Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Physics Laboratory	PHYS611	-	6	3	13	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	-	Preparation for classes	-
Laboratory	90	Case studies	-
Exams and quizzes	5	Working on lab experiment	240
Lab demo	-	HW/Assignments	12
		Study for exam	11
Total	95	Total	263
Total Learning Hours = 358		Equivalent ECTS points = Total LH/28 =13	

BRIEF COURSE DESCRIPTION

- This course is designed to provide graduate level experimental experience for research in physics. This includes learning how to conduct experiments, mastering experimental instrumentation and methods, analyzing data and presenting results in a scientific manner. The course contains experiments covering a wide range of fields in Physics

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Use some of the equipment commonly used in research.
2. Perform experiments in different fields of physics.
3. Analyze measurements data considering error calculations.
4. Interpret measurements data considering error calculations.
5. Assess the experimental results and write lab. reports.
6. Analyze the data using a computer.

COURSE CONTENTS

Atomic and Modern lab:

- Zeeman effect (transverse and longitudinal– Zeeman splitting– optical pumping). Frank Hertz experiment (Mercury and Neon). X-rays: (Bragg's reflection–spectroscopy–absorption-Moseley's Law). Helium-Neon laser (wavelength–polarization -beam diameter inside the resonator).

Solid State Physics lab:

- Hall Effect for different metals and different semiconductors. Electrical conductivity and photoconductivity of solids. (temperature dependence of metals and semiconductor resistors– current-voltage characteristics of photo-resistors). Scanning-tunneling microscope (surface analysis of gold and graphite samples).

Nuclear and Particle Physics lab:

- Radioactivity (attenuation of beta and gamma radiation – radioactive decay and half-time). Gamma-ray Spectroscopy (detection – recording and calibrating – absorption – activity). Compton Scattering (quantitative observation of Compton effect). X-ray Tomography .

P**lasma Lab:**

- Nanoparticles fabrication using Micro plasma. Analysis of nanoparticles using DLS and UV-VIS

U**ltra-Low Level Quantum Measurements (JURLQM):**

- Time domain, real-time, voltage and current measurement and analysis with high speed Digital storage oscilloscope and DAQ. Frequency domain FFT-based real time signal analysis. Data acquisition using DAQ hardware and analysis.

ASSESSMENT CRITERIA

- Lab Report: 40 %
- Assignments and student activities: 20%
- Final Lab Exam: 40%

COURSE TEACHING STRATEGIES

- Self-learning, Open discussion, interactive comparisons, Question-answer method, demonstrations of laboratory equipment and experiments, Interactive Discussion, Case study, and individual presentation.

TEXT BOOK	REFERENCE BOOKS
• Equipment manuals	• J. W. Hammer, Advanced Lab Manual prepared by the department. • Advanced Physics Laboratory Manual by University of Notre Dame, 2008. • D. W. Preston and Eric R. Dietz, The Art of Experimental Physics, (John Wiley and Sons, 1991). • A. C. Mellissinos and Jim Napolitano, Experiments in Modern Physics, 2nd edition, (Academic Press, 2003). • R. A. Dunlap, Experimental Physics-Modern Methods, (Oxford University Press).