Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur (Empowered Autonomous).

Department of Physics

Date: 02/09/2024

Internal Examination Notice

The students of M.Sc. I and II are hereby informed that the internal examination of current semester is scheduled as per following time table:

Sr. No.	Class and Sem	Paper Code.	Title of the paper	Date and time
1.	M.Sc. I, SEM I	DSC12PHY11	Mathematical Physics	24/09/2024 12:00 to 01:00 pm
2.	M.Sc. I, SEM I	DSC12PHY12	Classical Mechanics	25/09/2024 12:00 to 01:00 pm
3.	M.Sc. I, SEM I	MIN12PHY11	Research Methodology	26/09/2024 12:00 to 01:00 pm
4.	M.Sc. I, SEM I	DSE12PHY11	Solid State Physics-I (Semiconductor Physics)	27/09/2024 12:00 to 01:00 pm
5.	M.Sc. II, SEM III	DSC12PHY31	Statistical Mechanics	24/09/2024 12:00 to 01:00 pm
6.	M.Sc. II, SEM III	DSC12PHY32	Atomic and Molecule Physics	25/09/2024 12:00 to 01:00 pm
7.	M.Sc. II, SEM III	DSE12PHY31	Thin solid films: Deposition and Properties	26/09/2024 12:00 to 01:00 pm

Nature of question paper

- **For M.Sc. I and II**

Total Marks (for each paper) = 20

Q: 1) Select correct alternative (02 marks)

Q: 2) Short answer question (any one out of two) (12 marks)

Q: 3) Short answer question (any one out of two) (06 marks)

(M.Sc. Co-ordinator)

VIVEKANAND COLLEGE KOLHAPUR ESTD JUNE 1964

HOD

HEAD
DEPARTMENT OF PHYSICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

"Education for Knowledge, Science and Culture"
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Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Empowered Autonomous).

Department of Physics

M.Sc. Part-I SEM I Examination (2024-25)
Solid State Physics-I (Semiconductor Physics)
(Paper code: DSE12PHY11)

Date : 27 /09 /2024 Total Marks: 20
Day : 12.00 to 1.00 pm Time :-

Instructions:-

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

Q.1) Select correct alternative **(02)**

1. If f(z) is analytic and its derivative is continuous at all points inside and an simple closed curve C, then $\int_c^{\square} f(z)dz =$ --------.

(a) 0 (b) π

(c) 2π (d) ∞

2. A point at which function f(z) is not analytic is known as ---------

(a) singular point (b) analytic point

(c) isolated point (d) removable point

Q.2) Long answer question (Attempt any ONE) **(12)**

1. If $f(z) = 4x + y + i(-x + 4y)$ *discuss* $\frac{df}{dz}$.
2. (a) Derive the necessary condition for function f(z) to be analytic in given region R.
   (b) Discuss the analyticity of the function $f(z)=z^3$

Q.3) Short answer question (Attempt any ONE) **(06)**

1. Evaluate $\int_c^{\square} \frac{e^z}{z^2+1} dz \; ; |z| = 2$
2. Evaluate $\int_c^{\square} \frac{z+4}{z^2+2z+5} dz$ over the circle $|z + 1| = 1$

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Department of Physics

M.Sc. Part-I SEM I Examination (2024-25)

Classical Mechanics

(Paper code: DSE12PHY12)

Date : 27 /09 /2024 Total Marks: 20

Day : 12.00 to 1.00 pm Time :-

Instructions:-

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

Q.1) Select correct alternative **(02)**

1. The distance between sun and earth is "R". The duration of the year if the distance between sun and earth id "3R" will ----------.

(a) $\sqrt{3}$ years (b) $3\sqrt{3}$ years

(c) 9 years (d) 3 years

2. Kepler's second law of motion is deals with ---------

(a) shape of the orbit of the planet

(b) time period of the revolution of the planet around the sun

(c) the sped/area that the planet travels

(d) all of above

Q.2) Long answer question (Attempt any ONE) **(12)**

1. State Kepler's laws of motion. Discuss the shape of the orbit using conic equation
2. Derive an expression for two body problems reduced to one body

Q.3) Short answer question (Attempt any ONE) **(06)**

1. Explain virial theorem
2. Write a note on
   a) Degrees of freedom
   b) Constraints

Vivekanand College, Kolhapur (Empowered Autonomous)

M.Sc. Part-I (Sem-I) Internal Examination Sept. 2024

Course Code: RMD12PHY11

Research Methodology

Date: 26/09/2024

Time:12.00-01.00 pm **Marks: 20**

Instructions:

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

Q. 1 A) Select correct alternative. **(02)**

1) Ultra high vacuum range of pressure measurement ranges from……to…….

(a) $10^{5} to 10^{2}$ (b) $10^{5} to 10^{-1}$ (c) $10^{-1} to 10^{-6}$ (d) $10^{-6} to 10^{-11}$

2) In diffusion pump, diffusion of ……. molecules take place in downward shooting process.

(a) liquid (b) solid (c) plasma (d) gas molecules

Q.2) Long answer questions (attempt any one) **(12)**

1) Explain diffusion and sputter ion pump in detail.

2) Give detailed account of Pirani and penning gauge.

Q.3) Short answer questions (attempt any one) **(06)**

1) Write a note on rotary pump.

2) Explain halogen leak detector in detail.

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Department of Physics

M.Sc. Part-I SEM I Examination (2024-25)
Solid State Physics-I (Semiconductor Physics)
(Paper code: DSE12PHY11)

Date : 27 /09 /2024 Total Marks: 20
Day : 12.00 to 1.00 pm Time :-

Instructions:-

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

Q.1) Select correct alternative **(02)**

1. Atoms containing 5 valance electrons are known as--------semiconductor.
   a) P-type b) N-type
   c) insulator d) all of these
2. The electrons travel in the influence of electric field, this velocity is referred to as ------.
   a) Current density b) angular velocity
   c) drift velocity d) all of these

Q.2) Long answer question (Attempt any ONE) **(12)**

1. What is mean by alloy? Explain the variation of energy bands with alloy composition.
2. Write the short note on direct band-gap semiconductor.

Q.3) Short answer question (Attempt any ONE) **(06)**

1. Write the short note on optical absorption in semiconductors.
2. Write the short note on drift and diffusion current.

Name :- Sudarshan . Nivas Khutale.

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20/20 27303

SUPPLIMENT

Signature of Supervisor	

Suppliment No. : 1
Roll No. :
Class : M.Sc-I

Subject : Mathematical Physics.
Test / Tutorial No. :
Div. : -

(Q.1)

(1) If $f(z)$ is analytic and its derivative is continous at all points inside an simple closed curve C. then

$$\int_C f(z) \cdot dz = 0$$

(2) A point at which function $f(z)$ is not analytic is known as singular point.

Analytic Function :-

A single valued function $f(z)$ in which differentiable at $z = z_0$ it is known as analytical function.

A point at which of the function is not differentiable at it is known as singular point or pole of the function.

statement :-

The necessary condition of the function $f(z)$ is analytic.

The necessary condition of the function $f(z) = u + iv$ is analytic in the region R, are.

① $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$

② $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$.

provided that.

$\frac{\partial u}{\partial x}, \frac{\partial v}{\partial x}, \frac{\partial u}{\partial y}, -\frac{\partial v}{\partial x}$ exists.

Proof :-

Let $f(z)$ is the analytic at all region R.

$$f(z) = u + iv.$$

where, u & v is the function of x & y.

then the δu & δv is the small elements of u & v. respectively, corresponding to the δx & δy is function of element in x & y.

$$f(z+\delta z) = (u+\delta u) + i(v+\delta v)$$

~~$f(z+\delta z) - f(z) =$~~

$$f(z+\delta z) - f(z) = (u+\delta u) + i(v+\delta v) - (u+iv) \cdot \delta z.$$

$$= \frac{\delta u + i\delta v}{\delta z}$$

$$= \frac{\delta u}{\delta z} + \frac{i\delta v}{\delta z}$$

$$\lim_{\delta z \to 0} f(z+\delta z) - f(z) = \lim_{\delta \to 0} \left[\frac{\delta u}{\delta z} + \frac{i\delta v}{\delta z} \right].$$

Or

$$f'(z) = \lim_{\delta \to a} \left[\frac{\delta u}{\delta z} + \frac{i\delta v}{\delta z} \right]$$

since, δz approaches zero along any path.

(a) along real axis i.e.

$z = u + iv$ but on x-axis $y = 0$.

$z = x$, $\delta z = \delta x$, $\delta y = 0$.

Putting the values in eqn.

we get,

$$f'(z) = \lim_{\delta x \to 0} \left[\frac{\delta u}{\delta x} + \frac{i\delta v}{\delta x} \right]$$

$$= \frac{\partial u}{\partial x} + \frac{i\partial v}{\delta x} \quad \text{— (1)}$$

Name:- Sudarshan Nivas Khutale.

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor

Suppliment No. : 2.

Roll No. : -

Class : M.Sc-I

Subject : mathematical Physics.

Test / Tutorial No. : -

Div. : -

(b) along imaginary axis - y.

