"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Empowered Autonomous)

Department of Physics

B.Sc. Part-II SEM II Internal Examination (2023-24)
Paper-Thermodynamic and Statical Mechanics-II
Topic-Thermodynamic potentials

Day: -
Date: -

Time: - 10.00 am- 11.00 am
Total Marks: 10

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. Thermodynamic potentials are also known as .....

(a) thermodynamic variables (b) thermodynamic constants

(c) thermodynamic functions (d) thermodynamic relations

2. For an ideal gas, Joule-Thomson effect is .....

(a) zero (b) positive

(c) negative (d) infinite

Q.2 Attempt any two **(08)**

1. State and explain thermodynamic potentials: a) Internal energy b) Enthalpy.
2. State and explain Joule-Thomson effect.
3. Derive Clausius-Clapeyron's equations from Maxwell's thermodynamic relations.

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

Internal Attendance

Thermal & Statestical Mechanics - II

B.Sc. II

2023-24.

Gr. No.	Name of student	Seat No.	Sign.
1)	Sakshi Raju Biranje	7726	SRBiranje
2)	Ritu R. Nishad	7731	Rnishad
3)	Tanishq Anil Mude	7730	
4)	Prasad P. Gurav	7729	
5)	Vedant M. Mangaonkar	7718	
6)	Shivaji R. Jadhav	7939	
7)	Vrushabh R. Chouglule	7727	
8)	Sahil C. Patnekar	7733	
9)	Sanika J. Kalamkar	7708	
10)	Aprita J. Patil	7714	
11)	Riya D. Patil	7732	
12)	Shridhar S Jadhav	7706	

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Shri Swami Vivekanand Shikshan Sanstha Kolhapur's
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor

Suppliment No. :
Roll No. : 7731
Class : B.Sc. Sy

Subject : Thermodynamic & statical Mechanics.
Test / Tutorial No. : 07/10
Div. :

Q.1 1) c) Thermodynamic function.

2) a) zero.

2

Q.2 1) Internal energy :
The sum of kinetic energy & potential energy of every element of in thermodynamic system is called internal energy. The infinitely heat energy supplyed to the thetrmodynamic systen. The internal energy is change by thermodynamic first law.

$$dQ = dU + dW.$$

but $dW = PdV.$

$$\therefore dQ = dU + PdV.$$

Enthalpy : It is denoted by H. It is the total heat content of thermodynamic system is in temal energy & pressure.

& volume.

$$H = U + PV.$$

differentiating

$$dH = dU + PdV + VdP$$
$$dH = Tds + PdV + VdP.$$

$$dH - PdV = Tds + VdP.$$

Q.2 When a gas in region constant, pressure, passes through a pours plug, to a region of lower constant pressure. its temperature reduces is called as Joule - Thomson effect.

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SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 7732

Class : B.Sc. SY

Subject :

Test / Tutorial No. : Internal Exam.

Div. : 08 / T0

Q-1 1) c) Thermodynamic functions. 1

2) a) zero. 1

Q-2 1) a) Internal energy : The sum of kinetic & potential energy of all the molecules in a thermodynamic system is called as internal energy. It is denoted by (U)

i.e. $dU = TdS - PdV$ from $dQ = dU + dW$.

b) Enthalpy - Enthalpy is a thermodynamic potential equal to the internal energy plus product of Pressure & volume. It is denoted by H.

i.e. $H = U + PV$.

2

2.2

5) Clausis- clapeyron's equations:

The clausis-clapeyron's equation is derived from Maxwell's eqn of first thermodynamic potential

i.e. $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$ — (1)

Multiplying both sides by T.

$T\left(\frac{\partial S}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V$ — (2)

We know $dQ = Tds$ from first law of thermodynamics.

eqn (2) becomes.

$\left(\frac{\partial Q}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V$ — (3)

Here $\left(\frac{\partial Q}{\partial V}\right)_T$ represents heat absorbed or emitted by the thermodynamic system. This heat must be latent heat. This also corresponds to change in volume. Let, L be the change in heat, $dQ = L$ & $dV = V_2 - V_1$

$\left(\frac{dQ}{dV}\right)_T = \frac{L}{V_2 - V_1}$ — (4)

Putting eqn (4) in (3)

$T\left(\frac{\partial P}{\partial T}\right) = \frac{L}{V_2 - V_1}$

$\therefore \frac{\partial P}{\partial T} = \frac{L}{T(V_2 - V_1)}$ This is clausius clapeyrons equations.

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Department of Physics

B.Sc. Part-II SEM III Examination (2023-24)
Waves and Oscillations

Date : Total Marks: 10
Day : Time :- 30 min

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 **(3)**

1) What is the frequency of SHM?

a) Number of oscillations per unit time b) Time for one oscillation

c) Time taken for motion to reverse direction d) Same as angular frequency

2) The waves, in which the particles of the medium vibrate in a direction perpendicular to the direction of wave motion, is known as _____

a) Transverse waves b) Longitudinal waves

c) Propagated waves d) Magnetic waves

3) Principle of superposition is obeyed by _____

a) Homogeneous equation b) Linear equation

c) non linear equation d) homogeneous and linear

Q.2 Attempt any One **(12)**

1. Discuss in detail , analytically , the resultant motion of two simple harmonic motions having same frequency and acting along the same line

2. Discuss in detail , analytically , the resultant motion of two simple harmonic motions having same frequency and acting at right angles to each other.

