = Constant

v) an ideal

05

VIVEKANAND COLLEGE KOLHAPUR (Autonomous) ESTD JUNE 1964

प्र. क्र.
Q. No.

Q.27 Freshel equations

Freshel equation also known as Freshel Coefficient equation which nothing but ratios of electric field of Rf & t with I light

. which gives relative amplitude as well as phase shift bet' waves.

. It gives reflection & transmission of light at interface of medium

. It proved that light has transverse nature

. We see FE effect on water surface

. It depends upon angle of incidence

. In this case plane of incidence plays important role.

. Polarization of light

1) S- Polarization
2) P- Polarization

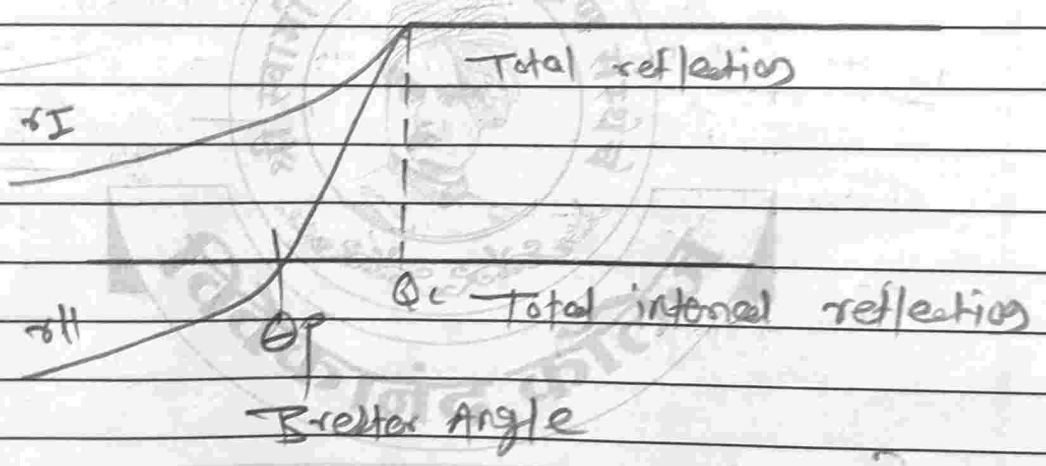
1) S- Polarization : When plane of Incident is perpendicular to the Polarization

प्र. क्र.
Q. No.

2) ⊥ polarization : when polarization of light ⊥el to the plane of incidence

Fresnel Equation :

It Considers magnitude & phase both



Fresnel equation for s-Polarization

let us have, $E_i + E_r = E_t$

Beat $\beta = \frac{nE}{C_0}$

So $\theta_i = \theta_r$

So $t_s = \frac{E_t}{E_i} = \frac{2n_i \cos\theta_i}{n_i(\cos\theta_i) + n_t \cos\theta_t}$

04 Section | Q. No. | Marks

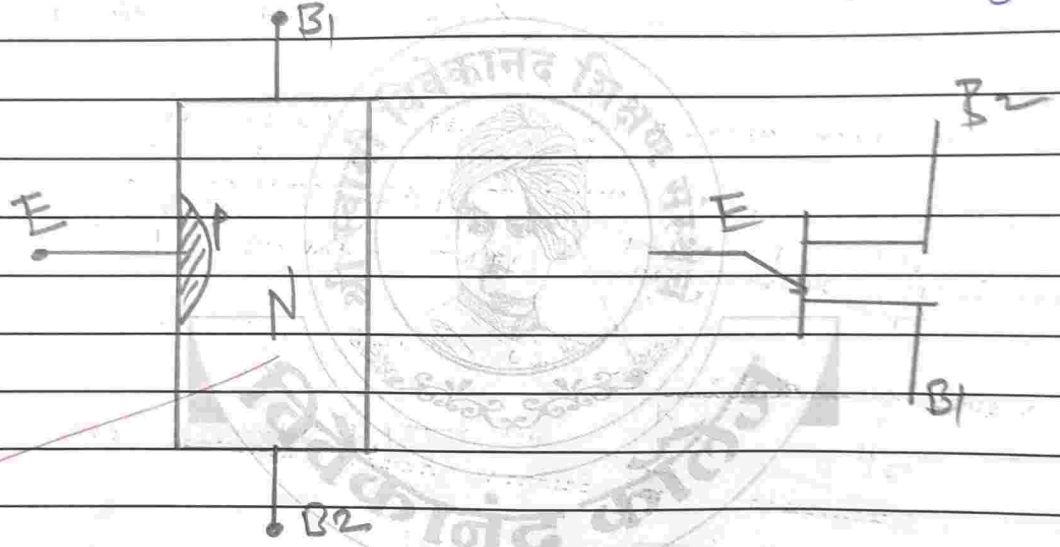
प्र. क्र. Q. No.

