University of Maryland
Department of Physics
College Park, Maryland

Physics 485/685
Spring 2011

GENERAL INFORMATION

Faculty

M. Coplan
Office: CSS 3215 (Computer Space Sciences Building)
Office Hours: Monday and Wednesday 11:00-12:00 and by appointment
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Teaching Assistant

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Course Emphasis

Physics 485/685 are survey courses in the basic methods of modern electronics with equal emphasis on laboratory work and lecture material.

Lecture meets once weekly Monday 2-3:50 p.m. in Room PHYS 4220.

There will be two laboratory sections each week on Wednesday and Thursday in PHYS 3321 from 1-5 p.m. A student i.d. is necessary for access to the laboratory area.

Textbooks/Manuals

Required

MicroElectronics, Second Edition, Millman and Grabel, McGraw Hill, 1987.

Physics 485/685 Laboratory Manual, Department of Physics, University of Maryland at College Park, Spring 2009 Edition. Available online.

Note. The required text, *MicroElectronics*, is out of print, but can be purchased used from a number of on-line book sellers. We have available a sufficient

number of copies for loan to all registered students in the course provided that the loaned copies are returned at the end of the semester in the same condition as they were received. Mr. Allen Monroe, the laboratory coordinator, arranges the book loans. Mr. Monroe's office is PHYS 3311; he can be reached by phone at 301-405-6002 and by email at amonroe@physics.umd.edu.

Recommended

The Art of Electronics, Second Edition, P. Horowitz and W. Hill, Cambridge, 1989.

Building Scientific Apparatus, Fourth Edition, J. H. Moore, C. E. Davis, M. A. Coplan, Cambridge University Press, 2009, Chapt. 6.

CMOS Cookbook, D. Lancaster, Howard W. Sams and Co., 1997

Lancaster's Active Filter Cookbook, D. Lancaster, Butterworth-Heinemann, 1996.

IC Op-Amp Cookbook, W. G. Jung, McMillan Computer Publications, 1986.

A Practical Introduction to Electronic Circuits, Second Edition, M. H. Jones, Cambridge, 1985.

Scientists Must Write, A guide to better writing for scientists, engineers, and students, Second Edition, Robert Barrass, Routledge, 2003

Reading Assignments

The text (Millman and Grabel) will be used principally as a reference. Additional materials will be distributed in class and posted on the elms website. These materials are intended to supplement the lectures. There will also be reading assignments from the Laboratory Manual in preparation for the laboratory work and lectures.

Homework

Homework will be assigned at approximately two-week intervals and will be due approximately two weeks from date assigned.

There will be approximately 7, 20 minute quizzes during the semester. They will be given at regular intervals during the regular Monday class. There will be a final exam at the end of the semester.

Laboratory Work

During the laboratory period there will be often be discussions of the theory and design of the circuits under study. Everyone is expected to participate. Each student should obtain a bound laboratory notebook in which all data and descriptive information about each experiment is to be recorded. Notes and

calculations on separate pieces of paper are not permitted. The laboratory notebook must have a table of contents in the beginning to aid in locating the different experiments. The notebooks will be periodically collected and checked. It should be possible to reconstruct the experiment from the information in the laboratory notebook. All entries in the notebook are to be made with pen, not pencil. Errors should be crossed out with a single line rather than erased or obliterated. Often an incorrect calculation or circuit will contain information that is useful later on. Because laboratory experiments will routinely be discussed in class on Mondays, it is recommended that the laboratory notebook be brought to lecture.

There are seven experiments during the semester including a 4 to 5 week individual project at the end of the semester. The laboratory experiments are flexible by design allowing students latitude in pursuing individual interests. Descriptions of the experiments are given in the Laboratory Manual along with data sheets for the devices used in the experiments. Operation manuals for all the laboratory equipment are available in the laboratory.

Laboratory Reports

Separate written laboratory reports for each experiment will be due at the lecture period (Monday) 1 week plus 4 or 5 days after the last scheduled laboratory session for that experiment. These reports should contain a description of procedures, tables and graphs showing results, and a discussion explaining the results. Unless prior arrangements are made with the staff, late reports will be subject to a penalty of 1/2 point (out of a maximum grade of 12 points) per day late. The laboratory reports should consist of four sections; Introduction, Experimental Procedure, Results, and Discussion and Conclusions.

The Introduction should contain a clear statement of the purpose of the experiment. Relevant circuit theory should be included in this section. Detailed derivations are not necessary.

The Experimental Procedure should contain all the information required to reproduce the experiment as it was done in the laboratory. A list of components and equipment along with schematic circuit diagrams should be part of this section. The measurement procedures should be clearly described here.

The experimental data form the Results section. Effective presentation of data is an important experimental skill. The usual ways of presenting data are in tables and graphs. When tables are used, columns should be clearly labeled with units. Graphs should have both axes clearly labeled. All experimental data should be presented with estimates of errors or uncertainties. The errors can be systematic as well as random and can be due to limitations of the measuring instruments as well as uncertainties in the values of the circuit components. For active devices, such as diodes and transistors, temperature effects can cause the results to deviate from the expected values. A discussion of the errors should accompany the data. It is not necessary to include component specification sheets, but reference to them should be given where appropriate.

The Discussion and Conclusions section should contain comparisons between the predicted and measured properties of the circuits. Suggestions for improving the experiment can be included in this section. Conclusions should be based on the data and comparisons with calculations based on the theory of the operation of the circuit. Applications of the results of the experiment should also be included here. Clarity rather than length or complexity is the goal of the reports. It should be possible to reproduce your results from the information in the report.

Each of the four sections of the report will be graded on a scale from 0 to 3 where a grade of 3 means that the section fully met the criteria listed above, and a grade of 0 means that none of the criteria were met. The maximum grade for a report is 12.

Final Grade

The semester grade for the course will be determined approximately in the following way:

Average laboratory grade	40%
Quizzes	20%
Homework	15%
Final exam	25%

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.

To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all examinations and assignments: "I pledge on my honor that I have not given or received any unauthorized assistance on this examination (assignment)."

LECTURE SCHEDULE

Week	Lecture Topic
1	RC Circuit Analysis
2	Properties of Diodes, Laplace Transforms
3	Bipolar Transistors, Amplifiers, Equivalent Circuits
4	Frequency Response, Stability
5	Feedback and Differential Amplifiers
6	Operational Amplifiers - Ideal and Real
7	Active Filters, Non-Linear Operational Amplifier Circuits
8	MOSFETs and CMOS Logic
9	Logic Gates, Binary Arithmetic
10	Digital Circuits
11	Flip/Flops, Counters, Shift Registers
12	Digital Systems, D/A and A/D Conversion
13	Microcomputer Architecture, Control Theory
14	Extraction of Signals from Noise