$z = x + iy$ - but on y-axis $x = 0$

$\therefore z = iy \quad , \delta z = \delta iy \quad , \delta x = 0$

$$f'(z) = \lim_{\delta y \to 0} \left[\frac{\delta u}{i\delta y} + \frac{i\delta v}{i\delta y} \right] \cdot \lim_{\delta y \to 0} \left[\frac{i\delta u}{i\delta y} + \frac{\delta v}{\delta z} \right]_{\delta z \to 0}$$

$$= -i\frac{\partial u}{\partial y} + \frac{\partial v}{\partial y} \quad \text{— (2)}$$

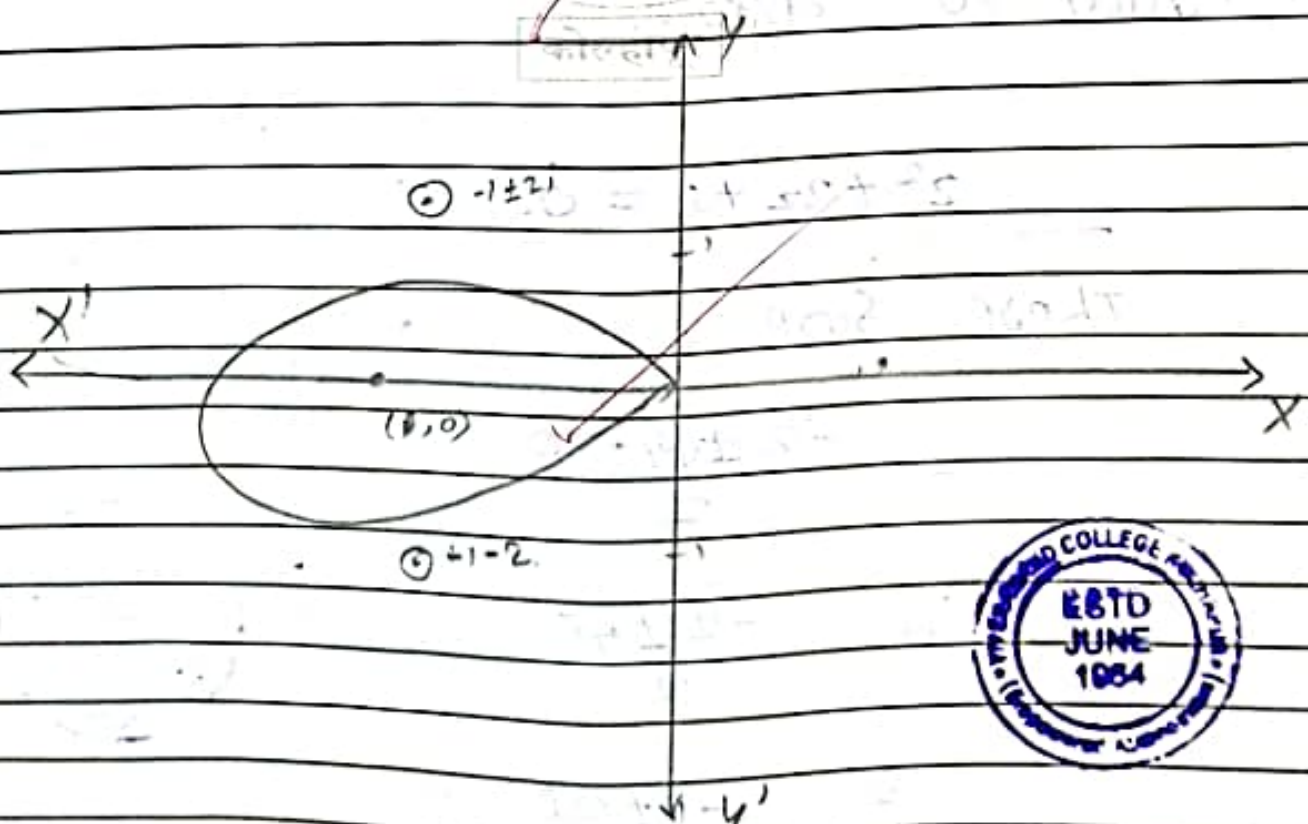
The poles of the circle in the region $|z+1|=1$ & radius of the circle $|z|=-1$

$$\frac{z+4}{z^2+2z+5} \cdot dz = 0.$$

By cauchy's integral theorem.

$$\int_C \frac{z+4}{z^2+2z+5} \cdot dz$$

$$= -1-2i$$



eqn of circle :-

Cartesian co-ordinal Form.

$(x-a)^2 + (x-b)^2 = r^2$: $C \equiv (a,b)$

radius = r.

Polar Form :-

$|z-z_0| = r$: $C = z_0 = x+iy$

radius = r.

Shrutika Sambhaji Khot

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SUPPLIMENT

Signature of Supervisor	
Suppliment No. :	Subject : Mathematical physics.
Roll No. :	Test / Tutorial No. : Unit test
Class : MSC I	Div. :

20/25

07.10.2

Q1)

i) a) 0

ii) a) Singular point

Q2)

⇒2) The analytic function $f(z)$

$$f(z) = u + iv$$

where x and y are the function of u and v

where δu and δv are the increment of u and v repectively

and δx and δy are the increment of x and y

$$z = x + iy$$

$$\delta z = \delta x + i\delta y$$

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$$f'(z) = \lim_{\delta z \to 0} \frac{f(z+\delta z) - f(z)}{\delta(z)}$$

$$f(z+\delta z) = (u+\delta u) + (v+i\delta v)$$

$$f'(z) = \lim_{\delta z \to 0} \frac{(u+\delta u)+(v+i\delta v) - (u+iv)}{\delta x + i\delta y}$$

$$f'(z) = \lim_{\delta z \to 0} \frac{\delta u + i\delta v}{\delta x + i\delta y} \quad \text{①}$$

This equation is differentiable.

a) along real axis

$$\delta y \to 0$$
$$\delta z \to \delta x$$

$$f'(z) = \lim_{\delta x \to 0} \frac{\delta u}{\delta x} + \frac{i\delta v}{\delta x}$$

$$f'(z) = \lim_{\delta x \to 0} \frac{\delta u}{\delta x} + \lim_{\delta x \to 0} \frac{i\delta v}{\delta x}$$

$$f'(z) = \frac{\partial u}{\partial x} + \frac{i\partial v}{\partial x} \quad \text{②}$$

b) along Imaginary axis

$$\delta x \to 0$$
$$\delta z \to i\delta y$$

$$f'(z) = \lim_{i\delta y \to 0} \frac{\delta u + i\delta v}{i\delta y}$$

$$f'(z) = \lim_{i\delta y \to 0} \frac{\delta u}{i\delta y} + \lim_{i\delta y \to 0} \frac{i\delta v}{i\delta y} \quad \ldots$$

$$f'(z) = \frac{i\partial u}{i^2 \partial y} + \frac{\partial v}{\partial y}$$

$$= -\frac{\partial u}{\partial y} + \frac{\partial v}{\partial y}$$

$$= \frac{\partial v}{\partial y} - \frac{\partial u}{\partial y} \quad \ldots (3)$$

from the equation (2) and (3) we get the equation

$$\boxed{\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y} \quad \text{and} \quad \frac{\partial v}{\partial x} = -\frac{\partial u}{\partial y}}$$

This is the cauchy raimann equation

where, $e^x(\cos y + \sin y)$

$e^x \cos y + e^x \sin y$

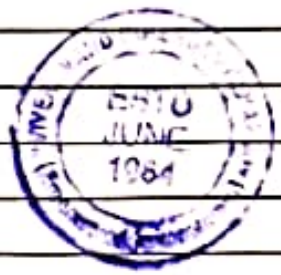
compare with $u + iv$

$u = e^x \cos y$

$v = e^x \sin y$

i) $\frac{\partial u}{\partial x} = e^x \cos y$

ii) $\frac{\partial v}{\partial y} = e^x \cos y$



iii) $\frac{\partial u}{\partial y} = -e^x \sin y$

iv) $\frac{\partial v}{\partial x} = e^x \sin y$

from above (i) and (ii)

$$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$$

and from above (iii) and (iv)

$$\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$$

where

$$f'(z) = \frac{\partial u}{\partial x} + i\frac{\partial v}{\partial x}$$

$$f'(z) = (e^x \cos y + e^x \sin y)$$

Shrutika Sanjay Khot

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SUPPLIMENT

Signature of Supervisor :

Suppliment No. : 01

Roll No. :

Class : MSc I

Subject : Mathematical physics.

Test / Tutorial No. :

Div. :

ESTD JUNE 1964

Q3)

1) $\oint_C \frac{e^z}{z^2+1}\,dz \quad |z| = 2$

$\Rightarrow$ let,

$|z^2+1| = 0$

$z^2 = -1^2$

$z = \pm i$

$\therefore z = \pm i$

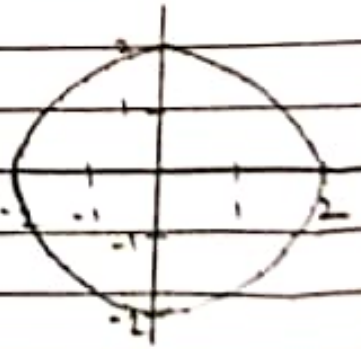
where the poles are

$z = -i$ and $z = +i$

where radius $r = 2$

The poles are inside the curve.

hence Cauchy's Integral theorm



the Cauchy's Integral theorem.

$$f(a) = \frac{1}{2\pi i} \int_c \frac{f(z)}{(z-a)} \, dz$$

$$\int_c \frac{f(z)}{(z-a)} \, dz = 2\pi i \, f(a)$$

$$\int_c \frac{e^z}{z+i} \, dz = \int_c \frac{e^z}{z+i^2} \, dz$$

$$= \int_c \frac{e^z}{(z+i)-(z-i)} \, dz$$

$$= \int_c \frac{e^z}{(z+i)} \, dz - \int_c \frac{e^z}{z-i} \, dz$$

$$= \frac{1}{2i} \int_c \frac{e^z}{(z+i)} \, dz - \frac{1}{2i} \int_c \frac{e^z}{(z+i)} \, dz$$

$$= \frac{1}{2i} 2\pi i \int_c \frac{e^z}{(z+i)} \, dz - \frac{1}{2i} 2\pi i \int_c \frac{e^z}{(z-i)} \, dz$$

$$= \pi e^i - \pi e^{-i}$$

$$\boxed{f(a) = \pi (e^i - e^{-i})}$$

Aniket Rajendra Pawar. 18

20

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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor

Suppliment No. :

Roll No. 1317

Class : MSc I

Subject Classical Mechanics

Test / Tutorial No. :

Div. :

Q.1

1. The distance between Sun and earth is 'R' The duration of the year if the distanc between Sun and earth id '3R' will. 9 ~~5~~ 3 year's

2. Kepler's Second law of motion is dealg caith time period of the revolution of the Phiet around the Sun.

Q2

2. Derive an expression for two body problems reduced to an body.

(12)

