Işık University
Faculty of Arts and Sciences
Department of Physics

PHYS 453 - Nuclear Physics

COURSE SYLLABUS

Course Name	Code	Semester	Theory (hour/week)	Application (hour/week)	Laboratory (hour/week)	Local Credits	ECTS
Nuclear Physics	PHYS 453	Fall	**3**	0	**0**	**3**	5

Prerequisities	PHYS 333

Course Language	English
Course Type	Elective
Course Level	First Cycle
Course Coordinator	-
Course Lecturer(s)	-
Course Assistants	-
Course Objectives	This is a one semester course which gives an introduction to the basic principles in nuclear physics. By the end of the course, students should • demonstrate a knowledge of the basic concepts in nuclear physics. • discuss the basic principles of radiactive decay and radioactivity. • recognize the existence of various nuclear models to explain the behavior of nuclei.
Course Learning Outcomes	On successful completion of this course students will be able to 1. recognize the basic concepts in nuclear physics. 2. describe the force between nucleons. 3. distinguish between independent and collective models of nuclei. 4. explain alpha, beta and gamma radiation processes. 5. develop an understanding of the interaction of radiation with matter. 6. demonstrate an understanding of some of the recent developments in nuclear physics.
Course Content	Introduction to subatomic particles; properties of nuclei and nucleons; spin and magnetic moments; nuclear reactions; radioactivity; alpha and beta decays; nucleon interactions and nucleon scattering at low energies; nuclear models; elementary particles.

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

Week	Subject
1	Basic concepts in nuclear physics
2	Basic principles of quantum mechanics
3	Nuclear properties: nuclear radius and charge
4	Nuclear properties: mass and abundance of nuclides, nuclear binding energy
5	Nuclear properties: nuclear angular momentum and parity, nuclear electromagnetic moments and excited states
6	The force between nucleons
7	The force between nucleons
8	Review
9	Nuclear models
10	Nuclear models
11	Radioactive decay
12	Radioactivity
13	Alpha decay
14	Beta decay
15	Gamma decay

TEXTBOOKS

Required Textbook(s)	Kenneth S. Krane, *Introductory Nuclear Physics*, Wiley, 3rd edition, 1987.
Recommended Readings	• G. A. Jones, *TheProperties of Nuclei,Oxford University Press, 2nd edition, 1987.* • Carlos A. Bertulani, *Nuclear Physics in a Nutshell*, Princeton University Press, 2007.

EVALUATION SYSTEM

Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	-	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	3	8
Homework Assignments	10	14
Presentation/Jury	-	-
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	2	52
Final/Oral Exam	1	26
Total	16	100

Percentage of Semester Work	15	74
Percentage of Final Work	1	26
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**	**85**
4	**Bilim**	**46**	**Matematik ve İstatistik**	**15**
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.					
3	To have a comprehension of computer programming and chemistry.					
4	To have a comprehension of the importance and practice of good ethical standards.					
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 solid foundation of basic concepts in nuclear physics for further study in physical sciences. Students should 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	2	30
Presentations / Seminar	-	-	-
Project	-	-	-
Homework Assignments	10	2	20
Quizzes	3	1	3
Midterms / Oral Exams	2	9	18
Final / Oral Exam	1	9	9
		Total Workload	**125**
		Total Workload/25	**5**