**OSTIM TECHNICAL UNIVERSITY**
**FACULTY OF ENGINEERING**
**COURSE SYLLABUS FORM**
**2022-2023**

| Course Name | Course Code | Period | Hour | Apllication Hour | Lab Hour | Credit | ECTS |
|---|---|---|---|---|---|---|---|
| Modern Physics | EEE205 | Fall | 3 | 0 | 0 | 3 | 3 |

| | |
|---|---|
| **Prerequisite** | Calculus, algebra, trigonometry, complex numbers, classical mechanics, electricity and magnetism |
| **Language of Instruction** | English |
| **Course Status** | Compulsory |
| **Course Level** | Undergraduate |
| **Method of Teaching** | In class lectures, with home textbook reading |
| **Learning and Teaching Techniques of the Course** | Lectures, Homeworks, Quizzes, Textbook Reading |

## Course Objective

The aim of the course is to introduce the students to the electromagnetic waves based on the Maxwell equations for develop conceptual understanding of waves, learning the relevant mathematics, pursuing advanced studies in engineering, the ability to reason, and gain skills for problem solving.

## Learning Outcomes

Upon successful completion, students will have the knowledge and skills to:

| | |
|---|---|
| **1** | Understand basic concepts of special relativity, quantum mechanics, quantum theory of atoms, molecules, solids, metals and semiconductors, elementary particles and cosmology |
| **2** | Understand basic mathematical tools used in the elementary presentation of Modern Physics |
| **3** | Understand basic experiments, which stimulated the development of major concepts of Modern Physics from the earlier days until the latest achievements. |
| **4** | Formulate, analyze, and solve typical problems in the general course of Modern Physics |

## Course Outline

This course is an introduction to Modern Physics that covers special relativity, quantum mechanics, quantum theory of atoms, molecules and solids, metals and semiconductors, basics of electronic devices, lasers and superconductivity, elementary particles and cosmology. The course presents basic knowledge in these areas concening experimental facts, their interpretaions, historical development of theoretical concepts, and minimal mathematical tools needed for the discussion of these concepts.

| Weekly Topics and Related Preparation Studies | | |
|---|---|---|
| **Weeks** | **Topics** | **Preparation Studies** |
| 1 | Light Waves, Interference | [1], Ch. 35 |
| 2 | Diffraction, Polarization | [1], Ch. 36 |
| 3 | Special Relativity | [1], Ch. 37 |
| 4 | Quantum Mechanics: Origin | [1], Ch. 38 |
| 5 | Quantum Mechanics: Basic Laws | [1], Ch. 39 |
| 6 | Quantum Mechanics: Equations | [1], Ch. 39 |
| 7 | Quantum Mechanics: Atoms | [1], Ch. 40 |
| 8 | Midterm | |
| 9 | Molecules and Solids - I: Bonding and Molecules | [1], Ch. 41 |
| 10 | Molecules and Solids – II: Bonding and Solids | [1], Ch. 41 |
| 11 | Electrons in Solids: Metals and Semiconductors | [4], Ch. 16, 17 |
| 12 | Semiconductor Devices | [4], Ch. 18 |
| 13 | Nuclear Physics | [1], Ch. 42 |
| 14 | Nuclear Energy | [1], Ch. 43 |
| 15 | Particles and Cosmology | [1], Ch. 44,45 |
| 16 | Final Exam | |

## Textbook(s)/References/Materials:

**Textbook:**

[1] D. C. Giancoli, *Physics for Scientists and Engineers with Modern Physics*, 4th Ed., Prentice Hall, 2009

**References:**

[2] R. A. Serway and J. W. Jewett, Jr., *Physics for Scientists and Engineers with Modern Physics*, 9th Ed., 2014

[3] D. Halliday and R. Resnick, *Fundamentals of Physics*, 10th Ed. Extended, Editor J. Walker, Wiley, 2018

[4] S. H. Simon, *The Oxford Solid-State Basics*, 1st Ed., 2013 (some sections)

| Assessment | | |
|---|---|---|
| **Studies** | **Number** | **Contribution margin (%)** |
| Active Participation | | 5 |
| Lab | | |
| Application | | |
| Field Study | | |
| Course-Specific Internship (if any) | | |
| Quizzes / Studio / Critical | 5 | 15 |
| Homework | 5 | 25 |
| Presentation | | |
| Projects | | |
| Report | | |

| | | |
|---|---|---|
| Seminar | | |
| Midterm Exams / Midterm Jury | 1 | 25 |
| General Exam / Final Jury | 1 | 30 |
| | **Total** | **100** |
| **Success Grade Contribution of Semester Studies** | | 70 |
| **Success Grade Contribution of End of Term** | | 30 |
| | **Total** | **100** |

| **Course Category** | |
|---|---|
| Basic Vocational Courses | x |
| Specialization/Field Courses | |
| Support Courses | |
| Communication and Management Skills Courses | |
| Transferable Skills Courses | |

**Relationship Between Course Learning Outcomes and Program Competencies**

| No | Learning Outcomes | Contribution Level | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | Ability to apply knowledge of mathematics, science, and engineering | | | | | x |
| 2 | Ability to design and conduct experiments and to analyze and interpret experimental results. | | | | | |
| 3 | Ability to design a system, component, and process according to specified requirements. | | | | x | |
| 4 | Ability to work in teams in interdisciplinary areas. | | | | | |
| 5 | Ability to identify, formulate and solve engineering problems. | | | | x | |
| 6 | Identifies, defines, formulates and solves elementary problems of modern physics; chooses and applies analysis and modeling methods suitable for this purpose. | | | | | x |
| 7 | Develops, selects and uses appropriate techniques and tools necessary for the analysis and solution of physical problems encountered in Electrical and Electronics Engineering applications; uses required technologies effectively. | | | | x | |

**ECTS / Workload Table**

| Activities | Number | Duration (Hours) | Total Workload |
|---|---|---|---|
| Course hours (Including the exam week: 16 x total course hours) | 16 | 3 | 48 |
| Laboratory | | | |
| Application | | | |
| Course-Specific Internship | | | |
| Field Study | | | |
| Study Time Out of Class | 14 | 1 | 14 |
| Presentation / Seminar Preparation | | | |
| Projects | | | |
| Reports | | | |
| Homeworks | 5 | 1 | 5 |
| Quizzes / Studio Review (during the lectures) | 5 | - | - |
| Preparation Time for Midterm Exams / Midterm Jury | 1 | 5 | 5 |
| Preparation Period for the Final Exam / General Jury | 1 | 5 | 5 |
| **Total Workload** | **ECTS 77/25 = 3.08** | | |