· For P- Polarization :

$$\frac{E_t}{E_i} = \frac{2n_i \cos\theta_i}{n_t \cos(\theta_i) + n_i \cos\theta_t}$$

(Q.3) · UJT :

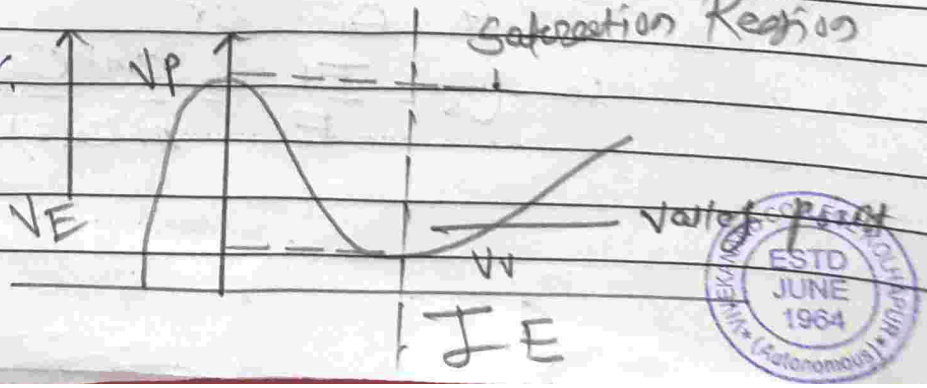
· It is double base diode.
· It 3 terminal solid state switching devices.



· Construction :

It consists of lightly doped N-type Si bar with heavily doped P-type material forms P-N junction.
· Base have two ohmic contact
· Emitter junction closer to Base junction
· structure is similar to JFET.

· Operation :



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-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM IV Internal Examination (2022-23)

SSP 3 : Physical Properties of Solid

Time - 02:00 pm - 03:00 pm Total Marks: 20

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. In colour centre defect of crystal there is excess of …….. Ion.
   a) Metalloid b) Metal c) Non-metal d) Non of the above

2. In Schotty defect density of crystal is…….
   a) Increases b) Decreases
   c) Remains same d) Both increases and decreases

3. Electron and Phonon interaction produces…….
   a) Polariton b) Photon c) Polaron d) Phonon

4. In case of quantization of Elastic wave the term…….is called as Zero point energy.
   a) $2\hbar\omega$ b) $4\hbar\omega$ c) $\frac{1}{4}\hbar\omega$ d) $\frac{1}{2}\hbar\omega$

5. Dispersion relation for electromagnetic wave shows that if $\varepsilon=\infty$ then there are…….
   a) Free oscillation b) longitudinal polarized wave
   c) damped oscillations d) Transverse polarized Wave

Q2. Answer the following (any one) **(10)**

1. Explain the concept of vibrations of crystal with monoatomic lattice also explain brillouin zone, group velocity and long wavelength
2. Derive an expression for number of vacancies in Schotty defect and explain the concept of F-centre.

Q3. Answer the following (Any one) **(5)**

1. Write a note on Edge dislocation and Grain boundary.
2. Explain the concept of Quantization of elastic wave.

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Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College (Autonomous) Kolhapur

Department of PhysicsM.Sc. II

2022-23

Attendance Sheet

Paper: Solid State Physics-III

Date:21/04/2023

Roll. No.	Name Of Candidate	Sign
1	Kshirsagar Vijaya Suresh	
2	Kumbhar Pooja Prakash	
3	Kurade Shubhangi Shivaji	
4	Latthe Sammed Rajendra	
5	Nikam Mrunali Tanaji	
6	Patil Aakansha Bhimarao	
7	Patil Anuja Dattajirao	
8	Patil Rajat Jaywant	
9	Patil Sanyogita Sanjay	
10	Patil Shrutika Jaysing	
11	Pirale Siddhant Deepak	
12	Rajguru Supriya Dhanaji	
13	Rajput Prerana Pundlik	
14	Sakate Santosh Shripati	
15	Sayyad Alsaba Javed	
16	Shelar Avinash Sanjay	
17	Sonkamble Rohan Raju	
21	Sutar Pooja Vishwanath	
22	Gaikwad Aishwarya Suryakant	
23	Chougule Shraddha S.	
24	Gaikwad Divya Ramesh	
26	Gavade Sayali Shantaram	
27	Gurav Rutuja Ravindra	
28	Hirave Pravin Prakash	
29	Jadhav Nikhil Sandeep	
30	Jamadar Wahida Sardar	
31	Kukade Seema Vishnu	
32	Khandekar Pooja Sanjay	
33	Khokar Raeez Rafiq	
34	Khot Priyanka Balaso	
35	Kondare Adinath Bhaskar	
36	Kore Jyoti Vinayak	

VIVEKANAND COLLEGE KOLHAPUR ESTD JUNE 1964 (Autonomous)

shraddha sanjay chougule.

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– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

27608

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1332

Class : M.Sc - II

16/20

Subject : Solid State Physics III

Test / Tutorial No. :

Div. :

Q1 ① Low

② Interstial

③ $F = U - TS$

④ Screw dislocation

⑤ Surface

4

① Consider the perfect crystal at temperature T and +ve and -ve ion in their lattice. according to the thermodymic equilbrium at a low external pressure at constant T. the helmoltz free energy of eqn is,

$$F = U - TS \quad \text{——— ①}$$

U - internal energy

S - entropy.

