

**UNIVERSITY OF PUERTO RICO  
RÍO PIEDRAS CAMPUS  
COLLEGE OF NATURAL SCIENCES  
DEPARTMENT OF PHYSICS**

Title: Advance Laboratory  
Code: PHYS 6406-0U1  
Credits: 6  
Professor: Vladimir Makarov  
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E-mail: vladimir.makarov@upr.edu  
Time schedule: Monday 10:00 am – 12:50 pm, Wednesday 8:30 – 11:20 am  
Prerequisites: Permission of the Graduate Committee

**Course Description**

Advance Laboratories. Development of the basic statements including the various representations and 'pictures' of experimental and theoretical research studies. Detailed consideration of modern experimental and theoretical methods. Study of methods of data analysis, creation of modeling analysis of experimental data etc.

**Objectives**

Through this course, the students will:

- Acquire a basic understanding of the modern experimental technique, methods of experimental system setup meaning study of basic statements of modern experimental setup designee, analysis of possible artifact creation during of experiment, application of such knowledge to correct data measurement, technical realization of correct data obtaining and analysis.
- Become proficient with the experimental and theoretical tools of the Advance Laboratories.
- Develop problem-solving skills and strategies in basic Advance Laboratories.
- Communicate effectively a topic pertinent to basic of Advance Laboratories.

**Instructional Strategies:** Teaching process is organized online without direct contact with students. Advance laboratory experiment is carried out by professor and results share with students. Online communication sessions are organized two time per week with respect to academic class schedule using Google Meet communication platform. Detailed discussion of experiments and obtained results are carried out during online sessions.

**Minimum Required Facilities**

Laboratory (FB146), commercial YAG laser, benzene liquid, etc. For online communication, computer, access to internet and access to Google Meet communication platform.

**Evaluation Strategies.** The course will be evaluated with three partial research reports addressed to carried out experimental works with a weight of 20% of the evaluation and the oral presentations with a weight of 40% of the evaluation.

**Grading.** Standard A to F system.

**Bibliography**

D.B.. Crisey, G.K. Hubler, Pulsed laser deposition of thin films, John Wiley & Sons Inc., 1994.

PROGRAM AND TIMETABLE.

<i>Week</i>	<i>Subjects</i>
1	Introduction
2	Learning and preparation pulsed laser synthesis (PLS) system for TiO <sub>2</sub> -GQD material synthesis. Preparation of sample and system alignment.
3	Learning and preparation pulsed laser synthesis (PLS) system for TiO <sub>2</sub> -GQD material synthesis. Preparation of sample and system alignment..
4	Synthesis of TiO <sub>2</sub> -GQD material using pulsed laser synthesis method.
5	Synthesis of TiO <sub>2</sub> -GQD material using pulsed laser synthesis method
6	Synthesis of pure GQD as reference material <b>using pulsed laser synthesis method</b>
7	First report and quiz
8	Characterization of optical properties both materials.
9	TEM and SEM measurements both materials..
10	TEM and SEM measurements both materials.
11	Thin film deposition synthesized materials and AFM measurements both materials
12	Second report and quiz.
13	Thin film deposition and EFE measurements both materials
14	EDS measurements
15	FTIR and, Raman measurements
16	Third report and oral presentations.

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UPR complies with all Federal and State Laws and regulations regarding discrimination, including the Americans with Disabilities Act 1990 (ADA) and the Commonwealth of Puerto Rico Law 51. Students receiving services through Rehabilitation Vocational must contact the professor at the beginning of the semester in order to plan for a reasonable accommodation and any required support equipment according to the recommendations given by the Oficina de Asuntos para Personas con Impedimentos (OAPI) of the Dean of Students. Likewise, students with special need that require some type of accommodation must contact the professor at the beginning of the semester.

## ACOMODO RAZONABLE

La Universidad de Puerto Rico cumple con todas las leyes federales, estatales y reglamentos concernientes a discriminacion, incluyendo "The American Dissabilities Act" (Ley ADA) y la Ley 51 del Estado Libre Asociado de Puerto Rico. Los estudiantes que reciban servicios de rehabilitacin vocacional deben comunicarse con el (la) profesor(a) al principio del semestre para planificar el acomodo razonable y equipo de apoyo necesario conforme a las recomendaciones de la Oficina de Asuntos para las

Personas con Impedimento (OAPI) del Decanato de Estudiantes. Una solicitud de acomodo razonable no exime al estudiante de cumplir con los requisitos academicos del curso.

#### INTEGRIDAD ACADEMICA

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