→ Polar Co-ordinate we can express it as
$F(r) = nF(r)$
n is unit Vector along equivalent one Body.
Conservation system has six degree of freedom bec motion of the system consisting of m_1 & m_2 can be thaugh of made up motion of center of mass

$$r = (r_1 - r_2)$$

Langrangen eqn become

$$L = T(R, \dot{r}) - V(r)$$

where

$$T(\dot{R}, \dot{r}_i) = \frac{1}{2}(m_1 + m_2)\dot{R}^2 + T'$$

express some kinetic energy of Motion of Centre of T

V is pure function of r

r_i' is seperation between two particle

$$T' = \frac{1}{2} m_1 \dot{r}_1^2 + \frac{1}{2} m_2 \dot{r}_2'^2$$

r_1' & $r_1'^2$ are position of Vector

Where $m = m_1 + m_2$

Mass of the System

$$\mu = \frac{m_1 \times m_2}{m_1 + m_2}$$

Reduce mass

The lagrang eqn

$$r = r_1 - r_2$$

$$= r_1' - r_2' \quad - (2)$$

$$\sum m_i r_i' = 0$$

$$m_1 r_1' + m_2 r_2' = 0$$

$$r_1' = -\left[\frac{m_2}{m_1}\right] r_2' \quad - (3)$$

Putting eqn (3) in (2)

$$r = r_1' + \left[\frac{m_1}{m_1 + m_2}\right] r \quad - (4)$$

K.E

$$T = \frac{1}{2}\left[m_1 + m_2\right) \dot{R}^2 + \frac{1}{2} m_1 \left[\frac{m_2}{m_1 + m_2}\right]^2 \dot{r}^2$$

$$+ \frac{1}{2} m_2 \left[\frac{m_1}{\quad}\right]^2 \dot{r}_1$$

Putting Value r_1 & r_2 in (4).

$$T = \frac{1}{2}[m_1 + m_2]R^2 + \frac{1}{2}\frac{m_1 m_2}{m_1, m_2}\dot{r}^2$$

$$= \frac{1}{2} mR^2 + \frac{1}{2}\mu\dot{r}^2$$

where $m = m_1 + m_2$

mass of the System.

$$\mu = \frac{m_1 \times m_2}{m_1 + m_2}$$

Reduce Mass

The lagrang On this,

$$L = \frac{1}{2} mR^2 + \frac{1}{2}\mu\dot{r}^2 - V(r) \quad \text{--- (5)}$$

Langranges eqn of motion in term of the two Variant R & r.

$$\frac{d}{dt}\left(\frac{\partial L}{\partial R}\right) - \frac{\partial L}{\partial R} = 0 \quad \text{--- (6)}$$

$$\frac{d}{dt}\left(\frac{\partial L}{\partial r}\right) - \frac{\partial L}{\partial r} = 0 \quad \text{--- (7)}$$

Aniket Rajendra pawar

Putting Value (5) in (6) (7).

$$\frac{d}{dt}(m\dot{R}) = 0$$

$$\frac{d}{dt}(u\dot{r}) + \frac{\partial V}{\partial r} = 0 \quad -(8).$$

eq^n 8 that momentum Conjugate to R. is Constant.

$M\dot{R}$ = Constant

R = Constant.

Central moves is Constant eq^n (8)

$$u\ddot{r} = -\frac{\partial V(r)}{\partial r}$$

$\mu \ddot{x} = Fx$.

interpatical distance as x

$$L = \frac{1}{2} \mu \dot{x}^2 - V(x) \quad -(9).$$

which effective is describing the motion of Component of x.

Q3

Explain Virial theorem.

- (6) System of Mass point with position Vectors r_i and applicable force F_i is fundamental eqn of motion coill be.

$$\dot{p}_i = F_i$$

Let us:

$$G = \sum_i p_i , r_i \quad \text{—(1)}$$

Time derivation coill be

$$\frac{dG}{dt} = \sum_i \dot{r}_i p_i = \sum m_i \dot{r}_i =$$

$$= \frac{1}{2} m_i x_i^2 = 2T$$

and

$$\Sigma p_i r_i = \Sigma F_i \dot{r}_i$$

So that

$$\frac{dG}{dt} = 2T + \sum_i F_i \dot{r}_i \quad \text{—(2)}$$

eqn (2) Over time integration will be

$$\frac{1}{\tau}\int_0^{\tau} \frac{dG}{dt}\, dt = 2T + \overline{\sum F_i r_i}$$

$$2T + \overline{\sum F_i r_i} = \frac{dG}{dt}$$

$$= \frac{1}{\tau}\left[G(\tau) - G(0)\right] \quad -(3)$$

If the motion is periodic & τ is Periodic Then

$$G(\tau) = G(0)$$

$$\overline{T} = -\frac{1}{2}\overline{\sum F_i r_i} \quad -(4)$$

eqn (4) known as a Virial theorem.

Shrutika Sambhaji Khot. 16/20

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SUPPLIMENT

Signature of Supervisor	
Suppliment No. :	Subject : Classical Mechanics
Roll No. :	Test / Tutorial No. :
Class : MSC I	Div. :

Q1

i) c) 9 years.

ii) b) time period of the revolution of the planet around the

Q2

⇒ i) Every planet which revolves around the earth is elliptical orbit.

(11)

The attractive force is given by planetary motion which is under the inverse square law

$$f(r) = -\frac{k}{r^2}$$

the equation of the orbit is

$$\frac{d^2u}{d\theta^2} + u = \frac{m}{h^2 u^2} \int \frac{1}{u}$$

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where

m = mass of planet
l = angular momentum
θ = poles of co-ordinates

where the equation of orbit is

$$\frac{d^2u}{d\theta^2} + u = -\frac{m}{l^2u^2} \times -\frac{k}{r}$$

$$= \frac{mk}{l^2} \quad \text{---} \quad (1)$$

lets put $y = u - \frac{mk}{l^2}$

where $\frac{dy}{d\theta} = \frac{du}{d\theta}$

which becomes,

$$\frac{dy}{d\theta} + y = 0$$

the second order gives the equation as

$$y = u' \cos(\theta - \theta')$$

where u' and θ' are constant.

$$u - \frac{mk}{l^2} = u \cos(\theta - \theta').$$

$$\frac{1}{r} = \frac{mk}{l^2}\left[1 + \frac{m^2k^2u\cos(\theta-\theta')}{l^2u^2}\right]$$

$$= \frac{l^2/mk^2}{1+u\cos\theta-\theta'}$$

where, for the simplification we take $\theta' = 0$
the θ'

$$= \frac{l^2/mk^2}{1+u\cos\theta} \quad \text{---} \quad (2)$$

form the geometry the conic term is

$$r = \frac{r_0(i^2)}{(1+\varepsilon)} \quad r_0 = \frac{l^2/mk^2}{1+\varepsilon} \quad (3)$$

Ellipse the bond are r_0 and r_1 or they are called radius also

where,

$$r_0 = \frac{l^2/mk^2}{1+\varepsilon} \quad \text{---} \quad (4)$$

$$\varepsilon = \frac{u'l'}{1+\varepsilon}$$

r_0 is minimum radius

for the r_1 radius is maximum where the equation is

$$r_1 = r_0 \frac{1+\varepsilon}{1-\varepsilon}$$

$$r_1 = \frac{l^2/mk^2}{1+\varepsilon} \quad \frac{1+\varepsilon}{1-\varepsilon}$$

where the equation is

$$r_1 = \frac{l^2/mk^2}{1-\varepsilon} \quad \text{---} (5)$$

where the smallest radius r_0 is called perhelion.
And the largest radius is called as aphelion.

For the potential equation

$$V_{eff} = V(r) = V(r) + \frac{l^2}{mr^2}$$

for the attractive force

$$f(r) = \frac{-k}{r}$$

for the potential force

$$V(r) = \frac{-k}{r}$$

Shrutika Sambhaji Khot

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Suppliment No. : 01
Roll No. :
Class : MSCI

Subject : classical mechanics
Test / Tutorial No. :
Div. :

the quadratic equation $\left(\frac{1}{r}\right)$

$$\frac{1}{r} = k \mp \sqrt{k^2 - 4m^2/2m\,|E|}$$

$$\frac{1}{r} = k \mp \sqrt{k^2 - 2\cdot - l^2/2m}$$

$$r = \left[\frac{1}{1 \mp \sqrt{\left(1 + \frac{2El^2}{mk^2}\right)}}\right]^{1/2}$$

for the minimum value we get r_0

$$r_0 = \left[\frac{1}{1 - \left(1 + \frac{2El^2}{mk^2}\right)}\right]^{1/2} \quad \text{---(6)}$$

and for the maximum value we get r_1

$$r_1 = \left[\frac{1}{1 + \left(1 + \frac{2El^2}{mk^2}\right)}\right]^{1/2} \quad \text{---(7)}$$

comparing eq^n ① with ③ we get

$$\varepsilon = \sqrt{1 + \frac{2El^2}{mk^2}}$$

for the ellipse where $E > 0$

$$\varepsilon = \frac{l^2/mk^2}{\left(\sqrt{1 + \frac{2El^2}{mk^2}}\right)\cos\theta}$$

Keplers laws of motion for the orbit.