The entropy of the ~~Helmolt Boltman~~ Boltzman equlibrium is,

$$S = K \log W \quad \text{——— ②}$$

The internal energy is,

$$U = Ep. \quad \text{——— ③}$$

Let, us consider lattice defect is N and number of ~~ion~~ cations and anion in the lattice defect is n.

$$W = \frac{N!}{(N-n)!\,n!} \quad \text{——— ④}$$

$$W^2 = \left[\frac{N!}{(N-n)!\,n!}\right]^2$$

put the value of W in eqn ②

$$S = K \log \left[\frac{N!}{(N-n)!\,n!}\right]^2 \quad \text{——— ⑤}$$

eqn ⑤ and ③ put in eqn ①

$$F = nEp - TK \log \left[\frac{N!}{(N-n)!\,n!}\right]^2$$

$$F = nEp - 2TK \left[\log \frac{N!}{(N-n)!\,n!}\right]^2$$

$$F = nE_p - 2TK\left[\log N! - \log (N-n)!\, n!\right]$$

$$F = nE_p - 2TK\left[N\log N - N - n\log n - n - (N-n)\log(N-n) - (N-n)\right]$$

this eqn comes according to the sterlling formula.

$$x \log x = x \log x - x$$

$$F = nE_p - 2TK\left[N\log N - n\log n - (N-n)\log(N-n)\right] \quad \text{---} (6)$$

Diff. the above eqn with w.r.t. n.

$$\frac{dF}{dn} = E_p - 2TK\left[N\log N - n\frac{1}{n} - (N-n)\frac{1}{(N-n)}\log(N-n)\right]$$

$$= E_p - 2TK\left[\log n - \log(N-n) - (-1)\right]$$

$$= E_p - 2TK\left[\log n - \log(N-n) - (+1)\right]$$

$$= E_p - 2TK\left[\log n - \log(N-n)\right]$$

$$\frac{dF}{dn} = E_p - 2TK\left[\log\frac{(N-n)}{n}\right]$$

consider $\frac{dF}{dn} = 0$.

$$E_p - 2TK\left[\log\frac{(N-n)}{n}\right] = 0$$

$$2TK\left[\log\frac{(N-n)}{n}\right] = E_p$$

$$\log\frac{(N-n)}{n} = \frac{E_p}{2TK}$$

$$\log \frac{N}{n} = \frac{E_P}{2TK}$$

$$\log n = \frac{N}{e^{E_P/2TK}}$$

$$\therefore \boxed{n = \frac{N}{e^{-E_P/2TK}}}$$

This is the eqn for expressing for the number of vacancies in schottky defect.

$$n = 2.8 \times 10^{11}$$

Shraddha Sanjay Chougule

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
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SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 1

Roll No. : 1332

Class :

Subject :

Test / Tutorial No. :

Div. :

3. ① point defect -

The deviation of the regutarlly, confined the small in region and only for few lattices defect is called as point.

The point defect is the zero diamentional.

Types of the point defect -

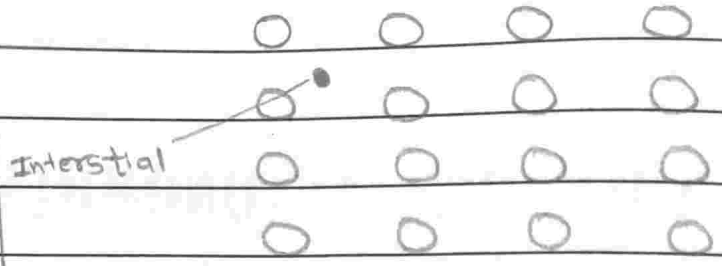
1] Interstial defect -

The presence of foreigen atom at any intertial position causes Interstial defect.

The some of hydrogen atom can causes intertial position.

The bombarding of crystal lattices on the elementry partices on the lattices.

~~The~~ This defect is used to modifie the chemical and physical properties of the material.



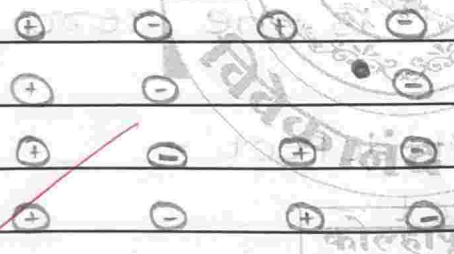
2] Schottky defect -

The vaccancy in the ion is schottky defect. The size of cation and anions are the same in this defect.

The defect density decreases by the given substrances.

In the ions the cation and anion are in the same size.

example - NaCl, $CaCl_2$ etc.



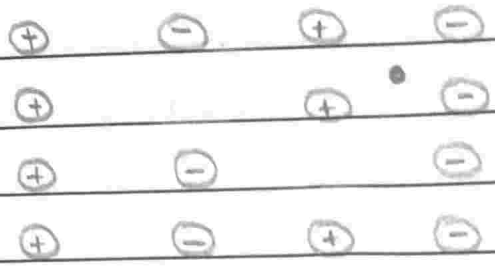
3] Frenkel defect -

The atom or the smaller ion can be live their place and form vaccancy this is known as frenkel defect

Frenkel defect observed in crystal having low co-ordination number

In this defect the ion cation and anion are different in size

Frenkel defect is the combination of the vaccancy defect and Interstial defect.



Gaikwad Divya Ramesh

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 1

Roll No. : 4335

Class : Msc-II

17/20

Subject : solid state physics III

Test / Tutorial No. :

Div. :

1

1

→ Low

2

→ substitutional

3

→ $F = U - TS$

4

→ screw dislocation.

5

→ surface.

5

2
(1)

→ Expression for number of vacancies in schottky defect

In the vacancies of in schottky defect.
The lattice of ~~the~~ having time t = 0 having ~~the~~ positive & negatived charged ions.

In Helmontans free energy.

$$F = U - TS \quad \text{--- (1)}$$

U → initional energy of lattice.
T → temperatur.

In initital energy eqn gives.

$$U = nEp. \quad \text{--- (2)}$$

Ep → vaccancy pair.
n → no. of charge.

Boltzman relaction

$$S = K \log W. \quad \text{--- (3)}$$

K → Boltzmon conct.
~~W~~ → total ~~vaccancy of~~ vibration energy.

