هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

# Course Specifications

| | |
|---|---|
| **Course Title**: | Statistical Physics |
| **Course Code**: | **353PHYS** |
| **Program**: | **Physics** |
| **Department**: | **Physics** |
| **College**: | **Science** |
| **Institution**: | **Jazan University** |

## Table of Contents

## A. Course Identification

| |
|---|
| **1. Credit hours:2** |
| **2. Course type**<br>**a.** University ☐ College ☐ Department ☑ Others ☐<br>**b.** Required ☑ Elective ☐ |
| **3. Level/year at which this course is offered: Level 2/ Year 3** |
| **4. Pre-requisites for this course** (if any)**: 222 PHYS** |
| **5. Co-requisites for this course** (if any)**: 301STAT** |

**6. Mode of Instruction** (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | **Traditional classroom** | **25** | **83%** |
| 2 | **Blended** | **5** | **17%** |
| 3 | **E-learning** | | |
| 4 | **Correspondence** | | |
| 5 | **Other** | | |

**7. Contact Hours** (based on academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1 | **Lecture** | **30** |
| 2 | **Laboratory/Studio** | |
| 3 | **Tutorial** | |
| 4 | **Others** (specify) | |
| | **Total** | **30** |

## B. Course Objectives and Learning Outcomes

### 1. Course Description

Statistical Physics is a probabilistic approach to equilibrium properties of systems with large number of degrees of freedom. Topics include: introduction to statistical methods, statistical description of systems of particles (Methodology of Statistical Mechanics), classical statistical mechanics, and quantum statistical mechanics ( Bose-Einstein and Fermi-Dirac Statistics).

### 2. Course Main Objective

**This course is designed to provide students with:**

- Introduction to statistical methods based on the probability theory.
- Statistical description of systems of particles
- Classical statistical ensembles (micro-canonical, canonical, grand canonical)
- Introduction to the quantum statistical mechanics

### 3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|---|---|---|
| 1 | **Knowledge and Understanding** | |
| 1.1 | **Describe** the statistical nature of concepts and laws in thermodynamics, | **PLO1.1** |
| 1.2 | **Define** statistical function, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems | **PLO1.1** |
| 1.3 | **Explain** the fundamental postulates of statistical mechanics | **PLO1.2** |
| 1... | | |
| **2** | **Skills :** | |
| 2.1 | **Calculate** statistical properties for systems such as gases, solids, photons or vibrations. | **PLO2.1** |
| 2.2 | **Compare** between statistical laws of classical particles, bosons and fermions | **PLO2.2** |
| 2.3 | **Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities | **PLO2.4** |
| **3** | **Values:** | |
| 3.1 | **Develop** skills of group working in group assignments and discussion and bear individual responsibility in the assigned tasks | **PLO3.1** |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1 | **Introduction to Statistical Physics** | **6** |
| 2 | **Statistical description of systems of particles (Methodology of Statistical Mechanics)** | **8** |
| 3 | **Classical Statistical Mechanics** | **8** |
| 4 | **Quantum Statistical Mechanics** | **6** |
| 5 | **Review** | **2** |
| **Total** | | **30** |

## D. Teaching and Assessment

### 1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge and Understanding** | | |
| 1.1 | **Describe** the statistical nature of concepts and laws in thermodynamics, | Lectures, discussion | **Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| 1.2 | **Define** statistical function, such as Boltzmann distribution, Gibbs distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems | Lectures, discussion | **Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| 1.3 | **Explain** the fundamental postulates of statistical mechanics | Lectures, | **Direct** (formative and |

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|---|---|---|---|
| | | discussion | summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| **2.0** | **Skills** | | |
| 2.1 | **Calculate** statistical properties for systems such as gases, solids, photons or vibrations. | Lectures, discussion | **Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| 2.2 | **Compare** between statistical laws of classical particles, bosons and fermions | Lectures, discussion | **Direct** (formative and summative): In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| 2.3 | **Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities | Discussion | **Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey |
| **3.0** | **Values** | | |
| 3.1 | **Develop** skills of working in groups in group assignments and discussion and bear individual responsibility in the assigned tasks | Discussion | **Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey |

**2. Assessment Tasks for Students**

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|---|---|---|
| 1 | **Homework assignment** | 2 | **2** (3%) |
| 2 | **Lecture Quiz 1** | 4 | **5** (5%) |
| 3 | **Homework assignment** | 4 | **2 (2%)** |
| 4 | **First Mid-term exam** | 6 | **15** (15%) |
| 5 | **Homework assignment** | 6 | **2** (3%) |
| 6 | **Homework assignment** | 8 | **2** (3%) |
| 7 | **Practical web based home work** | 10 | **5** (5%) |
| 8 | **Home work assignment** | 10 | **2 (2%)** |
| 9 | **Second mid-term exam** | 11 | **15** (15%) |
| 10 | **Final Exam** | 16 | **50** (50%) |

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

## E. Student Academic Counseling and Support

**Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :**

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

## F. Learning Resources and Facilities

### 1.Learning Resources

| | |
|---|---|
| **Required Textbooks** | Fundamentals of Statistical and Thermal Physics ; F. Reif, McGraw–Hill, 2002 |
| **Essential References Materials** | - Thermodynamics, Kinetic Theory and Statistical Thermodynamics; F.W. Sears and G. L Salinger, John Wiley& Sons, Inc., 1975.<br>- Introduction to Statistical Physics, W. G. Rosswe, Ellis Horwood, Ltd. 1982 |
| **Electronic Materials** | - http://www.wikipedia.org/<br>- http://www.hazemsakeek.com/ |
| **Other Learning Materials** | |

### 2. Facilities Required

| Item | Resources |
|---|---|
| **Accommodation** (Classrooms, laboratories, demonstration rooms/labs, etc.) | Class room |
| **Technology Resources** (AV, data show, Smart Board, software, etc.) | Blackboard |
| **Other Resources** (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | None |

## G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|---|---|
| Effectiveness of teaching | Students, Peer and program leader | Indirect (CES)- Indirect peer evaluation |
| Assessment | Students, Program assessment committee | Direct/ Indirect |
| Extent of achievement of course learning outcomes | Instructor | Direct/Indirect |
| Quality of learning resources | Students, Faculty members | Indirect |

**Evaluation areas** (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
**Evaluators** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
**Assessment Methods** (Direct, Indirect)

## H. Specification Approval Data

| | |
|---|---|
| **Council / Committee** | **Depaertment council** |
| **Reference No.** | **8** |
| **Date** | **1442/16** |