Q.3)

⇒ i) Viral theorem :-

We have consist of mass points x_i and the force f_i

the eq^n $p_j = f_i$

then the equation becomes

$$G = f_i . x_i$$

Its derivatice is ;

$$\frac{dG}{dt} = \sum_i r_i p_i + \sum_i p_i \cdot r_i$$

But $\sum_i r_i p_i = \sum_i m_i r_i \cdot r_i =$

$$= \sum_i m_i r_i^2$$

$$= 2T$$

and $\sum_i p_i r_i =$

It's time along integration is

$$\frac{dG}{dt} = \sum_i r_i p_i + \sum_i p_i r_i$$

$$\sum_i 2T$$

$$\gamma = (G - G_0)$$

$$\gamma = G = G_0$$

$$\boxed{T = -\frac{1}{2} \sum_i \nabla_i \cdot V r_i}$$

hence proved

Aniket Rajendra Powar

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SUPPLIMENT

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Suppliment No. :

Roll No. : 1317

Class : MSc I

Subject : Rese

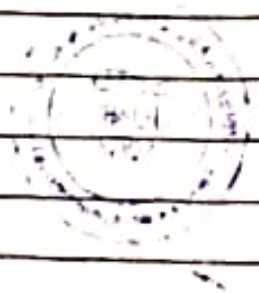
Test / Tutorial No. :

Div. :

Q1

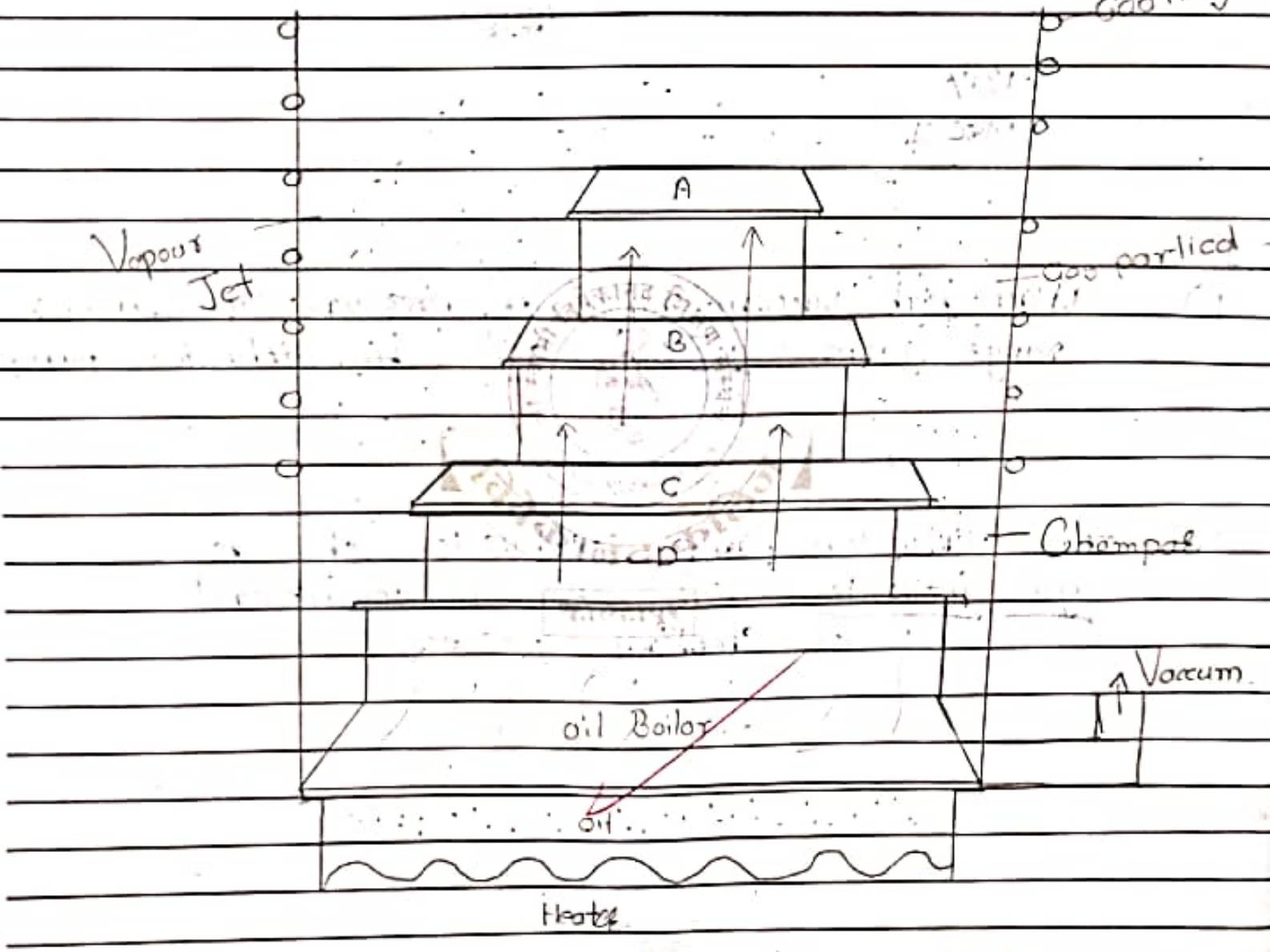
1) Ultra high vaccum range of pressure measurment ranges from 10^{-6} to 10^{-11} in diffussion pump

2) In diffussion pump, diffussion of a° gas molecules take place in downward sholling process.



Q 2 Long answer.

1) Explain diffusion and Sputter Ion pump



Diffusion Pump are Probably the Comunity used Mechanism for Creating high Vaccum of industrial Vaccum equipement. It is Commonly used in Mass apectroscopy, anylytic Instrument develop.

Work & Construction of

1. It is also highly effective in Producing Vaccum upto 10^{-2}mbr even a poor Condition ether reaction gases are Present

2. diffusion Pump is Shinless Steel Chamber that Very rare based of Application

3. The interior of diffusion pump regardless of Size of Some Condition Consists of a Veryiny Size Cose Shaped pressure jet Stacked Vertically

4. lower Cone is largest and decrease in Size as you move upsoard

5. The Very bottom Chamber is heater ethene Silicon based diffusion pump oil is heated until it' Reached to the gases State

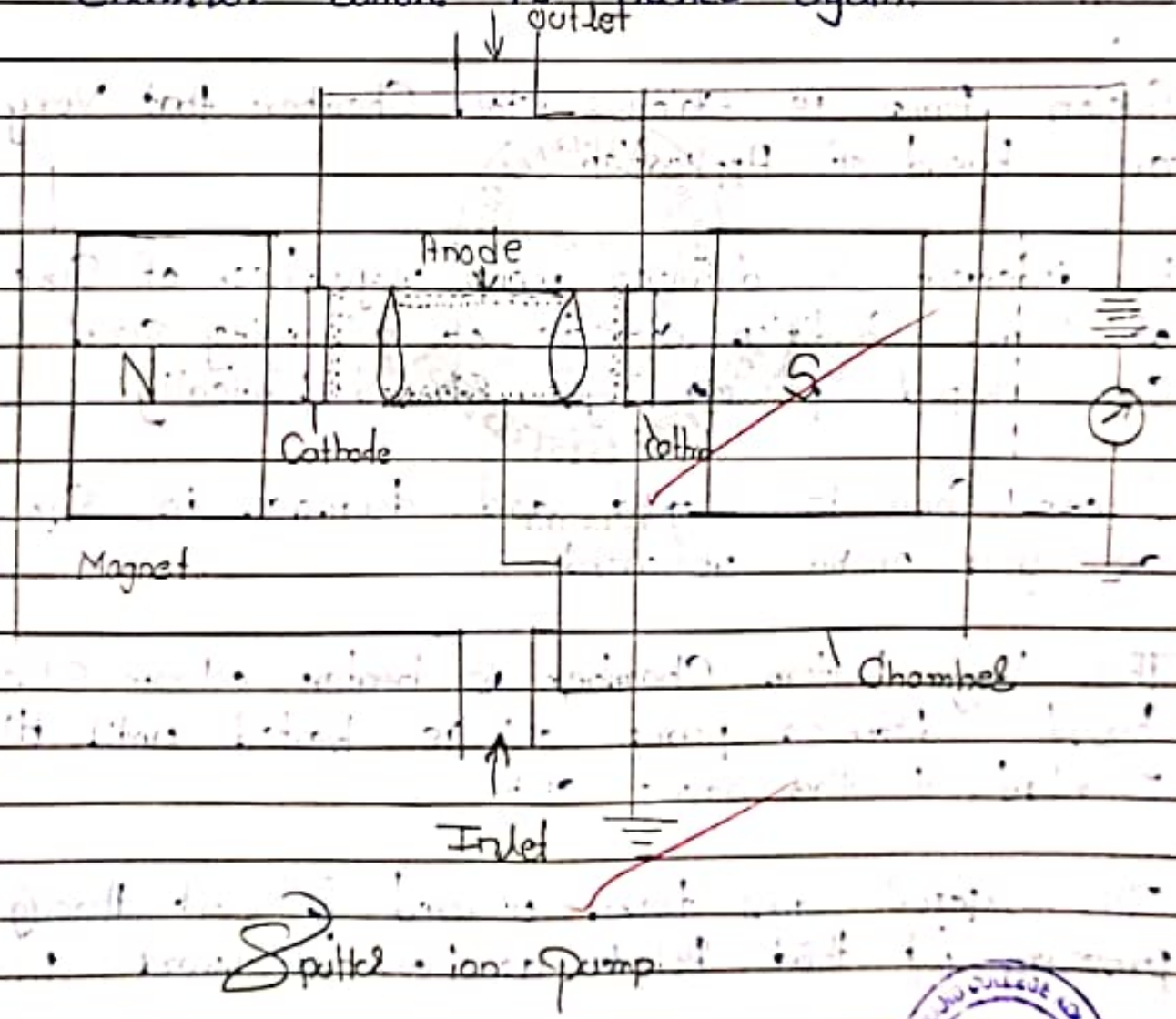
6. The exicted gas travel upsard & exit through pressure jet that Point at an downsard direction

7. The downsard Shooting Vapour travels at an increadible speed as the gas travels towards wall of the champer it traps that air

molecule along the way through Diffusion.

8. As the wall of the chamber are usually water Cooled as the gas reaches the Chamber wall immediatly returns to the liquid state releasing air molecules to the lower position & increased Pressure Great Vacuum.

9. The oil Pump to the bottom of the pump Chamber where is heated again.



Spitle ion Pump

Aniket Rajendra Power

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Spatter ion pump is gas Capture type Vaccum pume that function caithaut Pump Flaid. Spatter ion pu: It mainly Combines electric & Magnetic field to Ionic gas & that trape than & thete by Creat Vaccums

1. Spatter ion Pump basically Consists of two eletrodees. Ion i.e anode & Cathode & magnetic anode is usually Cylindrical & made up of Staineless steel

2 Cathode plate Positioned on basad both side of anode tube & made up of titanium which Stores as getteing Materia)

3 magnetic field is oriented along the axis of anode

4 as we apply electric field across cathode is emitts electrons & due to the pressure of magnetic field the move trajectories which improves thete chance to Collide with gas molecules

molecules

5. After Collision with gas molecules they Creates +ve & -ve ions so +ve ion moves toward cathode & -ve ion move toward anode Respectively So Charge seperation give +ve & -ve Current at cathod & anode.