Now, 'N' be the no. of atom ~~of~~ on crystal & 'n' be the schtteky defect.
The total vibrational energy becomes.

$$W = \frac{N!}{(N-n)!\,n!}$$

Squaring on both side of W.

$$W^2 = \left[\frac{N!}{(N-n)!\,n!}\right]^2$$

put this value in eqⁿ (3)

$$S = K \log W$$

$$S = K \log \left[\frac{N!}{(N-n)!\, n!} \right]^2$$

$$S = K 2 \log \left[\frac{N!}{(N-n)!\, n!} \right]$$

$$S = 2K \log \left[\frac{N!}{(N-n)!\, n!} \right]$$

Put the value in eqⁿ (1) and put value of V.

$$F = nEp - T2K \log \left[\frac{N!}{(N-n)!\, n!} \right]$$

$$F = nEp - T2K \left[\log N! - \log (N-n) - \log n! \right]$$

In lograthmatic term of

$$\log x! = x \log x - x$$

$$F = nEp - 2TK \left[N \log N - n - (N-n) \log (N-n) - n \log n! \right]$$

$$F = nEp - 2TK \left[N \log N - N - (N-n) \log (N-n) - n \log n! \right]$$

Diff. w.r. to n

$$\frac{df}{dn} = Ep - 2TK\left[N - \frac{1}{N}N - (N-n)\frac{1}{(N-n)}\log(N-n) - n\frac{1}{n}\log n\right]$$

$$= Ep - 2TK$$

$$f = nEp - 2KT\left[N\log N - (N-n)\log(N-n) - n\log n - 2\log n\right](N-n_i)$$
$$\log(N_i - n) + \log(N_i - n - 2\log n)$$

$$= nf_i$$

$$= nfp - 2KT\left[N\log N - (N-n)\log(N-n) - N_i \log N_i - (N_i+n)\log(N_i-n) - 2\log n\right]$$

$$= fip - 2KT\left[N\log N - \log(N-n) - \log n^2\right]$$

Diff. w.r. to n.

$$\frac{df}{dn} = Ep - 2KT\left[\log N_i - \log n - \log(N-n)\right]$$

$$\frac{df}{dn} = Ep - 2KT\left(\log n_i - \log(N-n)\right)$$

$$\frac{df}{dn} = Ep - 2KT\log n - \log(N-n)n.$$

$$\frac{df}{dn} = Ep - 2KT\log\left(\frac{N-n}{n}\right)$$

$$\frac{df}{dn} = Ep - 2KT\log\left(\frac{N-n}{n}\right)$$

Gaikwad Divya Ramesh

27620

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 2
Roll No. : 1335
Class : MSc-II

Subject : solid state physics III
Test / Tutorial No. :
Div. :

for the internal energy is zero

$$\frac{dF}{dn} = 0$$

$$E_P - 2KT \log\left[\frac{N-n}{n}\right] = 0$$

$$E_P = 2KT \log\left(\frac{N}{n}\right) \quad (N-n) \approx N$$

$$E_P = 2KT \log\left(\frac{N}{n}\right)$$

$$\frac{E_P}{2KT} = \log \frac{N}{n}$$

$$e^{E_P/2KT} = \frac{N}{n}$$

8

$$n = N e^{-E_P/2KT}$$

In

$$\frac{N}{n} = 2.8 \times 10^{18} \text{ sec}$$

~~sto~~ schottky defect is proportinal to the no. of atom of lattice

The schottky defect cant be mesured by mas, volum &

The density is ~~dec~~ increas by decrin, the schottky defect

03

1

→ A point defect :-

The point defect as a small atom of ~~poyst~~ crystal can be modified

point defect can be contained by small atom It particle be measured.

The point defect as four types.

① Instatial Defect
② substitutionalD Defect
③ schottk defect
④ fankel defect

① Instationtial Defect

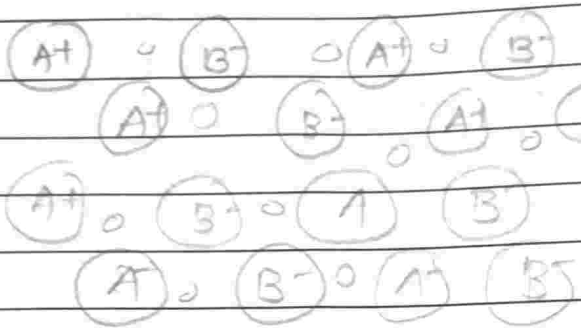
① In instational defect which as extra atom of instational side can be detect i.e small atom of particle contained extra particle of atom.

② The instationtutional defect contains Hydrogen & platinum atom whith the extra atom of interstial side

③ It defect can be measured by on elemanty ~~atom~~ molecules

③ In interstital defect which containing on physical & chemical properties of atom.

④ In interstital defect which maintain the charge on both cation & anion

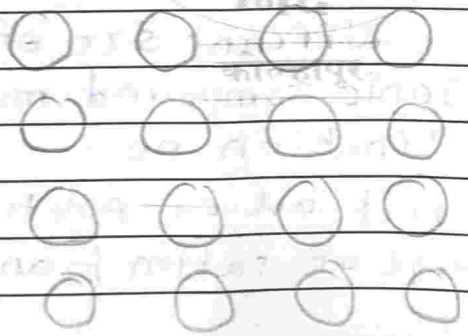


② Substitutional Defect :-

① substitution Defect contain original atom replaced by different atom or molecules

② Interstital side of atom can be modified by substitional defect.

