# AYDIN ADNAN MENDERES UNIVERSITY
## COURSE INFORMATION FORM

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|---|---|---|---|---|---|---|---|
| Course Title | Nonlinear Vibrations and Waves | | | | | | |
| Course Code | FİZ434 | | Couse Level | First Cycle (Bachelor's Degree) | | | |
| ECTS Credit | 7 | Workload | 180 *(Hours)* | Theory | 3 | Practice | 0 | Laboratory | 0 |
| Objectives of the Course | To understand nonlinear vibrations and waves and relations with nature also understand the difference of waves which propogate in linear and nonlinear medium. | | | | | | |
| Course Content | To teach the properties of nonlinear and linear vibrations and waves. Also apply them on natural events. | | | | | | |
| Work Placement | N/A | | | | | | |
| Planned Learning Activities and Teaching Methods | | | Explanation (Presentation), Discussion | | | | |
| Name of Lecturer(s) | | | | | | | |

## Assessment Methods and Criteria

| Method | Quantity | Percentage (%) |
|---|---|---|
| Midterm Examination | 1 | 30 |
| Final Examination | 1 | 70 |
| Quiz | 2 | 10 |

## Recommended or Required Reading

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|---|---|
| 1 | Waves (Berkeley) S. Frank , Jr.Crowford |

## Weekly Detailed Course Contents

| Week | Weekly Detailed Course Contents | |
|---|---|---|
| 1 | Theoretical | The difference between linear and nonlinear vibrations and their equations |
| 2 | Theoretical | The difference between linear and nonlinear solutions of equations |
| 3 | Theoretical | modes of coupled linear and nonlinear vibrations |
| 4 | Theoretical | reasons of changing in frequancy of modes and the meaning of them. |
| 5 | Theoretical | nonlinear modes and principle of superposition |
| 6 | Theoretical | examples of wave equations in linear mediums, their properties and solutions. |
| 7 | Theoretical | Wave equation nonlinear mediums and their difference from in which linear mediums. |
| 8 | Intermediate Exam | Midterm |
| 9 | Theoretical | To introduce with simple nonlinear wave equations |
| 10 | Theoretical | discussion on solutions of nonlinear wave equations |
| 11 | Theoretical | some applications of nonlinear wave equations in physics |
| 12 | Theoretical | The reasons of interactions with modes while nonlinear waves propogates. |
| 13 | Theoretical | investigation of nonlinear waves in traffic |
| 15 | Theoretical | The investigation of linear waves in conduction loops |

## Workload Calculation

| Activity | Quantity | Preparation | Duration | Total Workload |
|---|---|---|---|---|
| Lecture - Theory | 14 | 8 | 2 | 140 |
| Assignment | 1 | 5 | 2 | 7 |
| Quiz | 3 | 2 | 1 | 9 |
| Midterm Examination | 1 | 10 | 2 | 12 |
| Final Examination | 1 | 10 | 2 | 12 |
| | | | Total Workload (Hours) | 180 |
| | | | [Total Workload (Hours) / 25*] = **ECTS** | 7 |

*25 hour workload is accepted as 1 ECTS

## Learning Outcomes

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|---|---|
| 1 | It should be said and writen that linear and nonlinear vibrations and their properties. |
| 2 | It should be said how the nonlinear differantial equations can be solved and can be used any method for solution. |
| 3 | students should obtain the difference between the solutions of linear and nonlinear coupled systems and modes, |

| 4 | students should relate modes and waves of many body linear and nonlinear coupled systems |
|---|---|
| 5 | To be able to establishe a relation betweeen the modes and waves of lineer and nonlineer coupled systems with many particles. |
| 6 | To be able to write linear and nonlinear wave equations and show distinctions between them. |
| 7 | To be able to show the differences in the prepagation of linear and nonlinear waves and express how these differences mathematically change with the amplitudes of the waves. |
| 8 | To be able to say why the modes interact each other in nonlinear waves and to express the facts result in this interaction. |

**Programme Outcomes** *(Physics)*

| 1 | To understand the importance of physics by understanding the general concepts of physics, matter and energy |
|---|---|
| 2 | To be able to define the movements of matter and to distinguish the characteristics of movements under different force (potential) |
| 3 | Be able to say the meaning of Lagrange and Hamiltonian formulations of the movement and apply them to simple problems, |
| 4 | To be able to express the fundamental concepts such as time, space, force, momentum and energy in the movements of matter close to the speed of light and be able to solve and interpret the simple problems related to |
| 5 | To be able to establish the relationship between electric and magnetic forces and to be able to illustrate their applications to technology and solve problems related to the movement of particles in electric and magnetic fields |
| 6 | Be able to say the basic laws of electromagnetics and apply them to problems, illustrate their applications to simple technology |
| 7 | To be able to tell the reasons of the differences between the classical cases and the quantum scale and explain the reasons |
| 8 | Explain the concepts of discontinuity, uncertainty, matter-antimatter, indecisiveness of quantum physics with examples and explain simple problems related to the subject. |
| 9 | To be able to solve the problems of micro-particles under different simple potentials and be able to say their meanings |
| 10 | To be able to establish the relationship between the movements and properties of multi-particle systems and the laws of probability and solve simple problems |
| 11 | To be able to illustrate the laws, meanings and applications of thermodynamics and use them |
| 12 | Be able to use their knowledge about quantum physics and mechanics in explaining some properties of atoms and nuclei |
| 13 | To be able to show the meanings of some theoretical concepts by experimenting, and develop a strong relationship between thought and the real world, develop analytical thinking |
| 14 | To be able to apply the meanings of the basic laws of physics, their comprehension of universality and the relations between them and the unity of the laws of nature. |
| 15 | Use computer to solve physics problems |
| 16 | To be able to understand the problems by using their analytical knowledge skills and to propose solutions by dealing with the laws of physics |
| 17 | Be able to use the knowledge of physics to understand new technologies |
| 18 | To be able to tell the relations between symmetry and conservation laws in laws of physics |

**Contribution of Learning Outcomes to Programme Outcomes** *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

|     | L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 |
|-----|----|----|----|----|----|----|----|----|
| P1  |    |    |    |    |    | 4  | 3  |    |
| P2  |    |    | 4  | 4  |    | 4  | 5  | 4  |
| P4  |    |    | 4  |    |    |    |    |    |
| P5  |    |    |    |    |    |    |    | 4  |
| P6  |    |    |    |    |    |    |    | 4  |
| P11 |    |    |    |    |    |    |    | 4  |
| P13 |    |    |    |    | 4  |    | 4  |    |
| P14 |    | 4  |    |    | 4  |    |    |    |
| P16 |    |    |    |    |    |    |    | 4  |
| P17 | 4  | 3  |    |    |    |    |    | 4  |