University of Maryland
Department of Physics
College Park, Maryland

Physics 485/685
Fall 2004

GENERAL INFORMATION

Instructor

M. Coplan
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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 on Wednesdays and Thursdays in Room PHYS 3211 from 1-5 p.m.

Textbooks/Manuals

Required

Introduction to Electronic Circuit Design, R. R. Spencer and M. S. Ghausi, Prentice Hall, 2001.

Physics 485/685 Laboratory Manual, Department of Physics, University of Maryland at College Park, 2003/2004 Edition.

Recommended

Digital Design, Third Edition, M. Mano, Prentice Hall.

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

The Art of Electronics, Second Edition, P. Horowitz and W. Hill, Cambridge, 1989.
Building Scientific Apparatus, Third Edition, J. H. Moore, C. E. Davis, M. A. Coplan, Addison Wesley, Third Edition, 2003, Chapt. 6.

Designing with TTL Integrated Circuits, Texas Instruments Electronics Series, McGraw Hill.

TTL Cookbook, D. Lancaster, Howard W. Sams and Co., 1980

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.

Reading Assignments

The text (Spencer and Ghausi) will be used principally as a reference. There will be reading assignments and some problem assignments from Spencer and Ghausi. Additional materials will be distributed in class. 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 examination at the end of the semester.

Laboratory Work

During the laboratory period there will sometimes 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 often be discussed in class on Mondays, it is recommended that the laboratory notebook be brought to the lectures.

There are six experiments to be performed during the semester including a 4 to 5 week individual project at the end of the semester. The laboratory experiments are flexible by design and allow 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 + 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 10 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 in this section.

The experimental data form the Results section. Effective presentation of data is an essential experimental skill. The usual ways of presenting data are 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.

Grading

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

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

LECTURE SCHEDULE

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