③ for ex :- NaCl , PbCl .



③ Schottk Defect :-

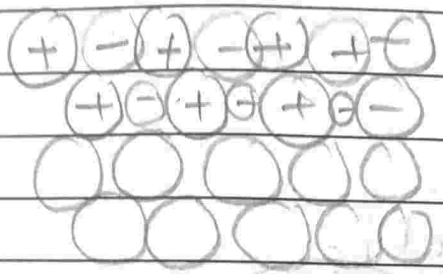
① This Defect containing missing of cation & anion of the atom. the cation & anion of the atom. on the instabinatutional defect.

② This Defect on the density will be decress on the small size of atom with large atom.

(3) ~~of~~ schottky defect on the molecule are in cation and anion are similar in size

(4) schottky defect can be identify by the +vely & -vely charge

(5) schottky defect containg simila of ~~st~~ schottky point.



(4) Franked defect :-

① It is the combination of ~~vi~~ vaccancy deffect to the intential defect.

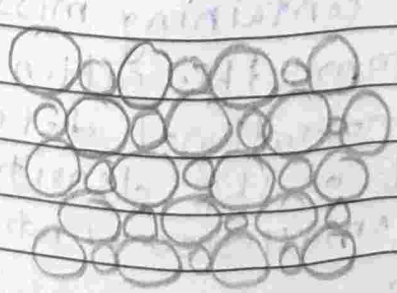
② condition for franked defect

i) franked defect occur in ionic compound with large no. of different size of cation & anion

ii) ions of ionic compound must hav low co-ordination no.

(3) franked defect are ~~a~~ positive and ~~negati~~. negative charge of cation & anion on the defect.

(4) franked defect as not similar size of cation and anion



"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

M.Sc. Part-II SEM IV Internal Examination (2022-23)

SSP IV (Energy Conversion and Storage Devices)

Time - 02:00 pm - 03:00 pm

Total Marks: 20

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. The region where the electrons and holes diffused across the junction is called _____

A) Depletion space B) Forward bias C) Depletion region

2. Dark current is the ..... That flows in the Solar cells is due to the absence of light.

A) Current at night B) leakage current C) light generated current

3. Solar cell generates I-V curve in ..... Quadrant.

A) I B) IV C) III

4. The series resistance in solar cell is a .....between the metal contact and the silicon.

A) Insulator B) contact resistance C) charge generators

5. The amount of photo generated current increases slightly with increases in.....

A) Resistance B) Temperature C) Low power

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

1. Discuss p-n junction Solar cells under dark and illumination state.
2. Derive I-V equation for solar cells
3. How solar simulator works?

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

1. Explain the Design of solar cell for High Voc, Fill factor and efficiency.
2. What are Second generation solar cells? Explain in details with Examples.
3. Define Solar cell. Explain the effect of various parameters on solar cells.

Internal Examination Attendance Sheet

Paper- Solid state physics-IV

Roll No. Name	Roll No. Name	Marks	Sign.
1332	Shradda S. Chougule	16	
1333	Divya R. Gaikwad	14	
1334	Gawade Sajali Shantaram	10	Sajali
1335	—		
1340	Jamadar Wahida Sardar	14	
1341	Kakade Seema Vishnu	16	
1354	Anuja Dattarao Patil	15	
1353	Akansha Bhimrao Patil	12	
1352	Bhunali Tanaji Nilam	11	
1350	Shubhangi Tanaji Kurade	15	
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1347	Jyoti Vimal Kore	16	
1345	Sajali Santosh Koli	18	
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1338	Hima Bhai Pradeep	14	
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1337	Gurav Rutuja Ravindra.	10	
1348	Kshirsagar Vijaya Sukesh.	13	
1358	Pirale Siddhant Deepak	18	
1351	Sammed Rajendra Latthe	10	
1359	Rajguru Hrishya Dhanaj.	09	
1349	Rajput Prerna Pundalik	11	
1360	Sutar Pooja Vishwanath	15	
1365	Kondure Aditya Bhaskar.	17	
1346	Jadhav Nikhil Jandeep	10	
1339	Gaikwad Aishwarya Satyadeep	11	
~~1337~~			
1338	Hirvale Pravin Pradeep	16	

Siddhant Deepak Pirale.

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

27165

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 1358

Class : MSc - II

18/20

Subject : Solid State Physics - IV

Test / Tutorial No. :

Div. :

Q II

⇒ a) Supercapacitor is also known as ultracapacitor.

b) A supercapacitor works on the same basic principal of conventional capacitor.

c) The capacitance of supercapacitor and energy storage is much more than that of conventional supercapacitor.

d) The reason behind this is the electrodes used in supercapacitor are thinner than ordinary capacitor, as a result the distance betn two electrodes increases Also surface area of supercapacitor is more than usual capacitor.

e) Hence we can store huge amount of energy and charge

f) Supercapacitor is used in many applications wherein we required more no of cycles of charging and discharging.

g) The use of supercapacitor has increased in day to day life due to its large capacitance

h) Supercapacitor consist of two types :

i) One which is associated with double layer

ii) Other which is associated with pseudocapacitor

i) Supercapacitor consists of two surfaces placed face to (EDLC)

