

PHYS485/685: Electronic Circuits-Fall 2019

Instructor

Ki-Yong Kim

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Office Hours: Right after class or by appointment

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Teaching Assistants

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Course Emphasis

Physics 485/685 are courses in modern electronics with an emphasis on hands-on laboratory work and topics that are useful as career skills.

Lecture meets Monday and Friday 2-2:50 p.m. in Room CHE 2136.

There are two laboratory sections each week--one on Tuesday (Section 0102) and one on Wednesday (Section 0101) in Room PHYS 3321 nominally from 1-4:50 p.m. A student ID card swipe is necessary for access to the laboratory area.

Manuals

Supplied

1) *Physics 485/685 Laboratory Experiment Descriptions*: available each week on the course elms page.

Recommended references

1) *The Art of Electronics*, Second Edition, Horowitz and Hill, Cambridge, 1989.

2) *Building Scientific Apparatus*, Forth Edition, Moore, Davis and Coplan, Cambridge University Press, 2009.

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

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

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

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

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

Laboratory Notebooks

Each student should obtain a bound laboratory notebook in which **all** data and descriptive information about each experiment is to be recorded in pen not pencil. The laboratory notebook should have a table of contents on the first page (added to over time) to aid in locating the different experiments. It should be possible to reconstruct the experiment from the information in the laboratory notebook. Errors should be crossed out with a single line rather than erased or obliterated. Often an incorrect calculation or circuit will contain information that can be useful later on. The laboratory experiments are flexible by design allowing students latitude in pursuing individual interests. Descriptions of the experiments are given in the Experiment descriptions

along with data sheets for the devices used in the experiments. Operation manuals for all the laboratory equipment are available in the laboratory.

PHYS 485/685 Laboratory Reports: Format will be discussed in lecture and the assignments. Laboratory report due dates will be available on elms, and turned in on elms. Late reports lose 5% per day they are late.

Grades

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

PHYS 485

Lab reports	60%
Participation in lecture	10%
Homework	15%
Project	15%

PHYS 685

Lab reports	60%
Participation in lecture	10%
Homework	15%
Project (by design more advanced)	15%

LIST OF LABORATORY PROJECTS (spread out over 15 weeks)

- RC Circuits
- Diodes
- Bipolar Junction Transistor
- Metal Oxide Semiconductor Transistors (MOSFETs)
- Feedback and Operational Amplifiers
- IR LED and photodiode sensor
- Logic gates and ring oscillators
- Actuators: transistor powered motor
- Measurement of magnetic field and temperature
- Arduino Mayhem!
- Peltier devices
- Chaotic Oscillator and machine learning predictions

PRELIMINARY LECTURE TOPICS

Intro materials	Grounds
Passive electronics LRC	Thermometry
Diodes and Hall probes	Bench instruments and lock-ins
Diodes 2 and varistors	Controls
LED's, photodiodes, and photovoltaics	PID
Transistors	Actuators
MOSFETS etc	Vacuum electronics
Op-amps, precision amps	AFM, SEM, TEM
Digital logic	Microcontrollers
Microprocessors	