

Physics 315

Instrumentation

Winter 2008

Lecturer	Jerry Clark.		
Prerequisites	Physics 260 or equivalent		
Textbook	James Diefenderfer and Brian Holton, <i>Principles of Electronic Instrumentation</i> , 3 rd edition (Saunders College Publishing, 1994)		
Electronic tools	The Web will be used as a means of communication and of providing information. You should be able to use a modern Web browser and obtain information from the Web.		
Learning objectives	At the end of this course you will be familiar with the fundamentals of analog electronics as applied to scientific instrumentation. You will have an appreciation of the work of an electronics technician and of an electrical engineer and be able to converse with them professionally. You will be able to build prototype circuits and test their operation. You will be familiar with a few sensors and with methods of signal to noise enhancement.		
Laboratory	During the laboratory period you will construct circuits, make measurements, and compare expected with actual performance of the circuits. You will learn how to use and understand the limitations of common measuring instruments. You will be required to keep a note book of your experimental investigations.		
Homework	Problems will be assigned at approximately one-week intervals. Students may consult with the instructor or each other, but each student must write out the answers individually. Some assignments may include simulation problems.		
Exams	There will be one exam and one final. There will be no make-up exams.		
Grades	Assignments will carry the following weighting:	Grades will be assigned using the following scale:	
	Homework	100 points	A 85 – 100
	Exam	100	B 70 – 85
	Laboratory reports	100	C 55 – 70
	Final Exam	100	D 40 – 55
	Total	400 points	F < 40
Students with disabilities	The University will make reasonable accommodations for persons with documented disabilities. Those students should register with the Disability Resource Services.		

Topics

Direct Current Circuits

- basic concepts
- schematic diagram
- Kirchoff's laws
- equivalent circuits

Alternating Current Circuits

- AC circuit elements
- circuit equations
- sinusoidal sources and the complex impedance
- resonance and the transfer function
- four-terminal networks
- Fourier Analysis

Filter Circuits

- filters and amplifiers
- log-log plots and decibels
- passive RC filters
- sequential RC filters
- passive RCL filters

Diode Circuits

- energy levels
- the PN junction and the diode effect
- circuit applications of ordinary diodes

Operational Amplifiers

- open-loop amplifiers
- ideal amplifier approximation
- analysis using finite open-loop gain

Instrumentation

- Noise
- Signal to Noise Enhancement