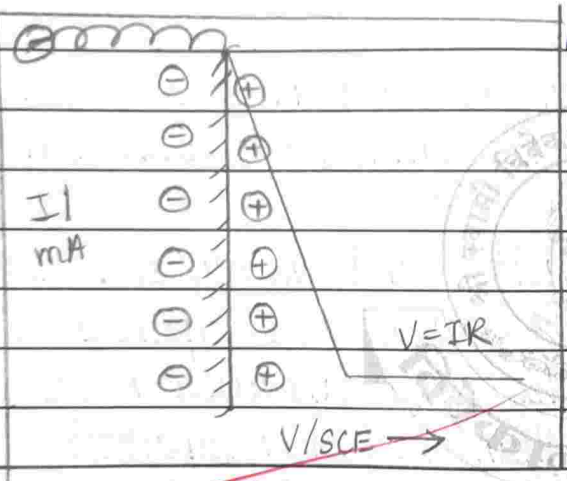
face with each other.

j) There is dielectric between these ~~the~~ two surfaces and a seperator seperates them.

k) To construct a good EDLC ~~cap~~ we require such surface which can work with opposite charges. In this one electrode is charged with charge and the other electrode is given opposite charge.

Models of EDLC.

1) Helmholtz model.



a) Helmholtz was the first scientist who ~~disc~~ put forth the first model of EDLC.

b) Here the inner side of electrode gains -ve charge through ionisation or due to adsorption of -ve ions.

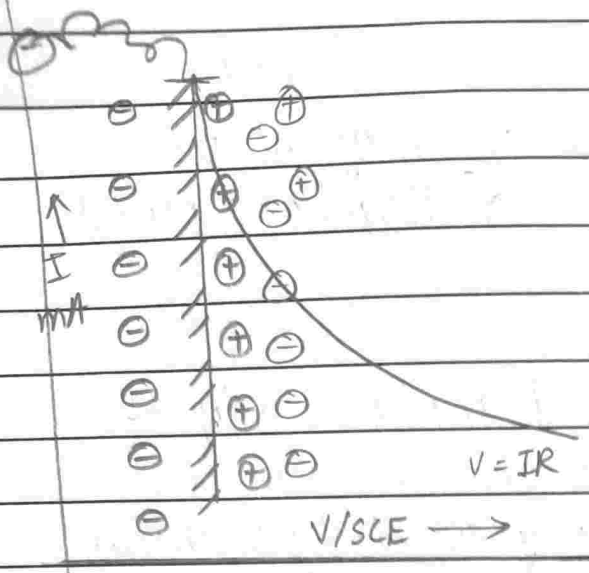
c) The soln side electrodes attracts +ve ions from the soln and those +ve charges get adsorped at the outer side of electrode. This forms a layer of +ve ions

d) After few years helmholtz model was discontinued because it was discovered that the +ve ion layer formed on soln side of electrode does not remain static under thermal change.

2) Gouy's model.

a) In 1924 Gouys took into consideration the disadvantage of Hellmholtz model ie the thermal instability of ions

b) He then assumed those ions as a point charge which was the main reason for the failure of his model.



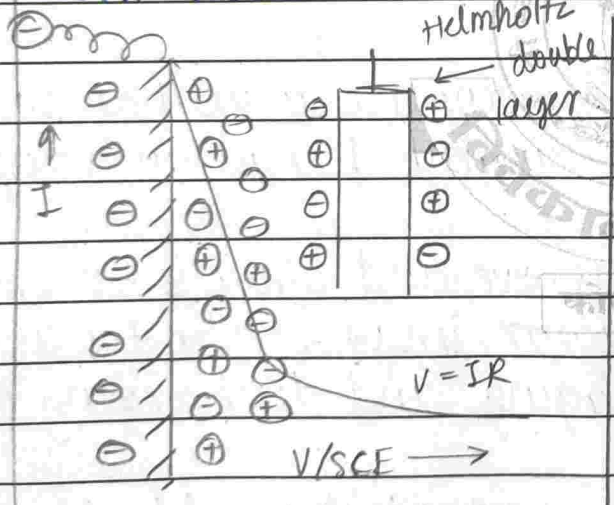
c) Here the inner side of electrode gets charge by a ionisation ~~plate~~ suppose them to be -ve charges

d) The soln side of the electrode by plate which emitts +ve ions which are attracted towards the charged ~~plate~~ surface

e) But as the ions are free they are easily available for ions of the soln to react with them.

f) As a result we can see localised charges near the electrode.

3) Stern model.



a) ~~In~~ Stern model is the modification of Gouy's model

b) In sterns model the inner side of electrode was -ve charged and the outer side of electrode was deposited by a +ve ion layer through the soln. This layer was called as Helmholtz layer.

c) There was another layer formation due to the charge that was deposited by the other electrode as well as soln. That layer was called Gouys layer.

d) In short stern model was the sum of Helmholtz as well as Gouy model.

e) Mathematically it can be given as

$$\frac{1}{C_S} = \frac{1}{C_H} + \frac{1}{C_G}$$

Where C_S = Capacitance of stern model
C_G = Capacitance of Gouys model
C_H = Capacitance of Helmholtz model.

