Sanjay Ghodawat University, Kolhapur

2018-19
EXM/P/09/00

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

Year and Program: F.Y.M.Sc	**School:** Science	**Department:** Physics
Course Code: PHS 506	**Course Title:** Statistical Mechanics	**Semester – II**
Day and Date: Friday 24/05/2019	**Examination:** End Semester Examination (ESE) A	**Time:** 30 Mins **Max Marks:** 20 2·30 to 3·00 pm

Seat No.:	PRN No.:	Student Sign:
Invigilator Sign:	Examiner Sign:	Marks Obtained:

Instructions:
1) All Questions are compulsory.
2) Mark √ to the correct option. Do not circle.
3) More than one options marked will not be considered for assessment.
4) Rough calculations on paper are not allowed.
5) Use non-programmable calculator is allowed.

		Marks	Bloom's Level	CO
Q.1. a) Select the correct alternative	**Marks (16)**			
1	In an isothermal change the internal energy of molecules	1	L2	506.1
	a) May increase or decrease b) Does not change			
	c) Increases d) Decreases			
2	The first Law of thermodynamics is conservation of	1	L1	506.1
	a) Energy b) Momentum			
	c) Both (a) and (b) d) None of these			
3	The state of the gas described in terms of the properties of its constituent is called	1	L1	506.1
	a) Macroscopic state b) Microscopic state			
	c) Phase space d) None of these			
4	In a canonical ensemble, a system A of fixed volume is in contact with large reservoir B then	1	L1	506.2
	a) A can exchange only energy with B b) A can exchange only particles with B			
	c) A can exchange neither energy nor particles with B d) A can exchange both energy and particles with B			

ESE

5   Which of the following relations between free energy F and the   1   L2   506.2
canonical partition function Z, is true?

a) $F = -\dfrac{\partial}{\partial T} \log Z$ b) $F = kT^2 \dfrac{\partial}{\partial T} \log Z$

c) $F = -kT \log Z$ d) $F = kT \dfrac{\partial}{\partial V} \log Z$

6   The volume of a cell is.........if, it is in six dimensional phase space.   1   L1   506.2
a) h^3 b) h^{3N} c) $6h^3$ d) h^2

7   Two identical particles are to be distributed over 3 energy levels.   1   L2   506.3
Treating the particles as distinguishable Maxwell-Boltzman particles,
the number of ways in which the particles can distributed is

a) 6   b) 9

c) 3   d) 8

8   The entropy of an ideal gas at absolute zero is   1   L1   506.3
a) 0   b) 1   c) ∞ d)   None of these

9   Neutrons obeys........................... statistics.   1   L1   506.3
a)   M-B Statistics   b)   B-E Statistics

c)   F-D Statistics   d)   Classical Statistics

10   For Bose-Einstein statistics the symmetry of the wave function is   1   L2   506.3
symmetric

a)   True   b)   False

11   The chemical potential for photon is zero.   1   L2   506.3
a)   True   b)   False

12   The temperature at which gas liquefies is called as.....................   1   L1   506.4
a)   fusing temperature   b)   boiling temperature

c)   melting temperature   d)   critical temperature

13   Identify which one is a first order phase transition   1   L1   506.4
a)   A liquid to gas transition   b)   A liquid to gas transition at
close to its triple point   its critical temperature

c)   A paramagnetic to   d)   A metal to superconductor
ferromagnetic transition in   transition in the absence of a
the absence of a magnetic   magnetic field
field

ESE

			Marks	Bloom's Level	CO

14 During second order phase transition of $BaTiO_3$, phase changes from Cubic to — 1 — L1 — 506.4

    a) Hexagonal   b) Triclinic   c) Trigonal   d) Tetragonal

15 He^4 isotope has spin — 1 — L1 — 506.4

    a) ∞ b) 1   c) 1/2   d) 0

16 Heat flows through liquid He II like a wave with definite velocity called_____. — 1 — L2 — 506.4

    a) He I   b) Liquid He I

    c) First Sound   d) Second Sound

Q.1. b) Fill in the blank

                                               Marks (04)   Marks   Bloom's Level   CO

1 The number of co-ordinate in the phase space of a single particle is........ — 1 — L2 — 506.1

2 The grand canonical partition function is given by........ — 1 — L2 — 506.2

3 According to Stefan's law, total energy radiated per unit area per unit time is proportional to T^n, where n=.... — 1 — L2 — 506.3

4 Clausius Clapeyron latent heat equation is given by................. — 1 — L2 — 506.4

EST

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Year and Program:	School: Science	Department: Physics
F.Y.M.Sc		
Course Code: PHS506	Course Title: Statistical Mechanics	Semester – II
Day and Date: Friday 24/05/2019	Examination: End Semester Examination (ESE) $\mathcal{B}$	Time: 2 Hrs 30 Mins Max Marks: 80 3 to 5.30 pm.

Instructions:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Neat diagrams must be drawn wherever necessary.
4) Assume suitable data if necessary.
5) Use of logarithmic table and non-programmable calculator is allowed.

			Marks	Bloom's Level	CO
Q.2 Answer the following questions.		Marks (16)			
a)	Explain Liouville's theorem in classical presentation.		12	L3	506.1
b)	Write a note on phase space and γ-space		4	L2	506.1
	OR				
b)	Differentiate between macroscopic and microscopic states.		4	L2	506.1
Q.3 Answer the following questions.		Marks (16)			
a)	What do you understand by the canonical partition function? Derive the expression for canonical partition function for ideal gas. Hence obtain its thermodynamic properties.		12	L3	506.2
b)	Write a short note on fluctuation.		4	L2	506.2
	OR				
b)	Give the physical significance of the normalization factor in microcanonical distribution.		4	L2	506.2
Q.4 Answer the following questions.		Marks (24)			
a)	Derive the expression for equation of state for ideal gas in quantum statistics.		12	L5	506.3
b)	Explain the phenomenon of Bose- Einstein condensation.		8	L4	506.3
	OR				
b)	i. Differentiate MB, BE and FD statistics		8	L4	506.3
	ii. Write a note on Einstein's explanation of Planck's law				
c)	Write a note on Radiation Pressure.		4	L2	506.3
	OR				
c)	Differentiate between Bosons and Fermions		4	L2	506.3

ESE

Q.5 Answer the following questions.   **Marks (24)**

a) What is mean by Phase transition? Explain in details the types of phase transitions by giving appropriate examples.	12	L4	506.4
b) Write a note on conditions of phase equilibrium	8	L2	506.4

<div align="center">OR</div>

b) i. Explain variation of Gibb's function, specific volume, entropy and specific heat at constant pressure with temperature.	8	L2	506.4
ii. Explain P-T diagram of one component system			
c) Write a note on peculiar properties of liquid He	4	L2	506.4

<div align="center">OR</div>

c) Derive the Clausius Clayperon latent heat equation.	4	L2	506.4

<div align="center">

ESE

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