CASE WESTERN RESERVE UNIVERSITY

Case School of Engineering

Department of Electrical Engineering and Computer Science

ENGR 210. Introduction to Circuits and Instruments

Spring 2005 DRAFT Agenda and Assignment Dates

Notes:

1. Labs are posted on MON mornings and reports are collected the following week, at scheduled lab times.
2. HW is posted and collected on WED mornings (in lecture), and solutions are posted on WED afternoons.
3. Quizzes are given on FRI mornings (in lecture), and solutions are posted on FRI afternoons.
4. Reading is from The Analysis and Design of Linear Circuits, 4th Ed., Thomas and Rosa, Wiley, 2004.

Date	Class	Due	Agenda	Reading	Lab
1/10	1		Course Outline and Information	1.1	
1/12	2		Electrical units, engineering notation	1.1-1.3	*intro*
1/14	3		passive sign convention; Ohm's Law	1.3-2.1	
1/17			Martin Luther King Day		
1/19	4	HW1	switches; v and I sources"	2.2	**L1**
1/21	5	Q1	KCL; KVL; element constraints	2.2-2.3	Ohm's Law
1/24	6		series/parallel	2.3	**L2**
1/26	7	HW2	equivalent R; source transforms	2.4	Computer-based
1/28	8	Q2	voltage and current dividers	2.5	Instruments
1/31	9		fuses; circuit reduction	2.5-2.6	**L3**
2/2	10	HW3	node voltage techniques	3.1	LabVIEW and
2/4	11	Q3	Cramer's method; supernodes	3.1	DMMs
2/7	12		mesh current techniques	3.2	**L4**
2/9	13	HW4	linear circuits; proportionality	3.3	Function Generator
2/11	14	Q4	turning sources OFF; superposition	3.3	and Oscilloscope
2/14	15		Thevenin and Norton equivalent circuits	3.4	**L5**
2/16	16	HW5	maximum power transfer	3.5	KCL and
2/18	17	Q5	interface circuits	3.6	Superposition
2/21	18		dependent sources	4.1-4.2	**L6**
2/23	19	HW6	Thevenin and Norton of active circuits	4.2	Thevenin Equivalent
2/25	20	Q6	basic OP AMP amplifiers	4.4	Circuits
2/28	21		summing/subtracting amplifiers	4.5	**L7**
3/2	22	HW7	voltage follower; multi OP AMP circuits	4.5	Intro to Operational
3/4	23	Q7	comparators	4.7	Amplifier
3/7			Spring Break		
3/9			"		*none*
3/11			"		
3/14	24		Instrumentation systems; transducers	4.6	**L8**
3/16	25	HW8	unit impulse, step & ramp; exponentials	5.1-5.3	Comparator and
3/18	26		sinusoidal waveforms; rms & average power	5.4-5.6	Schmitt Trigger
3/21	27	Q8	No lecture (Quiz only)		**L9**
3/23	28	HW9	Capacitors and Inductors, i-v characteristics	6.1-6.2	Exponential
3/25	29	Q9	Integrators and differentiators	6.3	Waveforms
3/28	30		Series/parallel L/C, steady-state characteristics	6.4	L10
3/30	31	HW10	Forced sinusoidal response, phasors	7.1,7.2, 7.4,8.1	555 Timer
4/1	32	Q10	Euler identity; phasor manipulation	8.2	
4/4	33		Phasor current/voltage; impedance	8.2	L11
4/6	34	HW11	Circuit analysis with phasors	8.3-8.4	Passive RC
4/8	35	Q11	Frequency Response; Bode diagrams	12.1	Filters
4/11	36		Frequency response examples	12.2	L12
4/13	37	HW12	More frequency response examples	12.2	Active RC Filters
4/15	38	Q12	Bandpass and notch filters	12.3	
4/18	39		Step response; zero-input response	7.1,7.2	
4/20	40		State variables and differential equations	7.2	none
4/22	41		Time constants; initial/final value theorem	7.2	
4/25	42		Responses other than state variables	7.2	
4/27,28			Reading Days		
5/3			**Final**	8:30 - 11:30 am	