Q III

⇒ a) Cyclic voltametric is electrochemical study of molecules that are adsorbed on the electrode.

b) Another defination is the study of electrochemical properties of a molecule's oxidation and reduction reaction on electrode.

c) When capacitor is kept in a cyclic region with linear potential applied to it gives ± I

d) Cyclic voltametric is the study of graph in which on x-axis there is potential and on Y-axis is the current.

e) We get both values of current +ve as well as -ve The potential and current changes with respect to time

f) We get two curves one is +ve and other is -ve, but the -ve curve is the mirror image of the +ve curve

g) These curves show charging and discharging of capacitors

h) Cyclic voltametry is an important charachteristic of supercapacitor.

i) Generally battery does not show reverse characteristic and change in direction of current. This is the major difference between capacitor and battery.

j) Batteries are non reversible because the potential required for oxidation is not uniform

S1

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– शिक्षणमहर्षी डॉ. बापूजी साळुंखे 27214
Shri Swami Vivekanand Shikshan Sanstha Kolhapur's
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Suppliment No. :

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Class :

Subject :

Test / Tutorial No. :

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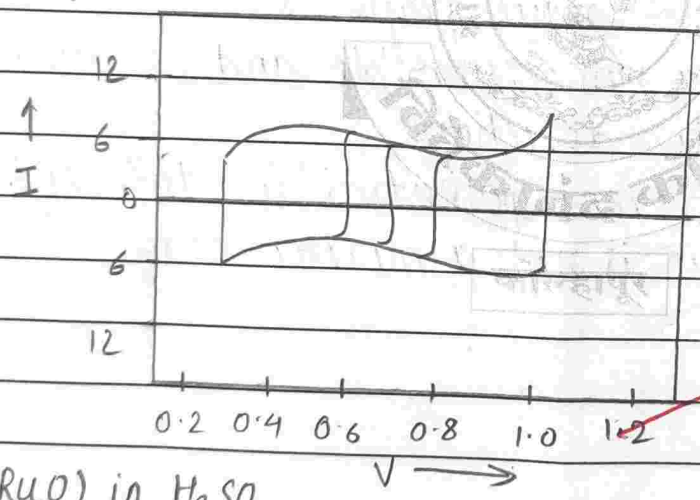
k) Consider an example of Ruthenium oxide (RuO_2) and Pb - $PbCl_2$. (RuO_2) is a supercapacitor and Pb - $PbCl_2$ is battery.

$LiClO_2$



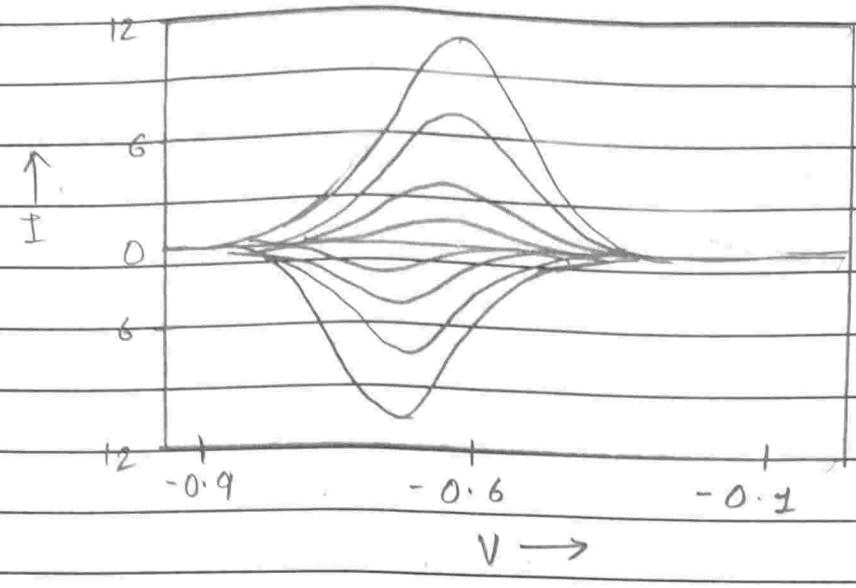
(RuO_2) in H_2SO_4

l) Here is a graph of cyclic voltametric of RuO_2 in H_2SO_4. The graph is potential (V) v/s Current (I).

m) The potential range of above graph is 0·2 to 1·2

n) We can see + ve as well as - ve curve the positive curve increases as potential increases this shows the charging ability of a supercapacitor.

o) But after some time the direction of current changes and the curve reverses. The - ve curve is the mirror image of +ve curve.



p) The above graph shows the cyclic voltametric of $PbCl_2$ in $LiClO_4$.

q) As we can see from the graph the -ve curve is not the exact mirror image of +ve curve.

r) The potential range of above graph is from -0.9 to -0.1

s) The above curve is not reversible and the current does not change its direction

t) As we require different potential for different oxidation the curve is not a mirror image.

Q I

1) mirror

2) Electrostatic force

3) MnO_2

4) Double layer

5) Insulator

Pravin Prakash Hirave.

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Suppliment No. :

Roll No. : 1338

Class : M.Sc-II

Subject : SSP-IV (physics)

Test / Tutorial No. : 4

Div. :

Q. 1. M.C.Q.

(1) mirror ✓

(2) Electrostatic charge ✓

(3) MnO_2 ✓

(4) Diffusion. ✓

(5) insulator. ✓

Q. 2.

(A) → EDLC Capacitor

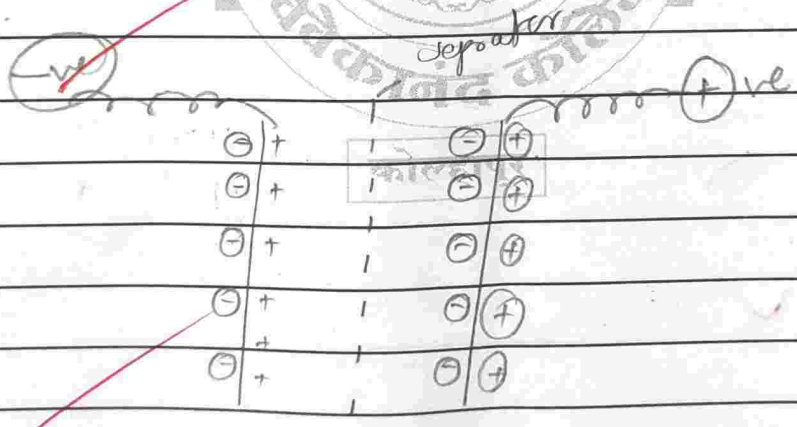
1] Electric Double layer capacitor is a ultra capacitor

(2) In EDLC capacitor having a no oxidation and reduction process

(3) In this types of two electrode has positive and - negative side of electrode attracted the charge by electrostatic force.

