C.U.SHAH UNIVERSITY
Wadhwan City

Subject Code : **5SC02PHC4**   **Summer Examination-2014**   Date: 16/06/2014
Subject Name:- **Quantum Mechanic - II and Statistical Mechanics**
Branch/Semester:- M.Sc(Physics)/II   Time:02:00 To 5:00
Examination: Regular

Instructions:-
(1) Attempt all Questions of both sections in same answer book / Supplementary
(2) Use of Programmable calculator & any other electronic instrument is prohibited.
(3) Instructions written on main answer Book are strictly to be obeyed.
(4) Draw neat diagrams & figures (If necessary) at right places
(5) Assume suitable & Perfect data if needed
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SECTION-I

Q-1   All Questions are compulsory   **7**

a) Write the equation of Helmholtz free energy, in term of U and S.

b) If S is entropy and E is surface of energy, $\left(\frac{\partial S}{\partial E}\right)_V$ = ---------

c) If H is hamiltonian and P is momentum, then $\left(\frac{\partial H}{\partial P}\right)$ = ---------

d) For N particle system, how many dimension of system in phase space.

e) What is super fluid?

f) What is value of T_λ for liquid helium?

g) What is value of entropy for super fluid?

Q-2   Answer the following .

a) Explain Gibb's Paradox.   **5**

b) Derive: derivation of thermodynamic under quasistatic system.   **5**

c) Explain: Crawling and Second sound effect for liquid He-II.   **4**

OR

a) Why does liquid helium not solify?   **5**

b) Exlain: Binary alloys.   **5**

c) Explain density function and derive density ρ = constant.   **4**

Q-3   Answer the following .

a) Derive the Equipartion theorems.   **7**

b) Explain Ising Model for ferromagnetic materials.   **7**

a) Obtain the equation of entropy (S) and energy (U) for classical ideal gas. **7**

b) Explain Macro canonical and Canonical ensemble in quantum statistics. **7**

SECTION-II

Q-4 All Questions are compulsory **7**

a) What is the integration limit of ϕ in scattering process?

b) In scattering process, the formula of $d\Omega$ = --------

c) 1 barn = --------- cm^2

d) Which symmetry of potential is used for partial wave analysis?

e) Write the time independent Schrodinger equation.

f) Give the formula between scattering amplitude and differential scattering cross section.

g) Which method does gives law energy approximation?

Q-5 Answer the following

a) Explain Eikonal approximation for scattering amplitude. **5**

b) Calculate the differential cross section for potential under condition

$V(\vec{r}) = + V_0$ for $r < a$ and $V(\vec{r}) = 0$ for $r > a$ **5**

c) Described the screened Coulomb potential. **4**

OR

a) Explain the differential and total scattering cross section for asymptotic behaviour **5**

b) Explain the kinematics of scattering process. **5**

c) Write a short note on Partial wave. **4**

Q-6 Answer the following in detail.

a) Explain Born approximation. **7**

b) Obtain: Scattering amplitude from asymptotic form of radial function for partial wave. **7**

OR

a) Explain scattering and scattering amplitude from wave mechanical picture. **7**

b) Give the relation between phase shift and potential and obtain expression for phase shift. **7**

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