**Işık University**
**Faculty of Arts and Sciences**
**Department of Physics**

# PHYS 344 - Statistical and Thermal Physics

## COURSE SYLLABUS

| Course Name | Code | Semester | Theory (hour/week) | Application (hour/week) | Laboratory (hour/week) | Local Credits | ECTS |
|---|---|---|---|---|---|---|---|
| Statistical and Thermal Physics | PHYS 344 | Spring | 3 | 0 | 2 | 4 | 8 |

| | |
|---|---|
| **Prerequisities** | None |

| | |
|---|---|
| **Course Language** | English |
| **Course Type** | Required |
| **Course Level** | First Cycle |
| **Course Coordinator** | - |
| **Course Lecturer(s)** | - |
| **Course Assistants** | - |
| **Course Objectives** | Statistical and Thermal Physics is an introductory course which covers probability, statistical meshanics and thermodynamics of many-particle systems. By the end of the course, students should<br>• demonstrate a knowledge of the fundamental physical laws of statistical and thermal physics.<br>• apply the fundamental physical laws of statistical and thermal physics to a variety of practical problems.<br>• recognize how statistical and thermal physics is relevant to the world around them. |
| **Course Learning Outcomes** | On successful completion of this course students will be able to<br>1. distinguish between microscopic and macroscopic systems;<br>2. demonstrate knowledge of basic probabilistic description of macroscopic systems;<br>3. perform statistical analysis on simple systems such as the ideal gas to derive macroscopic general statements of thermodynamics;<br>4. recognize the interrelation between microscopic and macroscopic description of systems;<br>5. state the laws of classical thermodynamics, and apply them to simple problems;<br>6. elucidate the differences in the descriptions of systems consisting of distinguishable and indistinguishable particles;<br>7. discuss elementary concepts in non-equilibrium statistical mechanics. |
| **Course Content** | Introduction to basic probability concepts. Statistical description of systems of particles. Statistical thermodynamics. Macroscopic parameters and their measurement, Simple applications of macroscopic thermodynamics. Basic methods and results of statistical mechanics. Equilibrium between phases or chemical species. Quantum statistics of Ideal gasses. Systems of Interacting particles. Elementary Kinetic Theory of Transport Processes. |

## WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

| Week | Subject |
|---|---|
| **1** | Introduction to basic probability concepts |
| **2** | Statistical description of systems of particles |
| **3** | Statistical description of systems of particles |
| **4** | Statistical thermodynamics |
| **5** | Statistical thermodynamics |
| **6** | Macroscopic parameters and their measurement, Simple applications of macroscopic thermodynamics |
| **7** | Simple applications of macroscopic thermodynamics |
| **8** | Simple applications of macroscopic thermodynamics |
| **9** | Review |
| **10** | Basic methods and results of statistical mechanics |
| **11** | Simple applications of statistical mechanics |
| **12** | Equilibrium between phases or chemical species |
| **13** | Quantum statistics of Ideal gasses |
| **14** | Systems of Interacting particles |
| **15** | Elementary Kinetic Theory of Transport Processes |

## TEXTBOOKS

| | |
|---|---|
| **Required Textbook(s)** | Federick Reif, Fundementals of Statistical and Thermal Physics, McGraw-Hill International Edition, 1985. |
| **Recommended Readings** | • Kittel, C., Kroemer, H., *Thermal Physics, 2nd edition*, Freeman, New York 1980.<br>• Feynman, R.P., Leighton, R.B., Sands, M. *The Feynman Lectures on Physics, Volume I*, Addison Wesley, 1977. |

**EVALUATION SYSTEM**

| **Semester Requirements** | **Number** | **Percentage of Grade** |
|---|---|---|
| Attendance/Participation | - | - |
| Laboratory | - | - |
| Application | - | - |
| Field Work | - | - |
| Special Course Internship (Work Placement) | - | - |
| Quizzes/Studio Critics | 5 | 10 |
| Homework Assignments | 10 | 15 |
| Presentation/Jury | - | - |
| Project | - | - |
| Seminar/Workshop | - | - |
| Midterms/Oral Exams | 2 | 50 |
| Final/Oral Exam | 1 | 25 |
| **Total** | 16 | 100 |

| | | |
|---|---|---|
| Percentage of Semester Work | 15 | 75 |
| Percentage of Final Work | 1 | 25 |
| **Total** | 16 | 100 |

