Işık University
Faculty of Arts and Sciences
Department of Physics

PHYS 334 - Quantum Mechanics II

COURSE SYLLABUS

Course Name	Code	Semester	Theory (hour/week)	Application (hour/week)	Laboratory (hour/week)	Local Credits	ECTS
Quantum Mechanics II	PHYS 334	Spring	3	0	2	4	8

Prerequisities	PHYS 333

Course Language	English
Course Type	Required
Course Level	First Cycle
Course Coordinator	-
Course Lecturer(s)	-
Course Assistants	-
Course Objectives	This is the second part of a two-semester long course that continuous to cover the basic principles of quantum mechanics and introduces special approximation schemes to deal with realistic problems. By the end of the course, students should • demonstrate an understanding of the concept of spin for the elementary particles in physics. • recognize how the fundamental laws of quantum mechanics together with special approximation methods can be applied to various realistic problems. • develop an understanding of how quantum mechanics can be applied to anlyze the scattering of elementary particles. • discuss how quantum mechanics, which was devoloped in thefirst part of the 20th century, is relevant to the world around them.
Course Learning Outcomes	On successful completion of this course students will be able to 1. visualize the concept of spin and discuss spin-spin and spin-orbit interactions. 2. recognize and apply special approximation techniques such as the perturbation theory, the WKB approximation, the variational principle to solve realistic problems. 3. analyze the behavior of many-particle systems and develope an understanding of the concept of identical particles. 4. establish a connection between the atomic structure of the chemical elements and the theory of quantum mechanics. 5. make a distinction between classical and quantum mechanical scattering of particles. 6. develop an understanding of the basic concepts of quantum computing .
Course Content	Spin and angular momentum, time-independent perturbation theory, time-dependent perturbation theory, many particle systems, scattering theory, variational principle, WKB approximation, basics of quantum computations.

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

Week	Subject
1	Spin
2	Spin and Angular Momentum
3	Time Independent Perturbation Theory
4	Corrections in the Hydrogen Atom Problem, Many Particle Systems
5	Many Particle Systems, Identical Particles
6	Atoms and Molecules
7	Atoms and Molecules, Variational Principle
8	Variational Principle, WKB Approximation
9	WKB Approximation
10	Time Dependent Perturbation Theory
11	Charged Particles in an Electromagnetic Field
12	Scattering Theory
13	Scattering Theory
14	Basics of Quantum Computations
15	Review

TEXTBOOKS

Required Textbook(s)	• David J. Griffiths, *Introduction to Quantum Mechanics, 2nd ed.* Prentice-Hall, 2005 • Gasiorowicz, S. *Quantum Physics, 3rd edition*, Wiley, 2003.
Recommended Readings	• Shankar, R. *Principles of Quantum Mechanics, 2nd ed.* New York: Plenum, 1994. • Feynman, R.P., Leighton, R.B., Sands, M. *The Feynman Lectures on Physics, Volume III*, Addison Wesley, 1966.

EVALUATION SYSTEM

Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	5	10
Homework Assignments	10	15
Presentation/Jury	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	2	50
Final/Oral Exam	1	25
Total	16	100

Percentage of Semester Work	15	75
Percentage of Final Work	1	25
Total	16	100

COURSE CATEGORY

ISCED GENERAL FIELD CODE	GENERAL FIELDS	ISCED MAIN AREA CODE	MAIN EDUCATIONAL AREAS	%
1	Eğitim	14	Öğretmen Yetiştirme ve Eğitim Bilimleri	0
2	Beşeri Bilimler ve Sanat	21	Sanat	0
2	Beşeri Bilimler ve Sanat	22	Beşeri Bilimler	0
3	Sosyal Bilimler, İşletme ve Hukuk	31	Sosyal ve Davranış Bilimleri	0
3	Sosyal Bilimler, İşletme ve Hukuk	32	Gazetecilik ve Enformasyon	0
3	Sosyal Bilimler, İşletme ve Hukuk	38	Hukuk	0
4	Bilim	42	Yaşam Bilimleri	0
4	**Bilim**	**44**	**Doğa Bilimleri**	**80**
4	**Bilim**	**46**	**Matematik ve İstatistik**	**20**
4	Bilim	48	Bilgisayar	0
5	Mühendislik, Üretim ve İnşaat	52	Mühendislik	0
5	Mühendislik, Üretim ve İnşaat	54	Üretim ve İşleme	0
5	Mühendislik, Üretim ve İnşaat	58	Mimarlık ve Yapı	0
6	Tarım	62	Tarım, Ormancılık, Hayvancılık ve Su Ürünleri	0
6	Tarım	64	Veterinerlik	0
7	Sağlık ve Refah	72	Sağlık	0
7	Sağlık ve Refah	76	Sosyal Hizmetler	0
8	Hizmet	81	Kişisel Hizmetler	0
8	Hizmet	84	Ulaştırma Hizmetleri	0
8	Hizmet	85	Çevre Koruma	0
8	Hizmet	86	Güvenlik Hizmetleri	0

THE RELATIONSHIP BETWEEN COURSE LEARNING OUTCOMES AND PROGRAM OUTCOMES

Number	Program Outcomes	Level of Contribution*				
		1	2	3	4	5
1	To have a comprehension of the core areas of physics, including classical and quantum mechanics, electromagnetism, statistical and thermal physics.					X
2	To have a comprehension of basic mathematics, including differential and integral calculus, linear algebra, differential equations and complex analysis.					X
3	To have a comprehension of computer programming and chemistry.			X		
4	To have a comprehension of the importance and practice of good ethical standards.	X				
5	To have a recognition of contemporary issues in science and its applications.					X
6	To have an ability to construct theoretical models, solve problems, design and conduct experiments, as well as to analyze and interpret data.					X
7	To have an ability to demonstrate their understanding of at least one advanced topic in theoretical or experimental physics.					X
8	To have an ability to function on multi-disciplinary teams					
9	To have an ability to effectively communicate information in both written and verbal form		X			
10	To have a recognition of the need for and an ability to engage in life-long learning.				X	
11	To have an ability to use modern physics techniques, skills, and computing tools necessary for physics practice (use laboratory and workshop equipment to generate data, prepare technical drawings, prepare technical reports, give technical presentations, take notes effectively, write computer programs, use mathematics and/or computational tools and packages to make models) .					X

*1 Lowest, 2 Low, 3 Average, 4 High, 5 Highest

Contribution of Course Learning Outcomes to Program Outcomes	The class contributes to the student development in terms of building a sound foundation of how quantum mechanics can be applied to realistic problems. Students are introduced to advanced topics and develop skills to construct theoretical models to solve problems. Students should, additionally, develop problem solving abilities and enhance critical thinking and improve their written communication skills.

ECTS / WORKLOAD TABLE

Activities	**Number**	**Duration (Hour)**	**Workload (Hour)**
Course Hours (Including Exam Week: 16 x Total Hours)	15	3	45
Laboratory	-	-	-
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	15	4	60
Presentations / Seminar	-	-	-
Project	-	-	-
Homework Assignments	10	5	50
Quizzes	5	2	10
Midterms / Oral Exams	2	10	20
Final / Oral Exam	1	15	15
		Total Workload	**200**
		Total Workload/25	**8**