

# Physics Department, University of Puerto Rico, Rio Piedras Campus

## PHYS 4049 Electronics

Lab: **PHYS 4049** (Créditos: 4)

Place: CNL C - 334

Date: LW

Time: 3:00am –6:20am

Question and answer time: 1 –2 PM Monday.

Lecturer: Dr Peter Feng

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**Prerequisites:** Sufficient preparation in general physics, general physics laboratory and electromagnetism

### Course Syllabus

**Course description:** This is a very interest course. In this course, we will study Electronic Circuits and Measurements techniques in **theory, computer simulation, and experiments**. It will include a study of digital and analogy electronics with emphasis in their application to circuit design of experimental set-ups, elements of semiconductor physics, diode and transistor operation and circuits, operational amplifiers, digital gates, flip-flops and timing circuits. Student will learn to design new experimental set; assemble experimental components; learn how to observe physics phenomena and measure physics parameters; learn data processing and explanation of results. Students will also study how to write experimental reports.

The course will consist of lectures and laboratory experiences where concepts learned in class will be demonstrated and explored. The purpose of the course is to provide a fundamental proficiency in Electronic Circuits and Measurements techniques

**Textbooks:** **Modern Instrumentation for Scientist and Engineers:** J A Blackburn,  
Springer-Verlag, New York, 2001, ISBN 0-387-95056-7  
**An introduction to Modern Electronics, Willian Faissler**  
John Wiley & Sons, Inc 1991 ISBN0-471-62242-7  
**Physics for scientists and Engineers, Modern Physics, General Physics, Manual**  
Fundamentals of physics by Halliday, Resnick, Walker, John Wiley & Sons Inc, ISBN 0-471-22861-1

**References:** 1 Analog and digital electronics for scientists: Basil H Vassos and  
Galen W Ewing John Wiley & Sons Inc. New York 1985  
2 Basic digital electronics with MSI applications: John A Dempsey  
Addison-Wesley Publishing Company, California 1979  
3 Experimentation with digital electronics: John A Dempsey  
Addison-Wesley Publishing Company, California 1977  
4 Advanced Labview Labs, John Essick, 1999 PRENTICE-HALL, Inc  
Simon & Schuster/A Viacom Company, ISBN 0-13-833949-X

**Note:** The textbook will be amply supplemented with handouts as the course progresses. Electronic version of lecture notes can be found in computers in laboratory.

### **Contents (1, Theory, 2, Computer simulation, and 3, Experiments)**

- [1] Basic concept for AC and DC circuits
- [2] Elements of semiconductor physics,
- [3] Diode and its application in power supply
- [4] Transistor operation, circuits, and applications
- [5] Operational amplifiers, and various applications
- [6] Digital gate,
- [7] Timing circuits, 555 system, and applications
- [8] Digital and analogy electronics with emphasis in their application to circuit design
- [9] Basic theory for PC-Instrumentation communication

**Grade Assignments:**

**The Final grade will be based on the following:** Experiments (25%), Lab Reports/presentations (20%), Project: (35%), and two quiz (20)

**Grade/Scale :** 90-100% (A), 80-89.9% (B), 70-79.9% (C), 60-69.9% (D), 0-59.9% (F)

Right of students with disabilities. 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 service through Rehabilitation Vocation must contact the professor as 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 Persons com Impedimentos (OAPI) of the Dean of students. Likewise, student with special need that require some type of accommodation must contact the professor at the beginning of the semester

**Time Schedule**

Week	Topic
1	Introduction Review: PC, PB-503 analog/digital proto-board, oscilloscopes, multi-meter, applications
2	Review simple DC and AC circuits, complex DC and AC circuits
3	Bridge experiment and calculation Computer simulations, experiments,
4	Basic theory for semiconductor diode, its application in power supply (theory, computer simulation and experiment)
5	nanostructured devices (theory, computer simulation and experiment) Transistor (basic mechanism and application) (theory, computer simulation and experiment)
6	OP-AMP circuits (theory, computer simulation and experiment)  Make up/1 <sup>st</sup> Presentation/1 <sup>st</sup> Quiz/
7	Introduction to Logical electronics Logical integrated circuits, combinational logic Karnaugh Map simplification.
8	Experiments: PC simulation construct the combinational logic circuit (Theory, Experiments: PC simulation) Logical MATH (Theory, Experiments: PC simulation)
9	Digital gates, flip-flops and 555 IC based timing circuits flip-flops-based logical device
10	DC & AC digit and DC & AC measurements Design and assemble 32 channels DMM  Make up/2 <sup>nd</sup> Presentation/2 <sup>nd</sup> Quiz
11	Based on PC+National instruments DAQ board Labview program
12	Introduction of Basic PC and GPIB communication Review, Final project

**Instructional Strategies:**

The instructional method is based on 1) Lecture/discussion/theory, 2) Computer simulation, and 3) Experiments. Emphasis is on its applications in gas sensors, UV detectors, diodes, etc. that are closely related to our current research project supported by NSF research office.

**Rights of Students with Disabilities:**

The University of Puerto Rico complies with state and federal laws and regulations concerning discrimination, including Law 51 of the Commonwealth of Puerto Rico and the federal law known as the 1990 Americans with Disabilities Act (ADA). Students who receive vocational rehabilitation services or require any assistance should inform the teacher (a) in charge of the course about this situation for reasonable accommodation to have equal access to education and services offered by the University of Puerto Rico accordance with the recommendations Affairs Office for Persons with Disabilities (OAPI) the Dean of Students.

**Academic integrity:**

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