ENGR 210 Circuits and Instrumentation

- modeling and circuit analysis
  - voltage & current
  - Kirchoff's Laws
  - Thevenin & Norton circuits
- DC sensors and amplifiers
  - operational amplifiers
- time dependent circuits
  - transients
  - time dependent waveforms
- frequency dependent circuits
  - phasors
  - frequency response
- instrumentation
  - digital multimeter
  - waveform generator
  - oscilloscope
  - computer data acquisition – Lab VIEW

Syllabus: vorlon.case.edu/~flm/engr210s05/index.html

Text

Thomas & Rosa, The Analysis and Design of Linear Circuits, 4/e
John Wiley & Sons
ISBN 0-471-27213-2

Grading

25% Homework*, due each Wednesday in class

25% Weekly quizzes* each Friday in class
based on Wednesday's homework, closed book

— Recitation Tuesday evening 6 – 8:30
Thursday evening 6:30 – 8:30 } White 411
Location TBA

25% Laboratory*, as scheduled
done in groups of two
lab reports (short)

Glennan 308, ID card access
workstation accounts
— telnet to cerne.cwru.edu
"new user"
press "Enter" for password
follow instructions on screen
3 days to activate

25% Final Exam
comprehensive
May 3, 8:30–11:30

* No late assignments accepted
Two Lowest (hw/quiz/lab) will be dropped

** Errors in grading should be submitted to appropriate TA
— copy of assignment (lab, hw problem, quiz problem)
— written explanation of why your solution is correct

Electrical Engineering and Computer Science Department

Computing Facilities Introduction and Policy Statement.

The Electrical Engineering and Computer Science (EECS) Department computing facilities are comprised of many different computer labs:

- Jennings Computing Center (Olin 404.5)
- Circuits Lab (Glennan 308)

Labs are open to current EECS students or those taking EECS courses. Most labs are open 24 hours a day, 7 days a week to all students, faculty and staff with an active account (via their CWRU ID card) and a need to use the equipment in the lab. The labs are administered by the EECS Technical Staff.

Account Applications

Accounts are usually created within 2 to 3 business days. Plan accordingly!

To apply for an account, please read the information located at:

http://www.eecs.cwru.edu/newuser/

Please note that the Unix and NT systems both have DIFFERENT account databases. Therefore, you will have two separate accounts and, therefore, may have two separate passwords.

When you register for an account, a request will be made on your behalf for card access to the general purpose computing labs in Olin 404.5. For other labs, your instructor will probably have submitted a request on your behalf for the labs you will need to use.

1-1 Book

circuit — interconnection of electrical devices

signal — time varying quantity (voltage & current)

linear circuit — output amplitude proportional to input amplitude

e.g., $V_{out} = K V_{in}$

interface — pair of accessible terminals at which a signal can be measured

1-2 Symbols and Units

time	t	seconds
frequency	f	hertz
power	p	watts
charge	q	coulombs
voltage	v	volts
impedance	Z	ohms
resistance	R	ohms
capacitance	C	farads
inductance	L	henrys
current	i	amperes

Table 1-2 Standard Prefixes

10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	~~centi~~	
10^{-1}	~~deci~~	
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T

milli volts

not standard engineering notation volts

kilovolts.

Megahertz

Hertz (frequency)

some interesting specifications

micro acres ≈ 4 square millimeters

a Pentium IV contains about a kilometer of electrical connections

Charge 1 coulomb = 6.25×10^{18} electrons

current $i = \frac{dq}{dt}$ $\frac{\text{coulombs}}{\text{sec}}$

ampere

amp

A

voltage $v = \frac{dw}{dq}$ $\frac{\text{joules}}{\text{coulombs}}$.

volt

$$\text{power} = \frac{dw}{dt} = \frac{dw}{dq}\frac{dq}{dt}$$

power voltage current

$$\boxed{p = vi}$$

watts