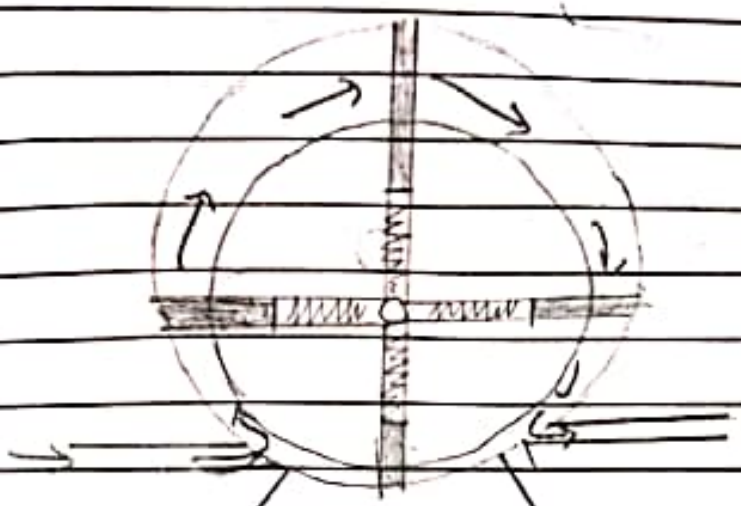
6. So we get Vaccum inside thic Cell due to Charge seperation & medium inside this pump Contains gas mleculs

7. Great Ultra high Vaccum range i.e 10^{-}" torr.

8. it's use ① Transmission ion Microscopy
② Semiconductor manfacturing Equpement.

Q3

Eatary pump.



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Class : M.sc-I

Subject : Research Methodology

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Div. :

Q.1)

1) Ultra high vaccum range of pressure measurement ranges from 10^{-6} to 10^{-11}

2) In diffusion pump, diffusion of gas molecules takes place in downwards shooting process

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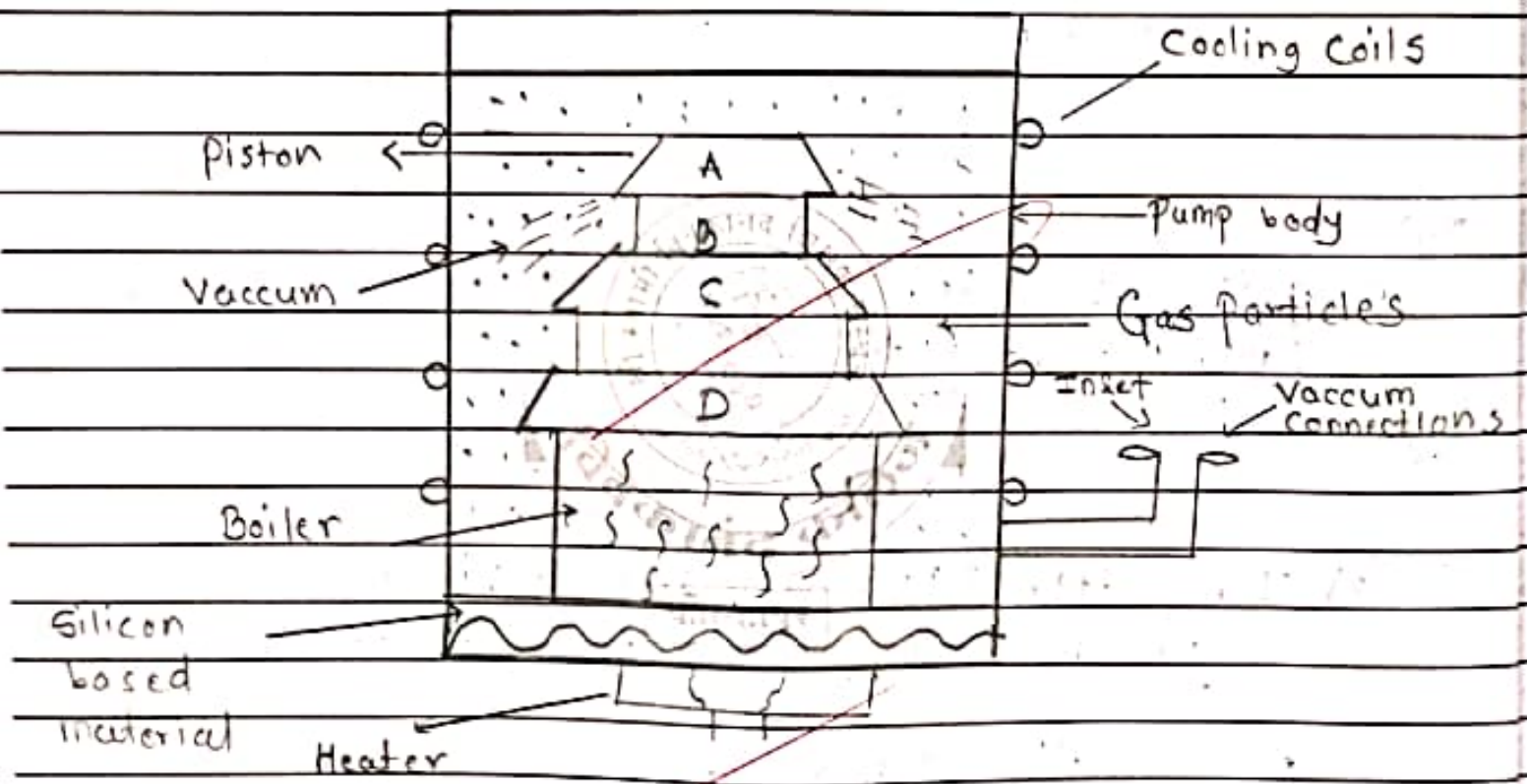
Q. 2)

Diffusion ion pump.

Diffusion ion pump is basically used to measure pressure of vaccum

Diagram



The diffusion ion pump pressure to create vaccum is around 10^{-12} mbr

Construction & working

1) The diffusion ion pump is mostly made of stainless ~~steel~~ steel body
2) in this pump piston are placed in vertically to each other
3) below the boiler silicon based reservoir is placed to heat
4) the size of piston is reduced as it moves upward.
5) the piston's are placed in a large cylindrical stainless steel body which has water in it.
6) below the ion pump there is a inlet is present (vaccum connections)

working:

1) when a silicon based material is heated its becomes in a gasseous state
2) after the heating the material is moves upward towards the piston's
3) the gas particles travels towards the end of piston with a very high speed.
4) the gas particles travels in a such speed beacause of ~~the~~ this speed there is a large portion of vaccum is created.

5) after gas particles enter in high pressure through the piston in the boiler there is water droplets are pressure

6) because of this water droplets the pressurised gas becomes in a liquid state.

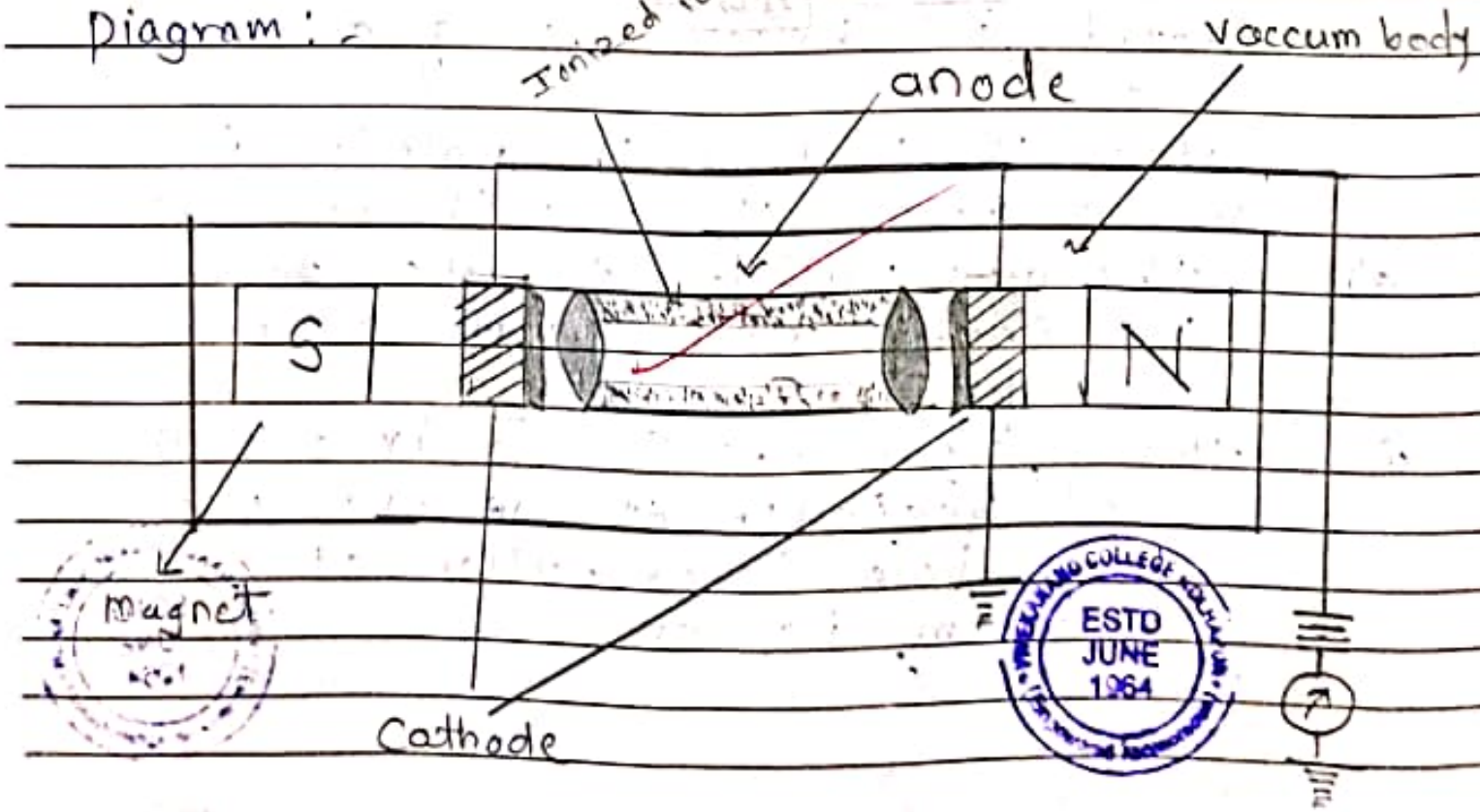
7) These gas droplets travels through the vaccum ~~con~~ connections & because of this vaccum is created.

