

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Instruction Division
First Semester 2015–2016
Course Handout (Part II)

Date: 03.08.2015

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. : PHY F312
Course Title : Statistical Mechanics
Instructor-in-Charge : **BISWANATH LAYEK**

Course Description:

Classical and quantum mechanics describe motion of particles. However, these approaches are successful only for system of small number of particles. Most systems that are encountered in the real world involve a rather large number of particles. Statistical mechanics combines physics and probability theory in describing such systems.

Scope and Objective:

This course deals with equilibrium statistical mechanics. Elements of ensemble theory are discussed. The theory of ideal quantum gases (bosons and fermions) is considered.

Text Books:

T1. Statistical Mechanics, Second Edition, R. K. Pathria, Butterworth-Heinemann (1996)

Reference Books:

R1. Thermodynamics and Statistical Mechanics, Greiner, Neise and Stocker, Springer (1995)

R2. Statistical Mechanics, Second Edition, Kerson Huang, WSE, Wiley (2000)

R3. Fundamentals of Statistical and Thermal Physics, First Edition, F. Reif, McGraw-Hill (1965)

Course Plan: Sections referred to are from the text book (CN stands for Class Notes).

Lecture No.	Learning Objectives	Topics to be Covered	Reference (Sec. No.)
1	Thermodynamics in 50 Mins. !	Thermodynamics variables (N, V, T, S etc.) and functions (U, F, H, G)	CN
2	Description of States	Macro and Micro-states	1.1, 1.2
3-5	Ensemble theory	Phase space, Liouville's theorem	2.1, 2.2
6-8	Microcanonical ensemble (MCE)	Microcanonical ensemble	2.3, 2.4
9-11	Canonical ensemble (CE)	Method of most probable values	3.1, 3.2
12	Physical Significance	Thermodynamic quantities in CE	3.3
13-15	Classical systems	System of non-interacting particles	3.5
16-17	Equipartition & Virial theorems	Equipartition & Virial theorems	3.7
18-19	A system of SHOs	Thermodynamic behavior	3.8
20-21	Paramagnetism	Thermodynamic behavior	3.9
22-23	Grand canonical ensemble (GCE)	Physical significance	4.1-4.3
24 - 26	Quantum Statistics	Various ensembles revisited	CN
27-29	Ideal gas	Micro- and other ensembles	6.1, 6.2
30-32	Ideal Bose gas	Thermodynamic behavior	7.1

33-34	Black body radiation	Thermodynamics	7.2
35-36	Ideal Fermi systems	Thermodynamic Behavior	8.1
37-40	Metals	Fermi sea	8.3

Evaluation Scheme:

EC No.	Component	Duration	Weightage (%)	Date & time	Nature
1	Midterm Test	90 min	30	6/10 2:00 - 3:30 PM	Closed Book
2	Tutorial Tests*		30	As will be announced from time to time	Closed Book
3	Comprehensive exam	3 hours	40	4/12 FN	Partly Open and partly Closed Book

* A total of 6 tutorial tests will be conducted, at nearly regular intervals and spread over the entire semester, out of which the best 5 will be taken into consideration.

Chamber Consultation Hours: To be announced in class

Notices: Will be put in the course web page, also in Physics Dept notice board.

Make-up Policy: Make-up will be given only in genuine cases, that is, due to serious illness etc. There are no make-ups for the tutorials.

Instructor-in-charge