AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Nonlinear Dynamical Systems								
Course Code	FİZ433			Couse Level		First Cycle (Bachelor's Degree)			
ECTS Credit	7	Workload	179 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course									
Course Content									
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	40
Final Examination	1	70

Recommended or Required Reading	
1	F. Verhulst, Non-linear Differential Equations and Dynamical Systems , Springer - Verlag, 1989.
2	Differential Equations, Dynamical Equations and Linear Algebra, M.W. Hirsch and S. Smale
3	Dynamical Systems with Applications using Mathematica. Stephen Lynch.
4	Invitation to Dynamical Systems. Edward R. Scheinerman

Week	Weekly Detailed Course Contents	
1	Theoretical	Linear theory of dynamic systems: Basic solutions, Autonomous linear systems and Phase portraits, critical points and stability
2	Theoretical	Nonlinear Dynamic systems: Autonomous nonlinear systems and Phase portraits, orbits and critical points
3	Theoretical	Linearization of nonlinear systems around critical point
4	Theoretical	Stability of linearization, asymptotic stability of solution, instability of periodic solutions
5	Theoretical	Periodic solutions, stability of periodic solutions, Hamiltonian systems and systems with first integrals
6	Theoretical	Conservative force fields and elliptical orbits, Hamiltonian mechanics, Volterra-Lotka hunting equations
7	Theoretical	Liapunov functions
8	Theoretical	Liapunov stability analysis
9	Intermediate Exam	Midterm Exam
10	Theoretical	ntroduction to irregularity theory, Poincare propagation theorem
11	Theoretical	Branching theory, central manifolds
12	Theoretical	Branching of critical points and Hopf branching
13	Theoretical	Chaos, Lorenz equations
14	Theoretical	One dimensional chaos
15	Theoretical	Lyapunov coefficients

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	8	3	154
Midterm Examination	1	10	2	12

Final Examination	1	10	3	13
			Total Workload (Hours)	179
			[Total Workload (Hours) / 25*] = **ECTS**	7
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	To be able to obtain and classify the critical points of dynamic systems
2	To be able to analyze the stability of nonlinear dynamic systems using linearization and Liapunov functions
3	To be able to analyze the applications of applied mathematics or problems in different fields by using techniques of dynamic systems
4	Be able to identify and classify non-linear differential equations
5	To be able to determine approximate solutions of nonlinear differential equations using perturbation techniques.

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
P1	4	3	3	4	3
P2		3			
P3	4		4		
P4				2	