~~ion pump~~

Sputter ion pump

In this pump the use of pump fluid is not necessary

Diagram:



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Construction and working..

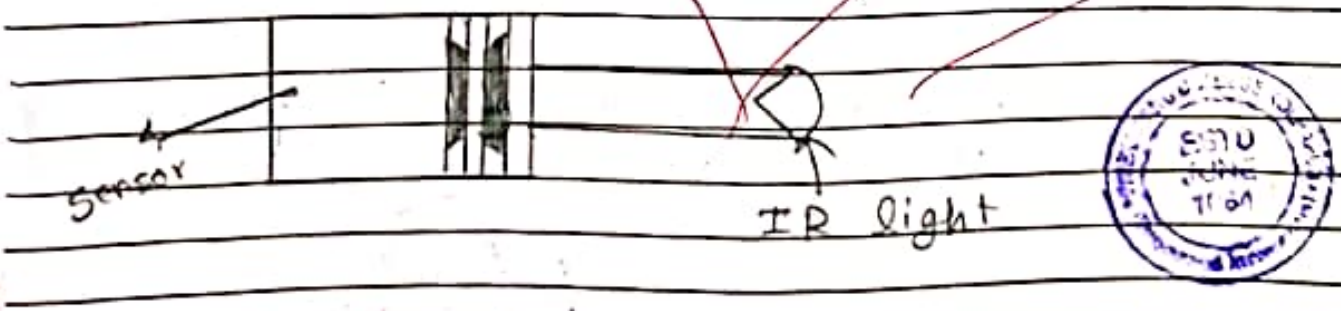
1) In this pump there is no pump fluid is required in this magnets are used which is cathode and anode
2) Two magnets are placed perpendicular to ~~each other~~ where cathode is used to produce ionized gas
3) Two cathode place are placed perpendicular To each other and between them anode plate is placed to produce ~~ionized~~ ion's
4) cathode and anode plates are placed in a vaccum body.

Working:

1) In sputter ion pump the vaccum is created in using ionized ions
2) when a charge is displaced in cathode the ions are formed on anode
3) the formed layer of ionized ions on anode Form +ve and -ve charge particles
4) where charged +ve and -ve ions are goes to there respectively
5) because of this displacement of +ve and -ve ions the ionized the vaccum is created in vaccum body.

Q.3)

2) Halogen leak detector.



Shrubika Ramchhaji Khot

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16/08

Q1)

1) b) N-type

2) c) drift velocity

2

Q2)

1) Alloy :-

It is made up by the combining of two or more metallic element

It is used to strength the corrosion

Example :-

The variation of energy bands with alloy and A_1GaAs and $AlAs$ and the variation it is shown by figure.

$Al_x Ga_{1-x} As$

where,

$$A_{1x}\ Ga_{1-x}\ As = 0$$

where the x elements are.

$$x = (0.0, 0.2, 0.4, 0.6, 0.8, 1)$$

By putting the values in it.

$$A_{10.0}\ Ga_{1-0.0}\ As = Ga\ As$$

$$A_{10.2}\ Ga_{1-0.2}\ As = A_{0.2}\ Ga_{0.8}\ As$$

$$A_{10.4}\ Ga_{1-0.4}\ As = A_{0.4}\ Ga_{0.6}\ As$$

$$A_{10.6}\ Ga_{1-0.6}\ As = A_{0.6}\ Ga_{0.4}\ As$$

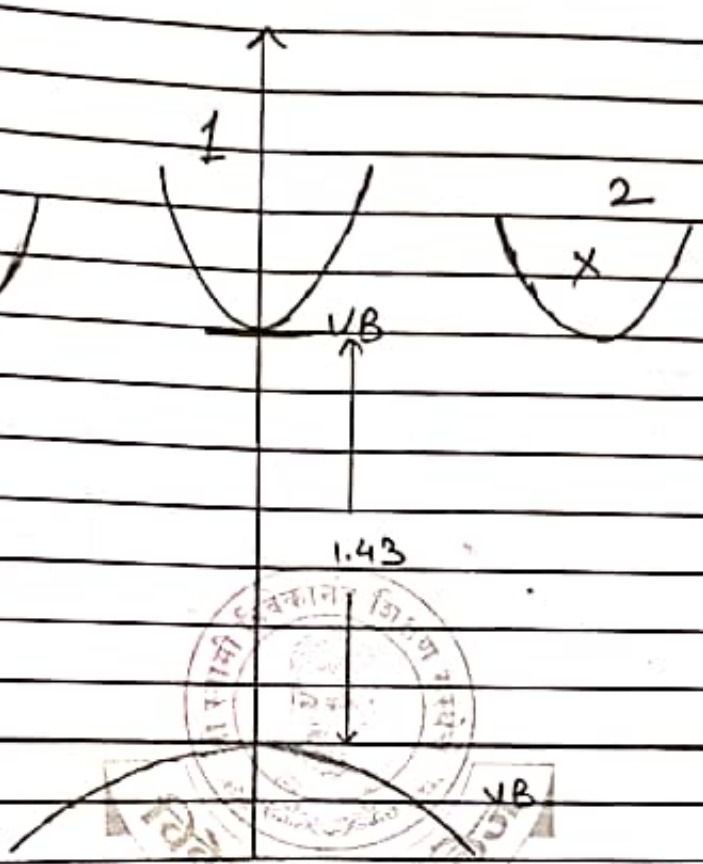
$$A_{10.8}\ Ga_{1-0.8}\ As = A_{0.8}\ Ga_{0.2}\ As$$

$$A_{11}\ Ga_{1-1}\ As = A_1\ As$$

We got the $Ga\ As$ for minimum and $A_1\ As$ for the maximum from the $A_{1x}\ Ga_{1-x}\ As = 0$

in the next from we will take the figure for the $A_{1x}\ Ga_{1-x}\ As = 0$ so we can get $Ga\ As$

Fig. (a)



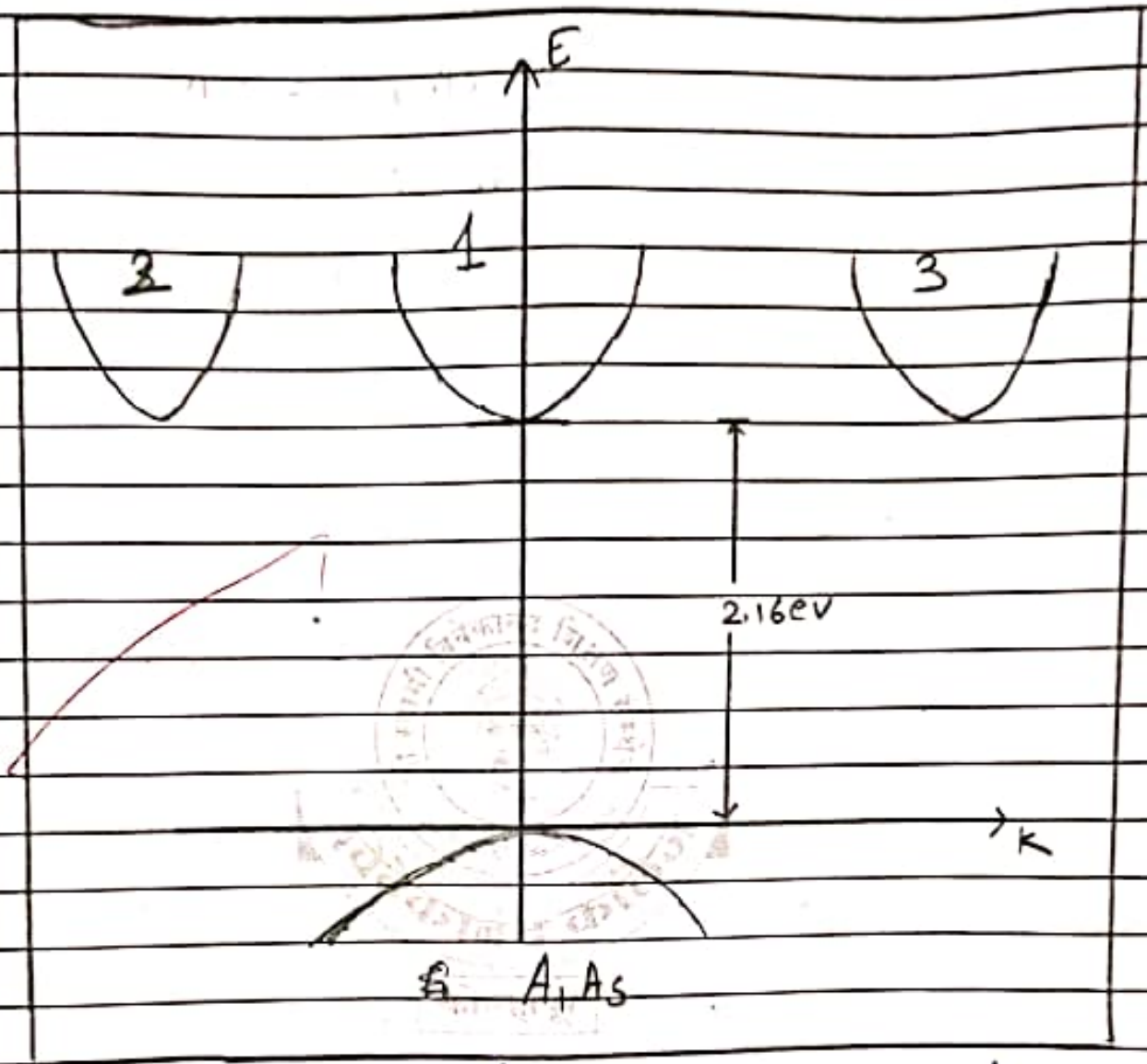
From the above figure it is shown that GaAs are how alloy composition been made and it has ev = 1.43 and it has the variation of energy bands with the composition of it

from $A_{1-x}Ga_{1-x}As$ = 0 if we got the first variation of GaAs at the point 0.0

$A_{1.0}Ga_{1-0.0}As$ = 0 A

= GaAs

fig (b)



from the above figure we can it is shown that the alloy composition of 1 is varied from it.