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

Internal Attendance

Waves & oscillations

B.Sc II

2023-24.

Sr. No.	Name of student	Seat No.	Sign.
1)	Sakshi Raju Branje	7726	SRBranje
2)	Ritu R. Nishad	7731	Rnishad
3)	Tanishq Anil Mude	7730	
4)	Prasad P. Gurav	7729	
5)	Vedant M. Mangaonkar	7718	
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VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

wave & oscillations

Suppliment No. :

Roll No. : 7732

Class : B.Sc. II.

Signature of Supervisor

Subject : Physics 06/10.

Test / Tutorial No. : Internal Examination.

Div. :

Q.1 1) a) Number of oscillation per unit time

2) ~~b)~~ a) Transverse wave.

2

Q.2 1) Consider a simple harmonic motion having same frequency ~~but diffn ampl~~ wt but different amplitude a_1 & a_2 so the phase difference are α_1 & α_2

Now the lineer SHM Y_1 & Y_2 it is

$$Y_1 = a_1 \sin(\omega t + \alpha_1) \quad (1)$$
$$Y_2 = a_2 \sin(\omega t + \alpha_2) \quad (2)$$

Here

$$Y = Y_1 + Y_2$$

$$Y = a_1 \sin(\omega t + \alpha_1) + a_2 (\sin(\omega t + \alpha_2)$$
$$= a_1 (\sin\omega t \cos\alpha_1 + \cos\omega t \sin\alpha_1)$$
$$+ a_2 (\sin\omega t \cos\alpha_2 + \cos\omega t \sin\alpha_2)$$

$$= a_1 \sin\omega t \cos\alpha_1 + a_2 \sin\omega t \cos\alpha_2 + a_1 \cos\omega t \sin\alpha_1 + a_2 \cos\omega t \sin\alpha_2$$

$$= \sin\omega t (a_1 \cos\alpha_1 + a_2 \cos\alpha_2) + \cos\omega t (a_1 \sin\alpha_1 + a_2 \sin\alpha_2)$$

Now,

$$(a_1 \cos\alpha_1 + a_2 \cos\alpha_2) = R\cos\alpha$$
$$(a_1 \sin\alpha_1 + a_2 \sin\alpha_2) = R\sin\alpha$$

$$\sin\omega t (R\cos\alpha) + \cos\omega t (R\sin\alpha)$$

$$= R(\sin(\omega t + \alpha)). \quad (4)$$

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06886

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 7731

Class : B.Sc. SY

Subject : Physics.

Test / Tutorial No. : 09 / To

Div. :

Q.1

1) a) Number of oscillations per unit time.

2) b) transverse waves.

2

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Q.2
17

Consider two simple Harmonic oscillations having same frequencies but different amplitudes & Phase acting on a particle in Y-direction. let Y_1 & Y_2 be the Displacement of two SHM's. Therefore, according to the principle of superposition of waves the resultant displacement is given by

$$Y = Y_1 + Y_2.$$

Here

$$Y_1 = a_1 \sin(\omega t + \alpha_1)$$
$$Y_2 = a_2 \sin(\omega t + \alpha_2)$$

where a_1 & a_2 are the amplitudes & α_1 & α_2 are phases.

$$Y = a_1 \sin(\omega t + \alpha_1) + a_2 \sin(\omega t + \alpha_2)$$
$$= a_1 (\sin\omega t \cos\alpha_1 + \cos\omega t \sin\alpha_1) + a_2 (\sin\omega t \cos\alpha_2 + \cos\omega t \sin\alpha_2)$$

$\because \sin(A+B) = \sin A \cos B + \cos A \sin B$

$$= a_1 \sin\omega t (\cos\alpha_1 + \cos\alpha_2) + a_2 \cos\omega t (\sin\alpha_1 + \sin\alpha_2)$$

put $a_1(\cos\alpha_1 + \cos\alpha_2) = R\cos\theta$ — (1)

& $a_2(\sin\alpha_1 + \sin\alpha_2) = R\sin\theta$ — (2)

$$Y = \sin\omega t + R\cos\theta + \cos\omega t \, R\sin\theta$$
$$\sin(\omega t + \theta)$$

$\because \sin(A+B) = \sin A \cos B + \cos A \sin B,$

$$Y = \sin(\omega t + \theta)$$

This is the resultant displacement of Two SHM's Having same angular frequency but different.

amplitude & phase.

Squaring & adding eqn ① & ②.

$$R\cos^2\theta + R\sin^2\theta = a_1^2(\cos\alpha_1 + \cos\alpha_2) + a_2^2(\sin\alpha_1 + \sin\alpha_2)^2.$$

$$= a_1^2\cos\alpha_1^2 + 2\cos\alpha_1\cos\alpha_2 + a_2^2 + a_2^2\sin\alpha_1^2 + 2\sin\alpha_1\sin\alpha_2 + \sin\alpha_2^2.$$

$$R(\cos^2\theta + \sin^2\theta) = a_1^2(\cos\alpha_1^2 + 2\cos\alpha_1\cos\alpha_2 + \cos\alpha_2^2) + a_2^2(\sin\alpha_1^2 + 2\sin\alpha_1\sin\alpha_2 + \sin\alpha_2^2).$$