



SYLLABUS

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
PHY	332	Statistical Physics	3	2	0	2	5	PHY 230, STA 111	6	English

A. Course Description

This course presents the mathematics and quantum mechanics needed to understand statistical thermodynamics. It covers several important topics, including a mathematically sound presentation of statistical thermodynamics; the kinetic theory of gases including transport processes; and thorough, modern treatment of the thermodynamics of magnetism.

B. Course Outcomes

At the end of this course the student will be able to:

1. Define and discuss the concepts of macrostate and microstate of a model system.
2. Discuss the Boltzmann distribution and the role of the partition function.
3. Define the Fermi-Dirac and Bose-Einstein distributions; state where they are applicable; understand how they differ and show when they reduce to the Boltzmann distribution.
4. Apply the Fermi-Dirac distribution to the calculation of thermal properties of electrons in metals.
5. Apply the Bose-Einstein distribution to the calculation of properties of black body radiation.
6. Develop critical thinking and analytical problem-solving skills.

C. References

Required Textbook

Asheley H. Carter, *Classical and Statistical Thermodynamics*, Prentise Hall (2000).

Other references

- Lokanathan S. and Gambhir R.S., *Statistical and Thermal Physics: an introduction*, P. H. I. (1991).
- Patharia R. K., *Statistical Mechanics*, Oxford: Butterworth (1996).
- Mandel F., *Statistical Physics*, 2nd Edition, John Wiley (1988).

Course Website: <http://www.imamm.org/>

D. Topics Outline

1. **Review of Thermodynamics:** Laws of thermodynamics, entropy, Gibbs free energy, Helmholtz free energy, fundamental equations, Maxwell's relations and chemical potential, problems (Contact hours: 4).
2. **Statistical Thermodynamics:** Coin model and the most probable distribution, quantum mechanics and the microscopic world, density of states, microstates of a system (Contact hours: 8).
3. **Classical Statistics of Maxwell-Boltzmann:** Hypothesis, degenerate states, some useful relations, partition function for non-degenerate states, partition function for continuous states (Contact hours: 12).
4. **Velocity Distribution Function of Maxwell-Boltzmann:** Average molecular speed, the root mean-square speed, most probable speed, equipartition of energy principle, molecules in a certain speed range (Contact hours: 12).



5. *Statistical Mechanics of Diatomic Gases: Vibration, rotational and translational motions (Contact hours: 8).*
6. *Quantum Statistics: Fermi-Dirac statistics, Bose-Einstein statistics, applications of Bose-Einstein statistics (Black body radiation, Bose-Einstein condensation, the properties of ideal Bose-Einstein gas) (Contact hours: 8).*
7. *Statistical of Magnetic Materials: Qualitative description of magnetization, quantitative description of magnetization, Langevin's theory for magnetization (Contact hours: 8).*

E. Office Hours

Office hours give students the opportunity to ask in-depth questions and to explore points of confusion or interest that cannot be fully addressed in class.

F. Exams & Grading System

The semi-official dates of the exams for this course are:

- **Midterm 1:** 6th or 7th week.
- **Midterm 2:** 11th or 12th week.
- **Quizzes & Homeworks:** During the semester.
- **Final Exam:** 16th week.

Your course grade will be based on your semester work as follows:

Midterm 1: 20 %	Midterm 2: 20 %	Final Exam: 40 %
Quizzes, Homework, Attendance & Participation: 20 %		

The grading distribution:

A ⁺	A	B ⁺	B	C ⁺	C	D ⁺	D	F
[95, 100]	[90, 95]	[85, 90]	[80, 85]	[75, 80]	[70, 75]	[65, 70]	[60, 65]	[0, 60]

G. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Exams](http://goo.gl/ykm7t3)

goo.gl/ykm7t3