And at the point 1 from $A_{1-x} Ga_{1-x} As = 0$

$A_1 Ga_{1-1} As = 0$

$= A_1 GAs$

the point at 2.16 ev the de height of the composition which is varied by energy band.

Shrutika Sambhaji Kute.

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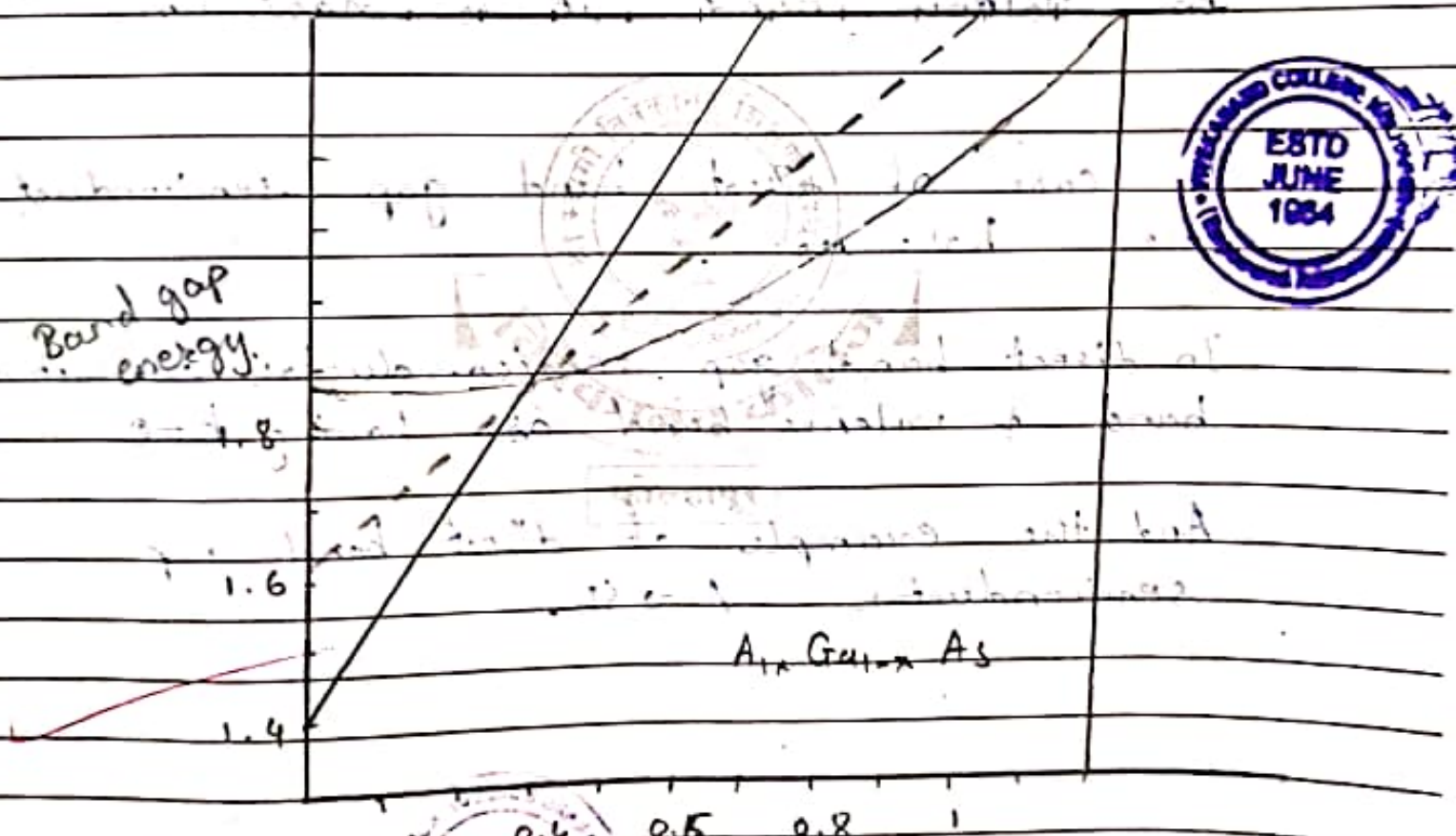

However, the variation of energy bands with alloy composition are done on $A_x Ga_{1-x} As$ where GaAs was the minimum conduction band and AlAs is the maximum band

2) Direct band gap semiconductor :-

In case of direct band gap semiconductor top of conductance band and at the bottom of valence band there is same k.

In case of direct band gap semiconductor conductance band is minimum and in valence band it is maximum.

In case of direct band gap semiconduct the $h\nu = \text{eev}$.

In direct band gap semiconductor conductance band & valence band are having $k = 0$

And the example of direct band gap semiconductor $Al \rightarrow Sb$.

Name :- Supriya Raju Ulle.

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Class : M.Sc. I

Subject : Solid State physics.

Test / Tutorial No. : Unit.

Div. :

10/20

1. Atoms containing 5 valence electrons are known as N-type Semiconductor.

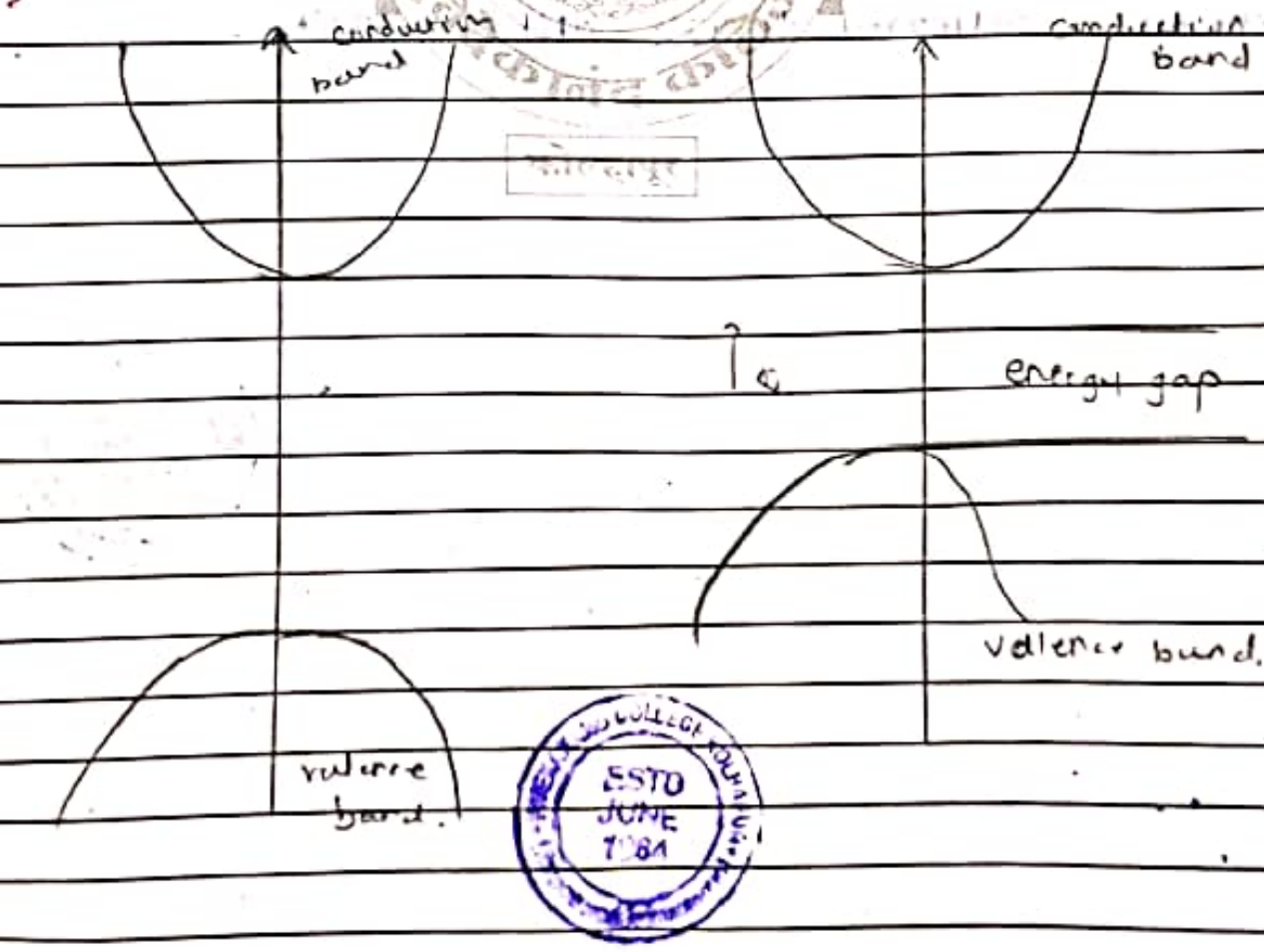
2. The electrons travel in the influence of electric field, this velocity is refferred to as drift velocity.

2.

2. Direct band gap semiconductor :-

* ~~In this direct band gap semiconductor the charge carrier in the conduction band and top of valence band~~ bottom of

1). In this direct band gap semiconductor the charge carrier of the bottom of the conduction band and top of the valence band lies in the same K.
2) In this band the valence band is maximum and conduction band is minimum.
3) It does not have momentum.
4) In the direct band gap semiconductor the electrons get excited - de-excited due to the photon.