**COURSE CATEGORY**

| ISCED GENERAL FIELD CODE | GENERAL FIELDS | ISCED MAIN AREA CODE | MAIN EDUCATIONAL AREAS | % |
|---|---|---|---|---|
| 1 | Eğitim | 14 | Öğretmen Yetiştirme ve Eğitim Bilimleri | 0 |
| 2 | Beşeri Bilimler ve Sanat | 21 | Sanat | 0 |
| 2 | Beşeri Bilimler ve Sanat | 22 | Beşeri Bilimler | 0 |
| 3 | Sosyal Bilimler, İşletme ve Hukuk | 31 | Sosyal ve Davranış Bilimleri | 0 |
| 3 | Sosyal Bilimler, İşletme ve Hukuk | 32 | Gazetecilik ve Enformasyon | 0 |
| 3 | Sosyal Bilimler, İşletme ve Hukuk | 38 | Hukuk | 0 |
| 4 | Bilim | 42 | Yaşam Bilimleri | 0 |
| **4** | **Bilim** | **44** | **Doğa Bilimleri** | **70** |
| **4** | **Bilim** | **46** | **Matematik ve İstatistik** | **20** |
| 4 | Bilim | 48 | Bilgisayar | 0 |
| **5** | **Mühendislik, Üretim ve İnşaat** | **52** | **Mühendislik** | **10** |
| 5 | Mühendislik, Üretim ve İnşaat | 54 | Üretim ve İşleme | 0 |
| 5 | Mühendislik, Üretim ve İnşaat | 58 | Mimarlık ve Yapı | 0 |
| 6 | Tarım | 62 | Tarım, Ormancılık, Hayvancılık ve Su Ürünleri | 0 |
| 6 | Tarım | 64 | Veterinerlik | 0 |
| 7 | Sağlık ve Refah | 72 | Sağlık | 0 |
| 7 | Sağlık ve Refah | 76 | Sosyal Hizmetler | 0 |
| 8 | Hizmet | 81 | Kişisel Hizmetler | 0 |
| 8 | Hizmet | 84 | Ulaştırma Hizmetleri | 0 |
| 8 | Hizmet | 85 | Çevre Koruma | 0 |
| 8 | Hizmet | 86 | Güvenlik Hizmetleri | 0 |

**THE RELATIONSHIP BETWEEN COURSE LEARNING OUTCOMES AND PROGRAM OUTCOMES**

| Number | Program Outcomes | Level of Contribution* | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | To have a comprehension of the core areas of physics, including classical and quantum mechanics, electromagnetism, statistical and thermal physics. | | | | | X |
| 2 | To have a comprehension of basic mathematics, including differential and integral calculus, linear algebra, differential equations and complex analysis. | | | | | X |
| 3 | To have a comprehension of computer programming and chemistry. | | | | | |
| 4 | To have a comprehension of the importance and practice of good ethical standards. | X | | | | |
| 5 | To have a recognition of contemporary issues in science and its applications. | | | | | X |
| 6 | To have an ability to construct theoretical models, solve problems, design and conduct experiments, as well as to analyze and interpret data. | | | | | X |
| 7 | To have an ability to demonstrate their understanding of at least one advanced topic in theoretical or experimental physics. | | | | | X |
| 8 | To have an ability to function on multi-disciplinary teams | | | | | |
| 9 | To have an ability to effectively communicate information in both written and verbal form | | X | | | |
| 10 | To have a recognition of the need for and an ability to engage in life-long learning. | | | X | | |
| 11 | To have an ability to use modern physics techniques, skills, and computing tools necessary for physics practice ( use laboratory and workshop equipment to generate data, prepare technical drawings, prepare technical reports, give technical presentations, take notes effectively, write computer programs, use mathematics and/or computational tools and packages to make models) . | | | | | X |

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest

| | |
|---|---|
| **Contribution of Course Learning Outcomes to Program Outcomes** | The class contributes to the student development in terms of building a sound foundation of statistical and thermal physics for further study in physics. Students should develop problem solving abilities and enhance critical thinking and improve their written communication skills. |

**ECTS / WORKLOAD TABLE**

| **Activities** | **Number** | **Duration (Hour)** | **Workload (Hour)** |
|---|---|---|---|
| Course Hours (Including Exam Week: 16 x Total Hours) | 15 | 3 | 45 |
| Laboratory | - | - | - |
| Application | - | - | - |
| Special Course Internship (Work Placement) | - | - | - |
| Field Work | - | - | - |
| Study Hours Out of Class | 15 | 4 | 60 |
| Presentations / Seminar | - | - | - |
| Project | - | - | - |
| Homework Assignments | 10 | 5 | 50 |
| Quizzes | 5 | 2 | 10 |
| Midterms / Oral Exams | 2 | 10 | 20 |
| Final / Oral Exam | 1 | 15 | 15 |
| | | **Total Workload** | **200** |
| | | **Total Workload/25** | **8** |