Department of ...Physics....

College of...Education-shaqlawa

University of...Salahaddin...

Subject...Statistical Mechanics.....

Course Book-For Example (1 Year)

Lecturer's Name: M.S Zahraa Ali Mala Issa

Academic Year: 2022/2023

Course Book

1-Course Name	**Statistical Mechanics**
2-Lecturer in charge	
3-Department/ College	**...Physics/ Science.....**
4-Contact	E-Mail: Zahraa.malaissa@su.edu.krd Tel: (Optional)
5-Time(In hours) per week	Theory: 2
6-Office Hours	Availability of the lecture to the student during the week 12 Hours
7- Course Code	
8- Teacher's academic profile	Welcome to my Academic Profile page. My name is: Zahraa Ali malaissa **I am Assistant lecturer r with a MSc in Nuclear physics, teaching in the** Department of Physics, College of Shaqlaw Education at Salahaddin University in Kurdistan Region, F.R. Iraq e-mail: Zahraa.malaissa@su.edu.krd Mobile: (+964) -7505891478 **I teach several topics at the university, i.e.** 1. Electricity and magnetism 2. Matlab programing 3. Statistical Mechanics 4. Astronomy **My research interests focus on;** 1.Nuclear Paring models 2. Solar Cells.. Examination committee > 5o students Reviser for scientific research paper > 6
9- Keywords	

10- **Course Overview:**

The word “statistics” must be interpreted as applying to a technique for describing processes involving large numbers of particles whose individual interactions are known, without considering the individual behavior of each particle.

Statistical mechanics provides the framework for performing microscopic analyses. In practice, statistical mechanics regards the interaction between the particles composing a bulk sample, and predicts the equilibrium properties of the system that result from these interactions. A practical difficulty of statistical mechanics is in finding tractable mathematical approaches to describing the many interacting bodies in the system. As in the other core areas of Physics, some systems are exactly solvable, while more complex systems require approximations or numerical analysis.

Statistical mechanics aims at studying the macroscopic parameters of a system in equilibrium from knowledge of the microscopic properties of its constituent particles using the laws of mechanics. Statistical mechanics provides the connection between microscopic motion of individual atoms of matter and macroscopically observable properties such as temperature, pressure, entropy, free energy, heat capacity, chemical potential, viscosity, spectral, reaction rate, etc

11- **Course Objective:**

The study in this course of statistical mechanics is mainly classified in two categories, these are:

1- Classical statistics or Maxwell- Boltzmann statistics.

2- Quantum statistics or Bose-Einstein and Fermi- Dirac statistics.

We will begin with the fundaments of statistical physics and brief review of thermodynamics as an introduction of some important ideas which are fundamental in our understanding of statistical mechanics.

Student’s participation in on-line discussions (or other discussions)
is highly recommended. They will get credit for them on-line activities.

This is an introductory on Statistical Mechanics and Thermodynamics given to third year undergraduates.

12- **Student's obligation**

There will be classroom discussions and the lecture will give enough background to translate, solve, analyze, and evaluate problem sets, and different issues will discuss throughout the semester. Giving homework and quizzing them to provide

further challenge.

To get the best of the subjects, it's suggested that the students attend the classes as much as possible, listen to the teacher, understand the lectures, write notes, ask questions, and try to solve problems and exercises as much as possible.

.

13- **Forms Of Teaching**

Different forms of teaching will be used to reach the objectives:

Main form of teaching will be used to reach the objectives is power point. Power point will be used to present the head titles, main object, definitions, illustrate examples and exercises; also we'll use whiteboard for more illustration of difficult problems to the students.

14- Assessment scheme

The students are required to do at least three examinations besides some homework sets which have 40 marks. There will be a final examination on 60 marks.

15- **Student Learning Outcome:**

Statistical mechanics is one of the subjects which serve students in physics. To understand any branch in physics, students been to understand statistical mechanics first, specially the students who wants to complete his study for MSc and PhD in any field of physics.

16- **Course Reading list and References:**

The books for the course are:

- Fundamental university physics, part three, quantum and statistical physics, Alonso-Finn.
- An introduction to thermodynamics, the kinetic theory of gases, and statistical mechanics, Francis Weston sears.
- Introduction to statistical physics, A. J. Pointon.
- Thermal physics, Charles Kttel & Herbert Kromer.
- Statistical thermal physics, Reif.
- We based around these books. Students are encouraged to search for any other book references which contain material that may be helpful to understand the objects.

17- The Topics	**Lecture's Name**
Fundaments of statistical physics. Statistics.	

Fundaments of statistical physics. Statistics. Statistical mechanics science definition. Mean, median, and mode. Standard deviation and other measures of dispersion. andard deviation, variance, coefficient of variation, and andard error. actorial. ermutations and combinations. irling's approximation. Regression Probability distribution.	5 weeks
Brief review of thermodynamics. Thermal equilibrium. Thermodynamics. Thermodynamics laws. Kinetic theory of gases.	3 weeks
Statistical distribution laws. Basic approach in the three statistics. Phase Space, Energy levels and energy states, Microstates and macrostates Classical statistical mechanics. Maxwell-Boltzmann distribution. Applications of M.B. distribution. Some limitations of M-B distribution.	9 weeks
Quantum statistical mechanics. Bose-Einstein distribution. Fermi-Dirac distribution. Comparison of M-B, B-E, and F-D laws. An illustration example. Difference between classical and quantum mechanics.	9 weeks

Four examinations depending on time board. This syllabus may be subject to changes; i.e. we may take either longer or shorter time to finish the topics, if any changes happened we will be notified well in advance.	4 weeks
18-Practical Topics (if there is any)	

19- **Examinations:**

Monthly Examination Example

Answer all questions, 10 marks for each question, time: 1.5 hours.

Q1/ Write down the binomial probability formula, then identify each of the variables in this formula. A coin is tossed six times. Find the variance of the number of heads that will be obtained.

Q2/ A system of two energy levels with, n_1= 2, g_1= 2 and n_2= 1, g_2= 2. Using M.B distribution, find the number of ways in which the particles can be distributed, with diagram;

a- For each level. **b- For the system.**

Q3/ Show that the ratio of most probable velocity to mean velocity of gas molecules at a particular temperature is (1/1.128).

= 3.1416, $F_{BM} = N\,(m/2\pi KT)^{3/2}\, e^{-E/KT}\pi$

Useful integrals: If $I_n(\alpha) = \int_0^\infty u^n e^{-\alpha u^2}\, du$, $I_3(\alpha) = \frac{1}{2\alpha^2}$ and $I_4(\alpha) = \frac{3}{8}\sqrt{\frac{\pi}{\alpha^5}}$

20- Extra notes:

21-Peer Review

.