AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Introduction to Nonlinear Physics								
Course Code	FİZ329		Couse Level	First Cycle (Bachelor's Degree)					
ECTS Credit	6	Workload	148 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	To present the need for nonlineer equations as explaining phenomenons in physics and present the difference in physical meaning and solutions between linear and nonlinear differential equations								
Course Content	Constructing, solving and learning the physical meaning of solutions of basic differential equations in physics.								
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	
1	Differantial Equations,,Shepley L.Ross,
2	NonlinearDynamics and Chaos,S.H.Strogatz
3	3. Introduction to Nonlinear Dynamics and Chaos,www.cns.gatech.edu/~roman/phys4267/index.html

Week	Weekly Detailed Course Contents	
1	Theoretical	The classification of differential equations as lineer and nonlinear ones, presenting the difference between their physical meanings and solution methods.
2	Theoretical	Introduction to geometric solutions of nonlinear equations.
3	Theoretical	Raching the equilibrium points and stable and unstable equilibrium points of 1st order nonlinear differential equations and discusing physical meanings of those.
4	Theoretical	Introduction to variation of equilibrium(constant) points of 1st order nonlineer differential equations with respect to parameter and bifurcation concept; discussion of the meaning of those.
5	Theoretical	The classification of bifurcation in 1st order nonlineer differential equations and normal forms.
6	Theoretical	The representation of second order lineer differential equations as two 1st order equation and classification of equilibrium points.
7	Theoretical	The representation of second order non-lineer differential equations as two 1st order equation and classification of equilibrium points.
8	Intermediate Exam	Midterm
9	Theoretical	Jacobi matrix and determination of stability of equilibrium points.,
10	Theoretical	The variatiof of stability of equilibrium points with respect to parameter in 2nd order nonlineer differential equations and bifurcation.
11	Theoretical	New bifurcation and limit cycle in 2nd order nonlineer differential equations.
12	Theoretical	The investigation of the conditions of being limit cycle of periodic vbrations in 2nd order nonlineer differential equations.
13	Theoretical	The conditions of global stability in nonlineer differential equations and indice theory
14	Theoretical	Examples in nonlineer systems and the investigation of the phase spece.
15	Theoretical	Introduction to solution of nonlineer differential equations with perturbation method.

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	3	3	84
Quiz	2	5	1	12
Midterm Examination	1	18	2	20

Final Examination	1	30	2	32
			Total Workload (Hours)	148
			[Total Workload (Hours) / 25*] = **ECTS**	6
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	. Must classify differential equations as linear and nonlinear equations, present the difference between the basic solution methods of above ones and present the physical meanings of them.
2	Must solve first order nonlinear differential equations geometrically and reach the constant, stable and unstable points.
3	Must classify the bifurcation of first order nonlinear differential equations and present their normal forms.
4	Must classify the static points of second order linear differential equations and must give examples.
5	. Must classify the static points of second order linear differential equations and must give examples.
6	Must write the Jacobi matrix of systems and must determine the stability of stable points using it.
7	Must solve some kind of nonlinear differential equations by using simple perturbation methods.

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
P1			4			3	
P2	3			3	3		
P3							3
P13		2					
P14		3	4			3	
P15				3			4
P16	4			3	3		