(4) In Electric Double layer capacitor have more capacitance value and energy density & power density than conventional capacitor.

(5) In EDLC have two types of process one is one layer of charge and another is Pseudo capacitor.

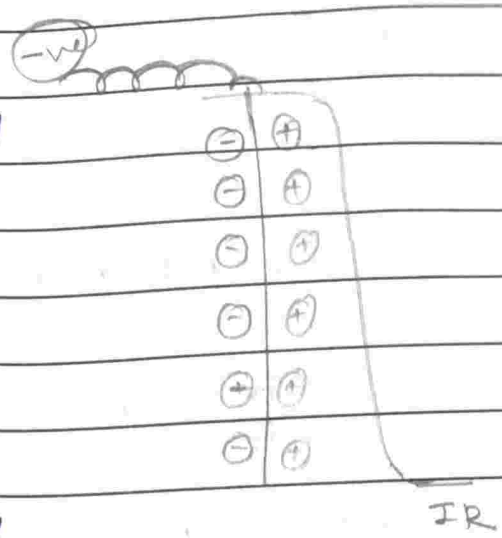


various modes and structures of EDLC.

(1) First steps is Helmholtz proposed the two plates separated by dielectric medium one is +vely charge orther plate is -ve charge.

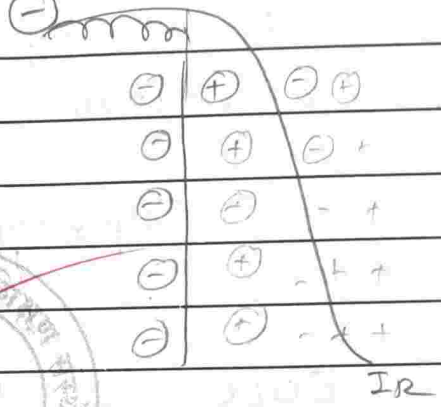
(2) In Helmoltz model shows the applied potential on plate the charge distribution occurs by ionization or absorbtion process

③ The ions are separated by applied potential but it's not stable they will fluctuated by thermal process



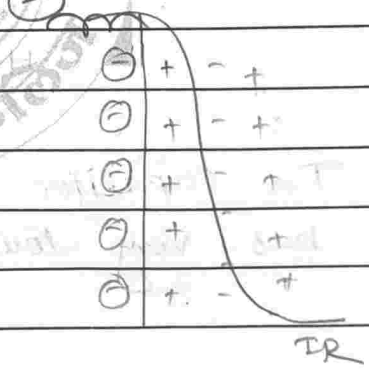
④ Gouy - chapman model

⑤ proposed New model the the charge on plates they are point charge



⑤ This Gouys model is field to explaine.

⑥ while aplied field the charges or ions are attracted towards the opposite sides ~~of~~ so the ~~CH~~ ions comes to close on charge plate



⑦ Stern model ~~is~~

~~The~~ In electrolytes ions are attracted towards ~~the~~ opposite side of electric field so the charge are accumulated on plates called 'Helmoltz model' a and

Stern is is combination Helmoltz and Gaouy model is

$$\frac{1}{C_S} = \frac{1}{C_H} + \frac{1}{C_G}$$

C_S = Stern

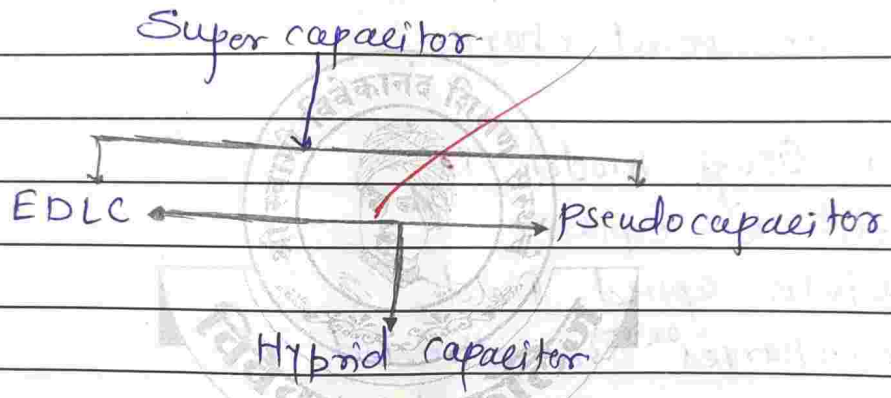
C_H = Helmoltz , C_G = Gouy

Q. 3.

→ The linear potential is changes with time

$$\frac{dv}{dt} = s$$

In capacitor having a redox reaction occure for the stores the charges by help of gain of electron and loss of electrone.



* In capacitor or In conentional capacitor has very low powder density and current density