## A) COURSE

| Course Id: | Course |
|---|---|
| 0064 | PHYSICS D |

| Class Hours per Week | Lab hours per week | Complementary practices | Credits | Total hour course |
|---|---|---|---|---|
| 2 | 2 | 2 | 6 | 64 |

## B) GENERAL COURSE INFORMATION

| | EE (IEA) | ME (IM) | MME (IMA) | EME (IME) | MTE (IMT) |
|---|---|---|---|---|---|
| **Level:** | II | II | II | | II |
| **Course Type (Required/Elective)** | Elective | Elective | Elective | | Elective |
| **Prerequisite Course:** | PHYSICS A | PHYSICS A | PHYSICS A | | PHYSICS A |
| **CACEI Classification:** | CB | CB | CB | | CB |

## C) COURSE OBJECTIVE

| At the end of the course, the student will be capable of: |
|---|
| After completing the course the student will get the foundations of wave mechanics and quantum mechanics which will lead to better understanding of the physics of the micro world and all the modern instrumental because it bases its operation on the quantum laws of the universe, allowing also access advanced courses related to these topics. |

## D) TOPICS (CONTENTS AND METHODOLOGY)

| 1.- WAVE MOTION | |
|---|---|
| Specific Objective: | Students will learn quantitatively and qualitatively, the different types of waves and their properties and relations math. In this first unit presents the wave equation in a general way as well as the Doppler effect. |
| 1.1 Types of waves.<br>1.2 Mechanical waves.<br>1.3 Speed of a wave.<br>1.4 Wave equation.<br>1.5 Superposition Principle.<br>1.6. Interference waves.<br>1.7 Sound Doppler Effect. | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

| 2.- NATURE OF LIGHT AND SPREAD OF LIGHT | |
|---|---|
| Specific Objective: | The student will know that visible light is only a small portion of the electromagnetic spectrum and behaves entirely as a wave (conventional treatment), except that it requires a continuous medium for transportation. |
| 2.1 Visible light<br>2.2 The speed of the light<br>2.3 The electromagnetic spectrum<br>2.4 The special theory of relativity<br>2.4.1 The problems of classical physics<br>2.4.2 The postulates of special relativity<br>2.4.3 Consequences of the postulates of Einstein<br>2.4.4 The Lorentz transformation<br>2.4.5 Measurement of the space-time coordinates in a event<br>2.4.6 Transformation of the speeds<br>2.4.7 Consequences of the Lorentz transformation<br>2.4.8 Relativistic momentum and energy.<br>2.5 The Doppler Effect of Light | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

| 3.- GEOMETRICAL OPTICS AND WAVE | |
|---|---|
| Specific Objective: | The student will know the other side of the light when treated as lightning, ending finally with all the wave properties and realize perfectly the difference between geometrical optics and wave in the classical treatment. |
| 3.1 Reflection<br>3.2 Refraction<br>3.3 Creating Images in plane mirrors<br>3.4 Creating Images in Spherical Mirrors<br>3.5 Thin Lenses<br>3.6 Interferences<br>3.7 Diffraction<br>3.8 Diffraction Gratings<br>3.9 X-ray Diffraction<br>3.10 Polarization<br>3.10.1 Polarization by transmission<br>3.10.2 Polarization by reflection<br>3.10.3 Circular Polarization | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

| 4.- LIGHT AND QUANTUM PHYSICS | |
|---|---|
| Specific Objective: | The student will know the different experiments in the last century and early this for which classical physics has no answer. These same experiments led to the conception quantum nature. |

| | |
|---|---|
| 4.1 Thermal Radiation<br>4.2 Planck Radiation Law<br>4.3 Quantification of Energy<br>4.4 Photoelectric Effect<br>4.5 Compton Effect<br>4.6 Line Spectra | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

| 5.- WAVE BEHAVIOR OF MATTER | |
|---|---|
| Specific Objective: | As the light has particle behavior, the matter has wavelike behavior. At the end of the unit the student will understand the dual nature of matter. Besides understanding the basic concepts of quantum mechanics. |
| 5.1 Broglie Wavelength<br>5.2 Waves<br>5.3 Wave packets<br>5.4 Particles<br>5.5 Relations Heisenberg Uncertainty<br>5.6 The wave function<br>5.7 Free Particle<br>5.8 Potential Well<br>5.9 Tunnel effect<br>5.10 Simple Harmonic Oscillator<br>5.11 The Rutherford Atom<br>5.12 The Bohr Atom<br>5.13 The hydrogen atom and the equation Schrödinger<br>5.14 Hydrogen Atom States<br>5.15 Atomic Structure<br>5.16 The Periodic Table<br>5.17 The Lasers<br>5.18 The Laser Light<br>5.19 How does a laser work? | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

| 6.- STATISTICAL DISTRIBUTIONS AND AVERAGE VALUES | |
|---|---|
| Specific Objective: | The student will have knowledge of the statistical treatment of physical phenomena from the standpoint of classical and quantum, and will see it is possible to reach the concepts of temperature, pressure, etc. using the statistical interpretation of microscopic systems. |
| 6.1 Mean free path<br>6.2 The distribution of velocities<br>6.3 The Distribution of Energy<br>6.4 Brownian Motion<br>6.5 Quantum Distributions | |
| **Readings and other resources** | Readings to investigation of concepts, as well as to complement and strengthen the topics discussed in class. |

| | |
|---|---|
| **Teaching methods** | Exhibition topics by teacher and / or students; use of some didactic techniques like teamwork, learning based in problems and/or projects. |
| **Learning activities** | Exercise class and homework, as well as them respective interpretation of results. |

**E) TEACHING AND LEARNING METHODOLOGIES**

The course will be organized around three sessions presentations by the teacher, and two sessions for discussion and solution of problems. It also frees the teacher to use new technology techniques to strengthen and increase learning.

**F) EVALUATION CRITERIA**

Evaluation according to the institutional rules must include four departmental exam, so the course evaluation will be as follows:

| | |
|---|---|
| Exams | 80% |
| Tasks or research | 10% |
| Participation | 10% |

Note:
In order for the course grade, the student must pass the theory course and must have accredited laboratory course (mandatory).

**G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES**

**Main Books:**


- Resnick/Halliday/Krane
  Física tomo I.II CECSA MÉXICO 1994

- Serway A. Raymond
  Física tomo I.II
  McGrau-Hill 2a. Edición México 1993

- Gettys, W.E., Keller, F. J, Skove, M. J.
  Física, Clasica y moderna
  Mc Graw – Hill, primera edición, Madrid, 1991.

- Acosta Virgilio, Cowan, Clyde L. Graham. B.J.
  Curso de física moderna
  Harla. México, 1975

- Goldemberg, José
  Física general y experimental, volumen 3,
  Interamericana, México, 1974


**Complementary Books:**