2.

1) Alloy :-

It is made up by the concerning of two or more metallic element.

It is used to strength the corrosion.

Example :-

The variation of energy band with alloy and GaAs and AlAs and the variation, it is shown by figure

$Al_x Ga_{1-x} As$

where

$Al_x Ga_{1-x} As = 0$

where the x elements are

$x = (0.0, 0.2, 0.4, 0.6, 0.8, 1)$

By putting the values in it

$Al_{0.0} Ga_{1-0.0} As = GaAs$

$Al_{0.2} Ga_{1-0.2} As = Al_{0.2} Ga_{0.8} As$

$Al_{0.4} Ga_{1-0.4} As = Al_{0.6} Ga_{0.4} As$

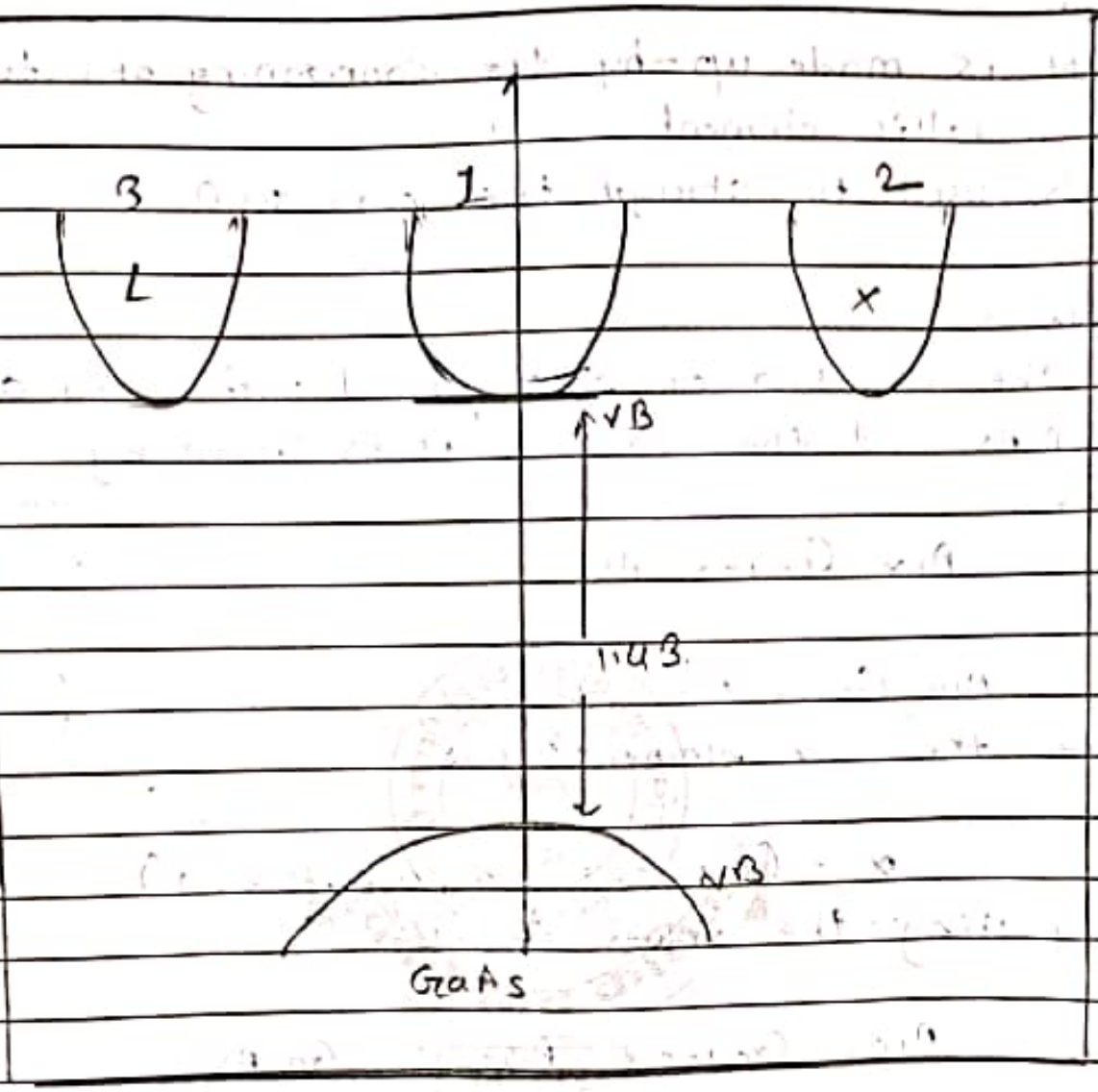
$Al_{0.8} Ga_{1-0.8} As = Al_{0.8} Ga_{0.2} As$

$Al_1 Ga_{1-1} As = AlAs$

From the GaAs for minimum and AlAs for maximum from the $Al_x Ga_{1-x} As = 0$.

In the next from we will take the figure for the $AlGa_{1-x} As = 0$ so we can get GaAs

fig (a)



from the above figure it is shown that GaAs are how alloy composition been the variation of energy bands with the composition of it.

from $Al_xGa_{1-x}As = 0$ we got the first variation of GaAs at the point 0.0.

$Al_{(0.0)}Ga_{1-0.0}As = A$.

= GaAs.

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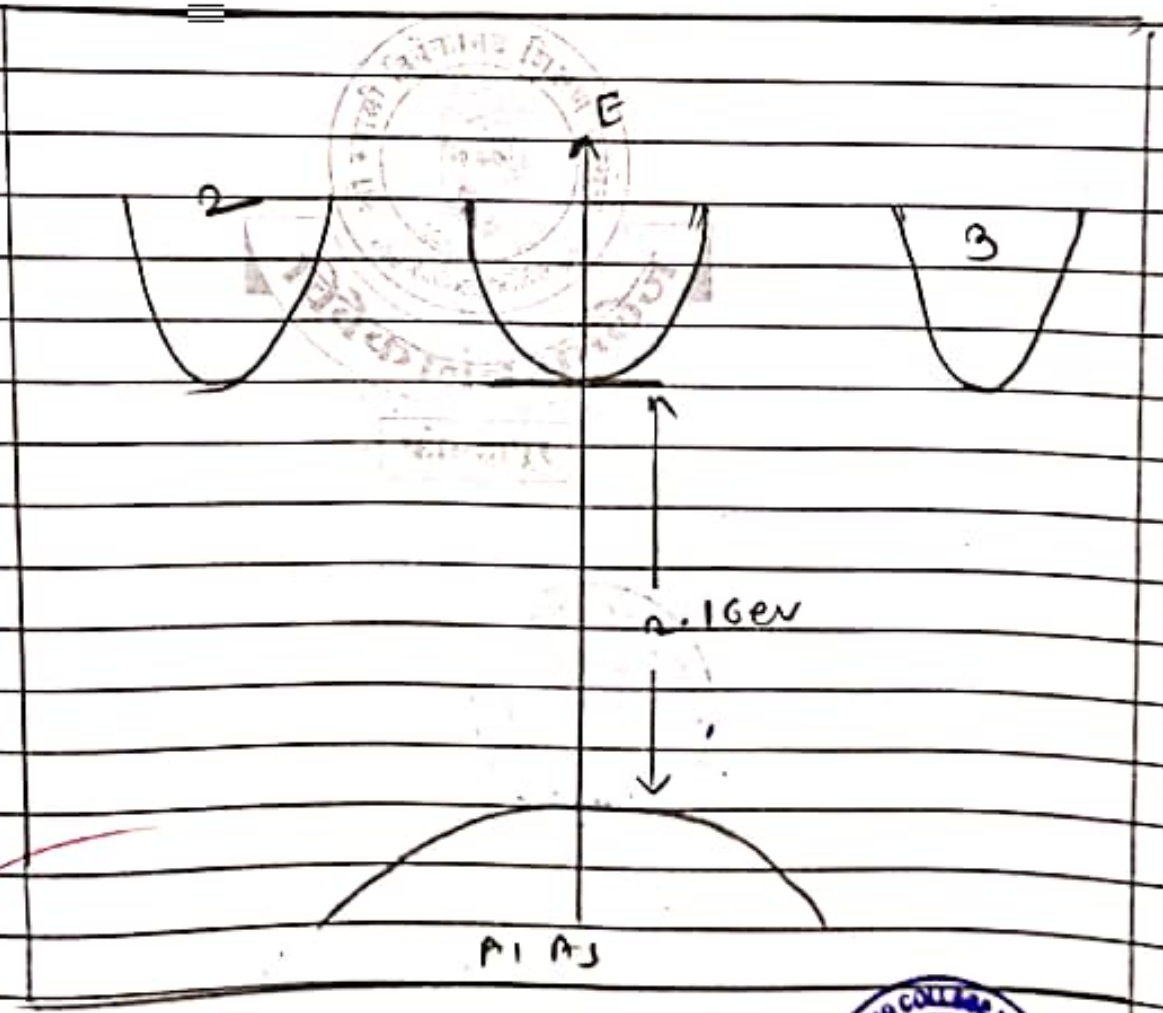
2. fig (6).

1)



from the above figure it is shown that the alloy composition of 1 is varied from it.

And at the point 1 from $Al_x Ga_{1-x} As = 0$.

$$Al_1 Ga_{-1} As = 0$$

$$= Al_1 GAs.$$

the point at 2.16 ev the height of the compositio which is varied by energy band.

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Vivekanand College, Kolhapur

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Department of Physics

B. Sc. / M.Sc. Part – I, Semester – I, PHYSICS Paper - _____

Title of the Paper: Classical Mechanics, Math Physics, Research Methodology & SSP-I

Name of Teacher: _____

Attendance Sheet

Sr. No.	Name of the Student	Math 26/09/24	classical 25/09/2024	R.M 26/09/2024	SSP-I 27/09/2024		
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2)	Rutuja S. Ghatte						
3)	Supriya R. Ville						
4)	Pooja J. Gadkari						
5)	Prajakta D. Desai						
6)	Vishal B. Ghatage						
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