AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Special Functions in Physics								
Course Code	FİZ328		Couse Level	First Cycle (Bachelor's Degree)					
ECTS Credit	6	Workload	151 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	Learning special functions and investigating the physical applications of them.								
Course Content	Integral transforms, Laplace transform, applications of special functions in physics								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation)								
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	Mathematical Methods in The Physical Sciences, Yazarı: Mary L. Boas
2	Mathematical Methods for Physicists, Yazarı: George B. Arfken
3	Special Functions and Their Applications, Yazarı: N. N. Lebedev
4	Special Functions, Yazarı: Nico M. Temme

Week	Weekly Detailed Course Contents	
1	Theoretical	Gama, beta and error functions
2	Theoretical	Asymptotic Series
3	Theoretical	Stirring formula.
4	Theoretical	Elliptic integrals and functions.
5	Theoretical	Partial differential equations (PDE) in physics and separation of variables.
6	Theoretical	Solutions of differential equations by power series methods.
7	Theoretical	Frobenius method
8	Intermediate Exam	MIDTERM EXAM
9	Theoretical	Legendre functions
10	Theoretical	Associated Legendre functions.
11	Theoretical	Bessel functions.
12	Theoretical	Spherical harmonics
13	Theoretical	Laguerre functions.
14	Theoretical	Hermite functions
15	Theoretical	Dirac Delta functions
16	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	4	3	98
Quiz	2	2	1	6
Midterm Examination	1	21	2	23
Final Examination	1	22	2	24
			Total Workload (Hours)	151
			[Total Workload (Hours) / 25*] = **ECTS**	6
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	The students should be able to define gamma, beta, and error functions
2	In Physics, the students should be able to use the separation of variable methods in order to obtain the solution of some important PDE
3	The students should be able to apply the power series method to ODE
4	The students should be able to solve Legendre differential equation and obtain the Legendre polynomials. Properties of Legendre polynomials can be used
5	The students should be able to solve Bessel differential equation and obtain the Bessel functions. Properties of Bessel functions can be used.
6	Solutions of the radial Schrodinger equation in 3D for a free particle should be able to describe by Bessel functions.
7	The students should be able to say that wave functions of the harmonic oscillator can be described by Hermite polynomials.
8	For spherical symmetric potentials, The students should be able say that angular part of wave functions can be given by spherical harmonic functions.
9	In quantum mechanics, relationships between the angular momentum operators and spherical harmonic functions should be able to express.
10	The relationship between the spherical harmonic functions and orbitals should be able to express.
11	The relationship between the hydrogen atom and Laguerre polynomials should be able to express.
12	Dirac delta function should be able to defined and used in physical problems.

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	L9	L10	L11	L12
P1	3	2	2	2	2	3	4	5	3	2	4	4
P2	3	3	3	2	3	3	4	5	4	4	4	4
P3	3	3	3	2	2	1	4	5	4	4	3	2
P4	3	2	2	2	1	1	1	5	1	1	2	3
P5	3	2	2	4	1	1	1	1	1	1	3	4
P6	3	3	3	3	1	1	1	4	1	1	2	4
P7	3	2	2	2	2	3	3	2	5	4	4	2
P8	3	3	3	1	1	2	2	5	2	2	2	2
P9	3	4	4	3	3	3	3	2	2	4	3	2

P10	4	3	3	2	2	2	1	1	5	3	2	2
P11	5	4	2	1	1	1	1	5	1	1	1	2
P12	3	2	4	4	5	5	5	1	5	5	5	2
P13	2	1	1	1	5	1	2	2	2	1	3	1
P14	2	4	4	3	1	2	3	1	4	3	5	3
P15	1	2	2	1	2	1	1	1	1	3	2	1
P16	1	1	1	1	1	1	2	1	1	1	2	1
P17	1	1	1	1	1	1	1	2	1	1	2	1
P18	2	1	1	3	1	3	3	4	4	4	4	3