Physics 311/511 DIGITAL INSTRUMENTATION Fall 2006

GENERAL INFORMATION

Instructor: Dr. R. Knispel Office: Halsey Science 348 Phone: (920) 424-4431

Course Meeting Times: Lecture: Tuesday, Thursday 3:00 to 4:30 pm HS456
Lab: Monday 3:00-5:10 pm HS369

Office Hours: M, T 11:30 to 12:30 am
W 10:20 to 11:20 am
Th, F 9:10 to 10:10 a.m.

COURSE OBJECTIVES:

The student should gain knowledge of the function and proper application of basic digital circuits and the use of microprocessors with analog-to-digital and digital-to-analog circuitry. This will be accomplished with hands-on laboratory experiments and theory-based exercises.

TEXT: Digital Electronics, 7th ed. by William Kleitz

SUPPLEMENTARY TEXTS:

1. Digital and Microprocessor Electronics for Scientific Application by Dennis Barnaal Waveland Press, 1982
2. Digital Theory and Practice Using Integrated Circuits by Morris Levine
3. An Introduction to Digital and Analog Integrated Circuits and Applications by S. K. Mitra
4. Electronics with Digital and Analog Integrated Circuits by R. J. Higgins
5. Analog Electronics for Scientific Application by Dennis Barnaal Waveland Press, 1982
6. Digital Principles and Applications by A. P. Malvino and D. P. Leach Fourth Edition, McGraw Hill 1986
7. Experiments in Digital Principles by D. P. Leach Third Edition, McGraw Hill 1986
8. Digital Fundamentals by Thomas Floyd Fifth Edition MacMillan 1990

Some supplementary texts are on 3 day reserve in the Halsey Resource Center.

This course covers six topics:

1. Basic gate circuits: Text Ch. 3, 5 & 6
2. Circuits constructed from basic gate circuits: Text Ch. 7-8
3. Flip-flops, Latches, Counters and Registers: Text Ch. 10-13
4. Timing and Triggering Circuits: Text Ch. 14 plus supplementary material
5. Sample and hold, analog-to-digital and digital-to-analog circuits: Text Ch. 15
6. Introduction to the microprocessor and its uses: Text Ch. 17 and supplementary material.

Grading is based on:

3 Tests, equally weighted	48%
Assignments	12%
Laboratory	40%

Your grade in this course will be based on the tests, assignments and lab work which you have completed by the end of the semester, Dec 15th.

University policy allows for a grade of incomplete in cases where a student is unable to finish a course because of "illness, injury or extenuating circumstances". For a full description of the restricted use of this grade the student is referred to the 2005 to 2007 Undergraduate Bulletin (mostly white one) page 26.

Grading of the laboratory work**: In most cases**, successful completion of a laboratory exercise involves constructing a circuit, getting it to work, and demonstrating it to the instructor. The laboratory grade therefore depends on the number of experiments completed successfully.

The one exception is Lab VIII, the Digital Combination Lock. For this lab, EACH student will design his/her Combination Lock, build it and demonstrate to the instructor that it works, then hand in a circuit diagram and a (approximate two-page) description of how it works.

In the chart below, experiments that are required for each grade have an R in the column under that letter grade.

UNIT	LAB GRADE	A	B	C	D
A. Digital Components					
1. Introductory		Both	Both	Both	Both
	I Introduction	R	R	R	R
	II Digital Components	R	R	R	R
2. Circuits based on Gates		VIII plus any 3	VIII plus any 2	VIII plus one other	VIII plus one other
	III Circuits Constructed from Gates				
	IV Encoders, Decoders, LEDs and Displays				
	V Introduction to Sequential Circuits				
	VI Comparator-operated Control Systems				
	VII Latches, Multi-plexers and Flip-flops				
	VIII Digital Combination Lock	R	R	R	R
	IX Shift Registers				
3. Triggering and Pulsing Circuits		XII plus any 2	XII plus and 1	Any one	None required
	X. Pulse Shaping using a Schmitt Trigger				
	XI. Monostable Multivibrator				
	XII 555 Timer as Multivibrator	R	R		
	XIII Design of a Schmitt Trigger				
B. Use of a microprocessor		All three	All three	Any two	Any two
	I. Examining memory and writing programs	R	R		
	II. Iteration, Flags, Decisions and Branching	R	R		
	III. Digital I/O and Software Timing	R	R		

C. Data Collection Systems		I, II, III plus one	I, II, plus one	I, II	I
	I. Analog to Digital Conversion with 8700 ADC	R	R	R	R
	II. Digital to Analog Conversion	R	R	R	
	III. Analog to Digital Converter using a D to A Converter	R			
	IV. Programmmable Gain Operational Amplifier				
	V. Introduction to a Logic Analyzer				
Total Experiments Required		16	13	10	7

Grading Scale:

In-class tests		Take-home Tests		Homework	
86-100	A	90-100	A	80-100	A
77-85	AB	84-89	AB	70-79	AB
68-76	B	73-83	B	60-69	B
62-67	BC	67-72	BC	52-59	BC
53-61	C	56-66	C	42-51	C
47-52	CD	50-55	CD	34-41	CD
40-47	D	40-49	D	25-33	D
< 40	F	< 40	F	< 25	F