Işık University
Faculty of Arts and Sciences
Department of Physics

PHYS 475 - Methods in Experimental Physics

COURSE SYLLABUS

Course Name	Code	Semester	Theory (hour/week)	Application (hour/week)	Laboratory (hour/week)	Local Credits	ECTS
Methods in Experimental Physics	PHYS 475	Spring	**2**	0	**2**	**3**	7

Prerequisities	

Course Language	English
Course Type	Required
Course Level	First Cycle
Course Coordinator	-
Course Lecturer(s)	-
Course Assistants	-
Course Objectives	This is a one semester course that introduces the fundamental concepts of statistical data analysis. By the end of the course, students should • demonstrate a knowledge of statistical analysis of experimental data. • recognize selected experiments in modern physics such as Frank-Hertz experiment, Balmer series, electron-spin resonance. • demonstrate a knowledge of basic optical measurements. • explain the basic principles of radiation physics and archaeological dating.
Course Learning Outcomes	On successful completion of this course students will be able to 1. estimate possible errors in experimental measurements. 2. explain how errors propagate in calculations. 3. generate theoretical fits to experimantal data. 4. analyze experimental data. 5. recognize selected experiments in modern physics such as Frank-Hertz experiment, Balmer series, electron-spin resonance. 6. design experimental setups for optical transmission and reflection measurements. 7. use the basic principles of radiation physics for archaeological dating of objects.
Course Content	Principles of experimentation. Statistical data analysis: error calculation, error propagation, least squares curve fitting, Poisson ve Gauss distributions, chi-square test for a distribution. Selected experiments in modern physics such as Frank-Hertz experiment, Balmer series, electron-spin resonance. Optical transmission and reflection measurements. Radiation physics and archaeological dating.

WEEKLY SUBJECTS AND RELATED PREPARATION STUDIES

Week	Subject
1	Principles of experimentation
2	Statistical data analysis: error calculation, error propagation
3	Statistical data analysis: error calculation, error propagation
4	least squares curve fitting
5	Poisson ve Gauss distributions, chi-square test for a distribution
6	Poisson ve Gauss distributions, chi-square test for a distribution
7	Selected experiments in modern physics: Frank-Hertz experiment
8	Selected experiments in modern physics: Balmer series
9	Selected experiments in modern physics: Electron-spin resonance
10	Optical Transmission and reflection measurements
11	Optical Transmission and reflection measurements
12	Measurements with a UV/VIs optical spectrometer
13	Radiation physics, Archaeological dating
14	Review
15	Review

TEXTBOOKS

Required Textbook(s)	Les Kirkup, *Data Analysis for Physical Scientists: Featuring Exce*, 2nd edition, Cambridge University Press, 2012.
Recommended Readings	• David C. Baird, *Experimentation*: An introduction to measurement theory and *Experimentation Design, 4th edition,Addison Wesley*, 1994. • Sheldon M. Ross*, Introduction to Probability and Statistics for Engineers and Scientists*, 4th edition, Academic Press, 2009.

EVALUATION SYSTEM

Semester Requirements	**Number**	**Percentage of Grade**
Attendance/Participation	-	-
Laboratory	15	-
Application	-	-
Field Work	-	-
Special Course Internship (Work Placement)	-	-
Quizzes/Studio Critics	4	10
Homework Assignments	5	10
Presentation/Jury	4	20
Project	-	-
Seminar/Workshop	-	-
Midterms/Oral Exams	2	40
Final/Oral Exam	1	20
Total	31	100

Percentage of Semester Work	30	80
Percentage of Final Work	1	20
Total	11	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**	**15**
4	Bilim	48	Bilgisayar	0
5	**Mühendislik, Üretim ve İnşaat**	**52**	**Mühendislik**	**5**
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.					
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 providing the fundamentals of statistical data analysis. Students devise selected modern physics experiments and perform simple optical measurements. Students should also 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	2	30
Laboratory	15	2	30
Application	-	-	-
Special Course Internship (Work Placement)	-	-	-
Field Work	-	-	-
Study Hours Out of Class	15	3	45
Presentations / Seminar	4	4	16
Project	-	-	-
Homework Assignments	5	4	20
Quizzes	4	1	4
Midterms / Oral Exams	2	2	20
Final / Oral Exam	1	2	10
		Total Workload	**175**
		Total Workload/25	**7**